



Antarctic Research Vessel (ARV)

Engineering Report: Dynamic Positioning System Performance Report

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P3	July 14, 2023	All	J. Cross-Whiter	Revised DP analysis for revised topsides, revised report according to review comments

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1. Executive Summary

The dynamic positioning (DP) requirements for the ARV are defined in Section 070.7 of ARV Performance Specifications (P-Spec), Reference (1), and the Science Mission Requirements, Reference (2). These specifications require that the thruster and DP system maintain station in 35 knot wind speeds, Sea States 4 and 5 and 2 knot current, at best wind and wave heading and current heading ranging from 0 to 180 degrees relative to the wind and wave heading. The acceptable watch circles are 5 meters (16.4 feet) in Sea State 4 and 20 meters (66 feet) in Sea State 5. In order to analyze compliance with the DP requirements in References (1) and (2), the DP supplier Kongsberg Maritime AS used their in-house software StatCap to evaluate the station-keeping capability of the ARV DP system.

The DP system was analyzed with two azimuthing 12,740 hp (9,500 kW) thrusters at the stern and one 2,851 hp (2,126 kW) tunnel bow thruster.

The best wind and wave headings are head seas and stern seas (0 degrees and 180 degrees, respectively). The system is capable of holding station in these wind and wave headings at all current headings from 0 to 360 degrees. The system is also capable of maintaining station, at all current headings, in seas up to 10 degrees off the bow and 20 degrees off the stern. If seakeeping and science mission criteria permit, in offset wind, wave, and current headings the thruster utilization can be minimized by aligning the vessel oblique to the wind and wave directions, so that the sway force and yaw moment due to current oppose those from wind and waves.

In Sea States 4 and 5, at best wind and wave heading, the required thrust from the bow thruster is high in quartering and beam current directions, likely leading to high radiated and structure-borne noise levels. A study of holding capacity with the bow thruster power limited to 50% revealed that it is possible to maintain station in all current directions with wind and wave heading at 0 deg (head seas). At all other wind and wave headings there is a range of current headings in which station-keeping is possible. Station-keeping with reduced bow thruster power comes at the cost of increased stern thruster utilization, to maintain yaw moment balance.

Reference (1) requires that the ARV hold station at the best wind and wave heading. Therefore, it is assumed that, when station-keeping is critical to operations, the vessel will maintain a heading within the acceptable range in Sea State 4 and 5.

The Kongsberg calculations computed static holding capacity in the environmental conditions specified in Reference (1), with a dynamic allowance to account for temporal variations in wind and wave forces. Kongsberg's interpretation of the results indicates that vessels meeting the static holding requirements, including dynamic allowance, will hold station within a radius of 5 meters (16.4 feet). This watch circle meets the Sea State 4 and 5 requirements.

The DP system is also able to control vessel heading and position in a 35 kt wind without assistance, demonstrating the ability of the ARV to berth without tug assistance.

1.1. Acronyms

ABB	ABB Ltd
ARV	Antarctic Research Vessel
DP	Dynamic Positioning
DPS	Dynamic Positioning System
hp	Horsepower
kN	Kilonewtons
kW	Kilowatts
lbf	Pounds-force
P-Spec	Performance Specifications

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2. Introduction

The DP requirements for the ARV are outlined in Section 070.7 of ARV Performance Specifications (P-Spec), Reference (1), and the Science Mission Requirements, Reference (2). In order to analyze compliance with the DP requirements in References (1) and (2), the DP supplier Kongsberg used their in-house software StatCap to evaluate the station-keeping capability of the ARV DP system. This software was used to assess the holding capacity of the ARV thruster system, in specified environmental conditions.

The Kongsberg calculations computed static holding capacity in the environmental conditions specified in Reference (1), with a dynamic allowance to account for temporal variations in wind and wave forces. Kongsberg's interpretation of the results indicates that vessels meeting the static holding requirements, including dynamic allowance, will hold station within a radius of 5 meters (16.4 feet).

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3. Approach

3.1. Requirements

The DP requirements for the ARV, in accordance with Reference (1), are as follows:

- The vessel shall be capable of maintaining position within 5 meters (16.4 feet) of a fixed location at best heading in 2-knot current, 35-knot winds, and up to and including Sea State 4, all acting simultaneously.
- The vessel shall be capable of maintaining position within 20 meters (66 feet) of a fixed location at best heading in 2-knot current, 35-knot winds, and up to and including Sea State 5, all acting simultaneously.
- The requirement shall be satisfied with the angle between current direction and wind and wave direction from zero to at least 180 degrees.
- The choice of thruster(s) and main propulsion shall ensure that dynamic positioning can be maintained effectively.
- The choice of tunnel thrusters versus retractable azimuthing thrusters shall consider the impacts on noise and bubble sweepdown.
- The DPS design and operation shall minimize noise, vibration, and adverse effects on the operation of acoustic systems as much as possible, and these issues shall be evaluated early in the design process.
- The DPS shall interface with science and navigation systems.

3.2. Dynamic Positioning Analysis Methodology

The DP system assumed for the analysis is supplied by Kongsberg Maritime AS. For the purposes of sizing thrusters and equipment Kongsberg undertook a DP capability analysis. Details for this analysis are shown in Kongsberg's ARV DP Capability Analysis Report, which is included in this report as Appendix A. The hull and superstructure geometries used in the analysis are based on the ARV General Arrangement, revision P4, Reference (3). For this analysis Kongsberg used their static holding capacity software StatCap. Gibbs & Cox supplied Kongsberg with the ARV hullform geometry, installed power, thruster locations, and environmental specifications. The hull and superstructure profiles, upon which the aerodynamic forces are based, are shown in the Appendix A, as are the positions of the thrusters.

For each environmental condition StatCap computes the steady forces and moments acting on the ship through wind, wave drift, and current. Only forces in the horizontal plane, i.e. surge force, sway force and yaw moment, are used in the holding capacity calculations.

Wind and current forces were computed according to conventional force coefficient approach. The equations take the following form:

$$F = \frac{1}{2} \rho V^2 C_F A$$

where:

ρ is the fluid density (air for wind, water for current)

V is the relative fluid velocity

C_F is a force coefficient

A is a normalizing area, e.g. the projected area normal to the force

The wind force coefficients were taken from Blendermann's research into wind forces on a wide variety of ship types. Current force coefficients were computed from strip theory calculations of hull section drag coefficients.

Wave drift coefficients were derived from Kongsberg's database of seakeeping data for similar ships, scaled to the ARV dimensions. Details of the force coefficients used in the DP analysis are reported in Appendix A.

The procedure above provides steady-state forces in a specified mean wind speed, mean current speed and significant wave height. Kongsberg adds dynamic allowances to the wind and wave forces, to account for the temporal variations in wind speed and wave heights. These allowances are functions of the characteristic spectra of the wind velocity and wave height.

The thrusters were modeled as two azimuthing propulsion units of 12,740 hp (9,200 kW) each and one 2,851 hp (2,126 kW) bow thruster. According to ABB data on ice-capable Azipod units and Kongsberg's estimates from typical thrust-power relationships, the maximum thrust available at each stern thruster is estimated at 247,359 lbf (1,100 kN) and the thrust available at the bow thruster is 70,107 lbf (312 kN). Thruster efficiencies were corrected to account for non-zero ambient fluid velocity, Coanda effect, thrust loss in waves, and, in the case of tunnel thrusters, tunnel friction, inlet losses and grid blockage.

The azimuth angles of the aft thrusters were restricted to avoid forbidden zones, where the jet wash from one thruster impinges on the other. In this study Kongsberg restricted the azimuth angle on the upstream thruster to be greater than 30 degrees from emitting jet wash directly at the downstream thruster.

According to the requirements outlined in Section 3.1, holding capacity was computed in a 35 knot wind measured at 10 m (32.8 foot) reference height, in Sea States 4 and 5. Two-parameter Pierson-Moskowitz sea spectra, equivalent to the Bretschneider spectra called for in Reference (1) were assumed. Holding capacity was computed for collinear wind and waves at headings from 0 degrees to 180 degrees, in 10-degree increments. For each wind and wave heading the current was varied from 0 to 360 degrees.

At each combination of wind, wave, and current heading the forces due to steady wind, wave drift and current were summed to provide the total surge force, sway force and yaw moment on the ship. Dynamic allowances were added to the steady forces, as discussed above. The StatCap force-balance algorithm searched for combinations of thruster power and azimuth angle that balanced these forces and moments, within the limitations of available power and restricted azimuth zones.

3.3. Dynamic Positioning Analysis Results

3.3.1. Analyzed Cases

The results of Kongsberg's DP analysis are presented in the form of polar plots showing the thrust required from the thrusters as a percentage of the maximum available thrust (i.e. thruster utilization percentage). The full Kongsberg report is included in this report as Appendix A. Appendix A presents polar plots for 39 cases: Cases 1 through 19 are in Sea State 4, with wind and wave headings from 0 to 180 degrees, Cases 20 through 38 are in Sea State 5, with wind and wave headings from 0 to 180 degrees, and Case 39 is a 35 knot wind, with no waves or current. Each polar plot for Cases 1 through 38 shows the variation of thruster utilization for a single wind and wave direction and current headings ranging from 0 to 360 degrees. The polar plot for Case 39 presents the variation of thruster utilization for wind headings ranging from 0 to 360 degrees.

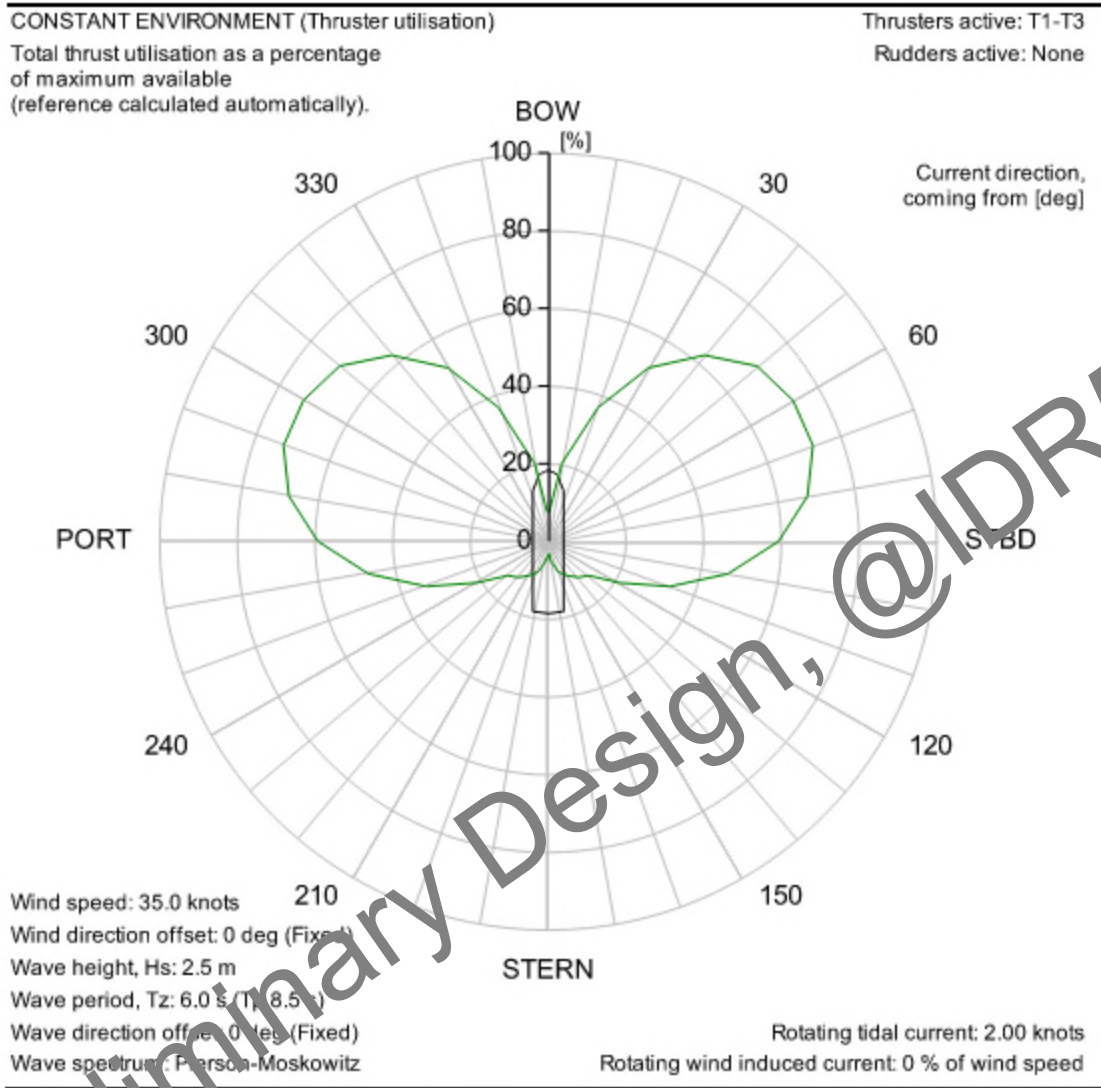
The polar plots for the 39 cases are presented in Sections 5.1 through 5.39 of Appendix A. The details of the environmental forces and individual thruster utilization for the 39 cases are presented in Sections 6.1 through 6.39 of Appendix A.

3.3.2. Sea States 4 and 5

As discussed in Section 3.1, the DP system is required to maintain position in the best wind and wave heading, with current varying from the wind and wave heading by up to 180 degrees. In Sea States 4 and 5 the best wind and wave heading is either 0 degrees (head seas) or 180 degrees (stern seas). In the 0 and 180 degree wind and wave headings, the DP system is capable of holding station (i.e. thruster utilization is less than 100%) for all current headings. The thruster utilization plots for Sea States 4 and 5, at 0 degrees wind and wave heading, are presented in Figure 1 and Figure 2, respectively. These figures are taken from Appendix A.

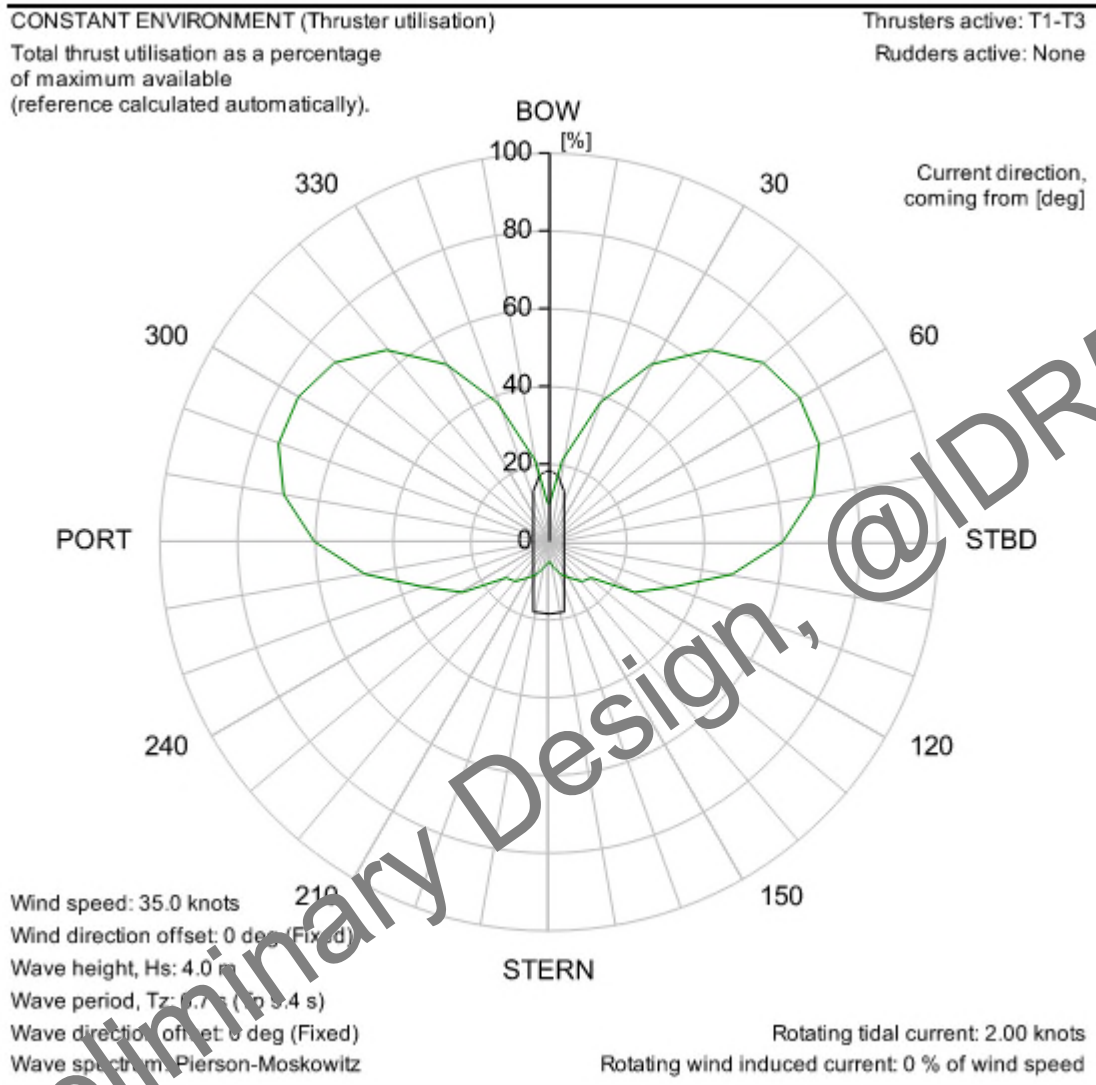
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**Figure 1: Thruster Utilization in 35 kts Wind, Sea State 4; Wind, Wave at 0°
 (from Appendix A)**



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**Figure 2: Thruster Utilization in 35 kts Wind, Sea State 5; Wind, Wave at 0°
 (from Appendix A)**



As shown in Appendix A, the DP system is capable of holding station in all current headings, in wind and wave headings of 0, 10, 160, 170, and 180 degrees, in both Sea States 4 and 5.

Kongsberg's interpretation of the results indicates that vessels meeting the static holding requirements, including dynamic allowance, will hold station within a radius of 5 meters (16.4 feet). This watch circle meets the Sea State 4 and 5 requirements.

It is noted that the worst-case utilizations in the 10 degree and 160 degree wind and wave headings are close to 100%, i.e. these headings are close to the wind and wave heading limits of the DP system. In wind and wave headings between 10 and 160 degrees there is a range of current headings in which the thruster utilization is greater than 100%. These current headings occur when the wind, wave and current forces all act on the same side of the vessel centerline. On the other hand, there is also a range of current headings in which the thruster utilization is less than 100%. In bow quartering wind and waves these current headings typically do not

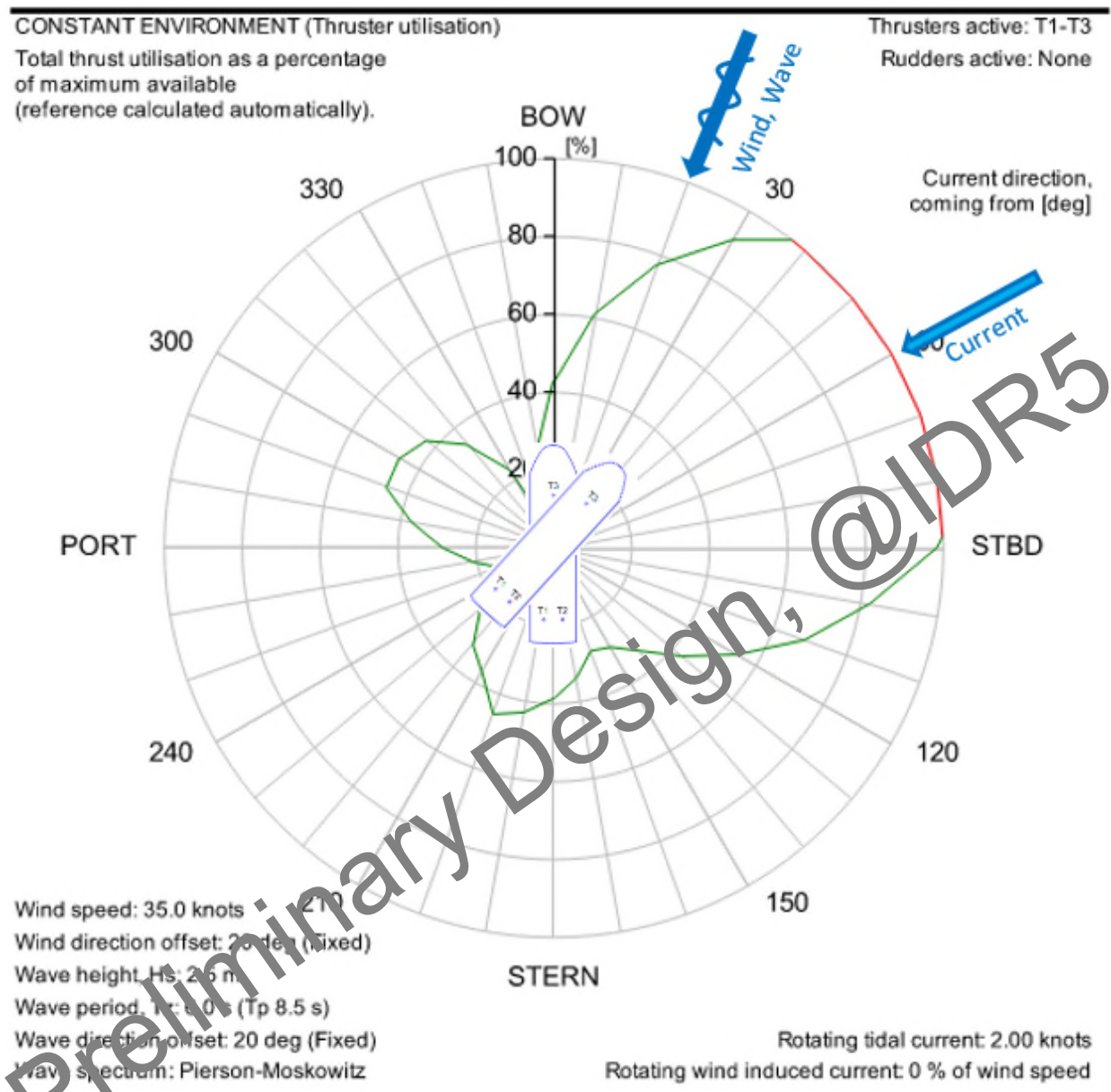
include headings collinear with the wind and waves, but a range of headings with current oblique to the wind and wave. The minimum total thruster utilization is found with the vessel heading approximately halfway between the wind and current, i.e. $Heading_{Current} \approx 360 - Heading_{WindWave}$. In stern quartering wind and wave headings the minimum thruster utilization is typically found at current headings approximately 180 degrees from the wind and wave headings.

In Sea States 4 and 5, therefore, it is possible to maintain station in all current headings by aligning the vessel with the wind and wave direction. If seakeeping and science mission criteria permit, in misaligned wind, wave and current headings it is also possible to reduce the thruster utilization by aligning the vessel oblique to the wind and wave directions, so that the sway force and yaw moment due to current act in opposition to those due to wind and waves.

An example of such a strategy is illustrated in Figure 3. Figure 3 shows Case 3 from Appendix A, with wind and waves at 20 degrees off the starboard bow. Looking, for example, at the condition with current at 60 degrees from the starboard bow (i.e. offset 40 degrees from the wind and waves), the polar plot shows excessive thruster utilization. If the orientation of the ARV were rotated 40 degrees to starboard, the wind and wave would impinge at 20 degrees off the port bow, and the current would impinge at 20 degrees off the starboard bow. This would lead to a condition equivalent to wind and waves at 20 degrees and current at 340 degrees, which requires low thruster utilization.

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Figure 3: Vessel Orientation Strategy for Minimizing Thruster Utilization



Referring to the thruster utilization tables in the appropriate sub-sections of Appendix A, Section 6, it is noted that the bow thruster (T3) is running at high thrust levels in many quartering and beam current directions, even in wind and wave headings of 0, 10, 160, 170, and 180 deg. The thrust exceeds 85% of the maximum thrust in the worst-case current headings in these wind and wave headings. These high thrust levels are likely to lead to high radiated and structure-borne noise levels.

To study the option of reducing noise levels by limiting bow thruster utilization, Kongsberg ran an additional set of analyses, limiting the bow thruster power to 50% of its maximum. The bow thruster thrust varies as $Power^{\frac{2}{3}}$, so at 50% power the available thrust is $312 \cdot 0.5^{\frac{2}{3}} = 196 \text{ kN}$ (44,200 lb). The results for this analysis are presented in Appendix B. The thruster utilization

plots for Sea States 4 and 5, at 0 degrees wind and wave heading, are shown in Figure 4 and Figure 5

Figure 4: Thruster Utilization in 35 kts Wind, Sea State 4; Wind, Wave at 0°; Bow Thruster Limited to 50% Power (from Appendix B)

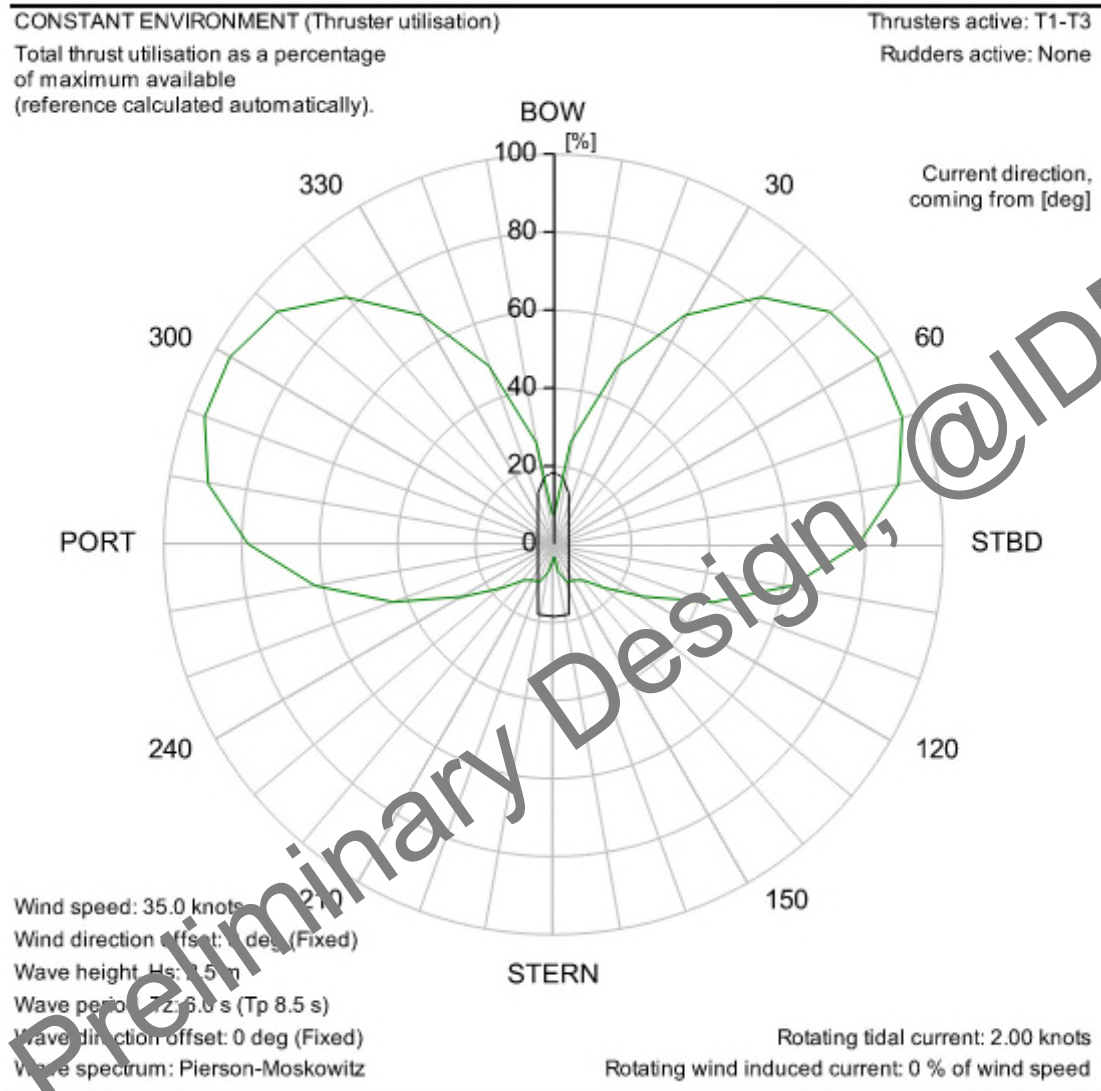
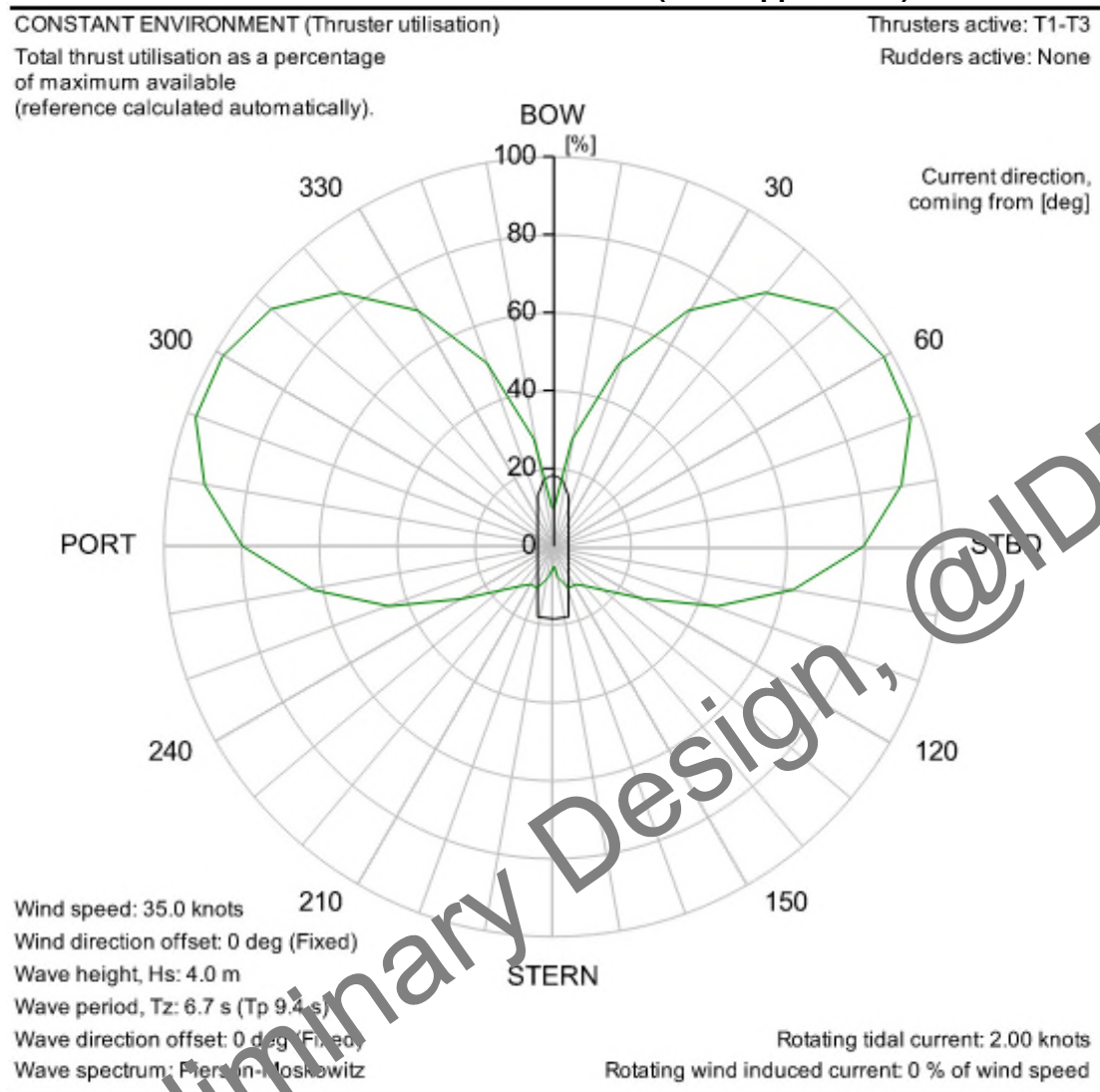


Figure 5: Thruster Utilization in 35 kts Wind, Sea State 5; Wind, Wave at 0°; Bow Thruster Limited to 50% Power (from Appendix B)



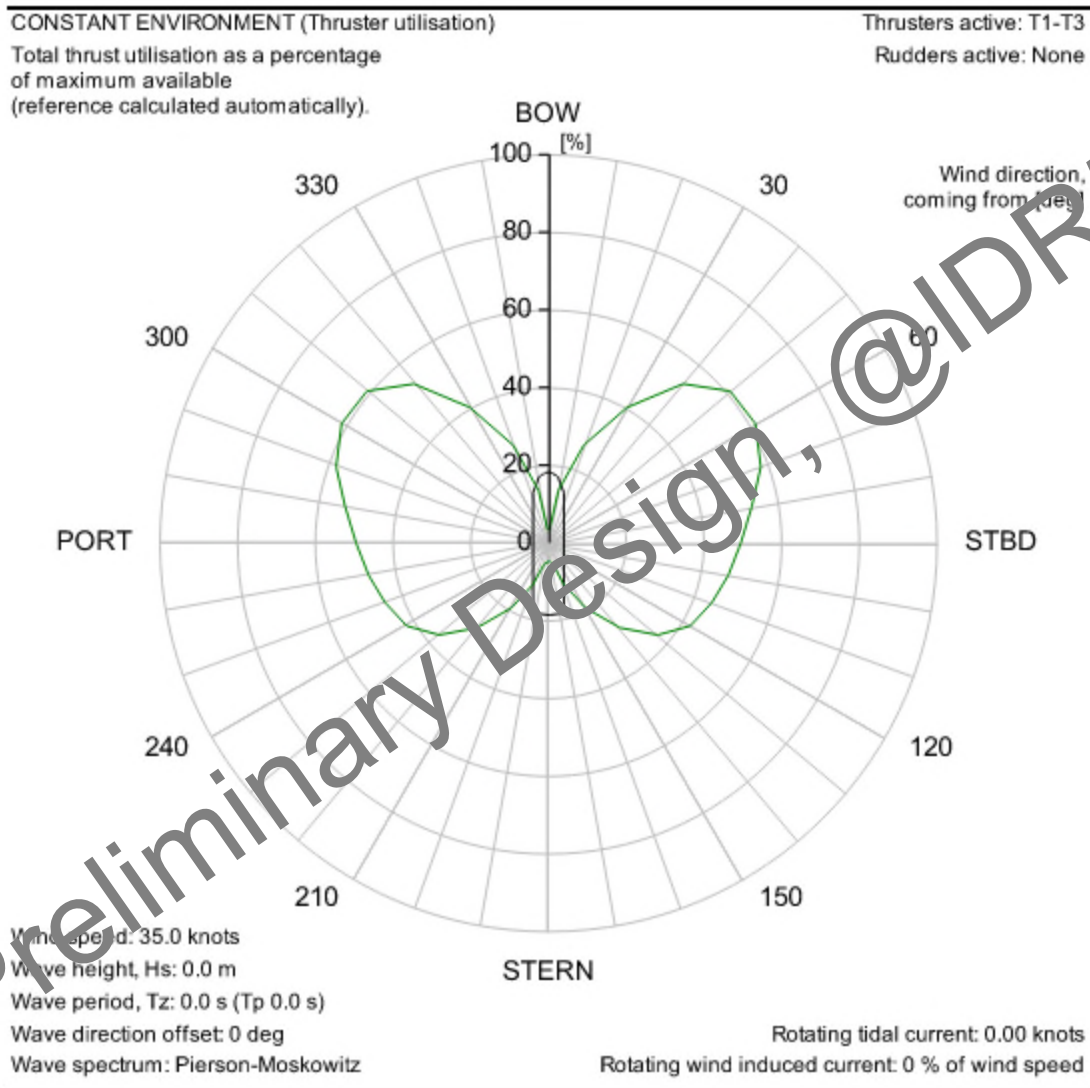
Station-keeping at all current headings is only possible in 0 degrees wind and wave heading with the 50% bow thruster power limit. For every other wind and wave heading, however, there is a range of current headings in which station can be maintained. Qualitatively, the thruster utilization follows similar trends with respect to current heading as discussed above, but the range of current headings in which the vessel is capable of maintaining station is narrower with a power limit of 50%. Thruster utilization can be optimized by following the same vessel alignment strategies as outlined above.

Station-keeping with reduced bow thruster power is achieved with increased utilization of the stern thrusters, to balance yaw moments.

3.3.3. Sea State 0 (Docking)

The thruster utilization in a 35-knot wind, with no waves or current (case 39 in Appendix A) is presented in Figure 6. Figure 6 represents a docking scenario, with no waves or current, and 35 knot wind. The DP system is capable of berthing the vessel in this scenario, with no tug assist, in all wind directions.

Figure 6: Thruster Utilization in 35 kts Wind, Sea State 0 (from Appendix A)



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4. Conclusions and Recommendations

Kongsberg's DP analysis of the ARV thruster system shows that the system is capable of satisfying the DP requirements specified in References (1) and (2), with the current system of twin 12,710 hp (9,500 kW) azimuthing thrusters aft and a single 2,851 hp (2,126 kW) bow thruster forward.

The system is capable of holding station within 5 meters (16.4 feet) in both Sea State 4 and 5 in the best wind and wave headings of 0 and 180 degrees, in all current headings, which meets ARV requirements. The system is also capable of holding station within a range of wind and wave headings near head and stern seas (± 10 degrees near head seas and ± 20 degrees near stern seas), in all current headings. In wind and wave headings outside of these ranges the system is not capable of holding station in all current headings, but, in each wind and wave heading, there is a range of current headings in which station can be maintained. If seakeeping and science mission criteria permit, in offset wind, wave, and current headings the minimum thruster utilization is found by aligning the vessel oblique to the wind and wave directions, so that the sway force and yaw moment due to current oppose those from wind and wave.

In Sea States 4 and 5, at best wind and wave heading, the required thrust from the bow thruster is high in quartering and beam current directions, exceeding 85% of the maximum thrust in the worst-case current directions. This high utilization is likely to lead to high radiated and structure-borne noise levels. A study of holding capacity with the bow thruster power limited to 50% revealed that it is possible maintain station in all current directions with wind and wave heading at 0 degrees (head seas). At all other wind and wave headings there is a range of current headings in which station-keeping is possible. Station-keeping with reduced bow thruster power comes at the cost of increased stern thruster utilization, to maintain yaw moment balance.

Reference (1) requires that the ARV hold station at best wind and wave heading. Therefore, it is assumed that, when station-keeping is critical to operations, the vessel will maintain a heading within the acceptable ranges in Sea States 4 and 5.

The DP system is also able to control vessel heading and position in a 35 kt wind, from all directions, demonstrating the ability of the ARV to berth without tug assistance.

5. References

- 1) *ARV Performance Specifications*, Rev. A, Change 05, 23 June 2023
- 2) *ARV PEP Appendix 01: ARV Science Mission Requirements*, Rev 3, 2022
- 3) *General Arrangement*, 5E1-001-D001, Rev P4

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6. Appendix A: Kongsberg DP Report

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DP Capability Analysis Report Arctic Research Vessel

<i>Foot no:</i>	Foot_8092_RevG3.scp				
<i>KM project:</i>	N/A				
<i>Product:</i>	The Kongsberg Maritime computer program StatCap Report v 3.3.4.1 has been used for the calculations.				
<i>Synopsis:</i>	This document contains a DP capability analysis for Arctic Research Vessel.				
<i>Document no:</i>	N/A			<i>Revision:</i>	G
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<i>Contract no:</i>	N/A			<i>Pages:</i>	350
<i>Rev</i>	<i>Date</i>	<i>Reason for issue</i>	<i>Made by</i>	<i>Checked</i>	<i>Approved</i>
A	Jun 23, 2022	First issue	MatthewD		
B	Sep 19, 2022	Redesign	MatthewD		
C	Sep 20, 2022	Updated Cases	matthewd		
D	Sep 27, 2022	Changed wave spectrum & frequency	MatthewD		
E	Dec 15, 2022	Modified Wind Profile	MatthewD		
F	Jan 06, 2023	Bow Thruster - 100%	MatthewD		
G	Jun 21, 2023	Updated Wind Profile	matthewd		

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Document history

<i>Revision</i>	<i>Description of change</i>
A	First issue
B	Updated wind model, LOA, LPP, breadth, draught, displacement, thruster size and locations
C	
D	
E	
F	
G	

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References

Reference 1	General arrangement
Reference 2	Thruster data and location input
Reference 3	Power configuration
Reference 4	Wind load coefficients Brix, J. (editor) Manoeuvring Technical Manual Seehafen Verlag, 1993.
Reference 5	Current load coefficients Faltinsen, O. M. Sea Loads on Ships and Offshore Structures Cambridge University Press 1990.
Reference 6	Wave-drift load coefficients Scaled from similar vessel.
Reference 7	Thrust to power relationship The International Marine Contractors Association Specification for DP capability plots IMCA M 140 Rev. 1, June 2000.
Reference 8	Thrust loss calculations Lehn, E. Practical methods for estimation of thrust losses MARINTeK publication R-102.80, October 1990. Lehn, E. and Larsen, K. Thrusters in extreme condition, part 1 & part 2. FPS-2000 1.6B, January, 1990. Svensen, T. Thruster considerations in the design of DP assisted vessels NIF, June, 1992.

<p><i>Reference 9 Thruster forbidden zones</i> <i>Lehn, E.</i> On the propeller race interaction effects <i>MARINTEK publication P-01.85, September 1985.</i></p>
<p><i>Reference 10 Wave spectrum</i> <i>Faltinsen, O. M.</i> Sea Loads on Ships and Offshore Structures <i>Cambridge University Press 1990.</i></p> <p>Model for a doubly peaked wave spectrum <i>SINTEF STF22 A96204, 1996.</i></p>
<p><i>Reference 11 Wind spectrum</i> <i>Norwegian Petroleum Directorate</i> Regulations relating to loadbearing structures in the petroleum activities <i>Guidelines relating to loads and load effects etc., 1998</i></p>
<p><i>Reference 12 Wind speed and wave height relationship</i> <i>The International Marine Contractors Association</i> Specification for DP capability plots <i>IMCA M 140 Rev. 1, June 2000.</i></p>

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1 Summary

This document contains a DP capability analysis for Arctic Research Vessel. The analysis has been based upon the information given in Reference 1 and Reference 2. The nominal bollard thrust is calculated from power according to Reference 7. The Kongsberg Maritime computer program StatCap Report has been used for the calculations.

The simulation case definitions are given in Table 1. T1 denotes thruster number 1, T2 thruster number 2 and so on. For details regarding thruster layout, see Figure 10.

<i>Case no.</i>	<i>Thrusters active</i>	<i>Case description</i>
1	T1-T3	Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 4
2	T1-T3	Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 4
3	T1-T3	Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 4
4	T1-T3	Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 4
5	T1-T3	Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 4
6	T1-T3	Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 4
7	T1-T3	Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 4
8	T1-T3	Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 4
9	T1-T3	Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 4
10	T1-T3	Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 4
11	T1-T3	Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 4
12	T1-T3	Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 4
13	T1-T3	Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 4
14	T1-T3	Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 4
15	T1-T3	Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 4
16	T1-T3	Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 4

		current, Sea State 4
17	T1-T3	Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 4
18	T1-T3	Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 4
19	T1-T3	Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 4
20	T1-T3	Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 5
21	T1-T3	Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 5
22	T1-T3	Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 5
23	T1-T3	Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 5
24	T1-T3	Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 5
25	T1-T3	Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 5
26	T1-T3	Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 5
27	T1-T3	Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 5
28	T1-T3	Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 5
29	T1-T3	Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 5
30	T1-T3	Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 5
31	T1-T3	Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 5
32	T1-T3	Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 5
33	T1-T3	Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 5
34	T1-T3	Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 5
35	T1-T3	Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 5
36	T1-T3	Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 5
37	T1-T3	Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 5

38	T1-T3	Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 5
39	T1-T3	Thrust Utilization: 35 knots wind. 0 current, 0 waves

Table 1: Simulation case definitions.

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The simulation results are summarised in Table 2 showing the limiting conditions at the most unfavourable directions.

Case no.	Wind speed [kts]	Wind direction [deg]	Wave height Hs [m]	Wave period, Tz [s]	Wave period, Tp [s]	Current speed [kts]	Thrust utilisation [%]
1	35.00	0	2.50	6.05	8.50	2.00	72.6
2	35.00	10	2.50	6.05	8.50	2.00	91.1
3	35.00	20	2.50	6.05	8.50	2.00	> 100.0
4	35.00	30	2.50	6.05	8.50	2.00	> 100.0
5	35.00	40	2.50	6.05	8.50	2.00	> 100.0
6	35.00	50	2.50	6.05	8.50	2.00	> 100.0
7	35.00	60	2.50	6.05	8.50	2.00	> 100.0
8	35.00	70	2.50	6.05	8.50	2.00	> 100.0
9	35.00	80	2.50	6.05	8.50	2.00	> 100.0
10	35.00	90	2.50	6.05	8.50	2.00	> 100.0
11	35.00	100	2.50	6.05	8.50	2.00	> 100.0
12	35.00	110	2.50	6.05	8.50	2.00	> 100.0
13	35.00	120	2.50	6.05	8.50	2.00	> 100.0
14	35.00	130	2.50	6.05	8.50	2.00	> 100.0
15	35.00	140	2.50	6.05	8.50	2.00	> 100.0
16	35.00	150	2.50	6.05	8.50	2.00	> 100.0
17	35.00	160	2.50	6.05	8.50	2.00	93.1
18	35.00	170	2.50	6.05	8.50	2.00	83.7
19	35.00	180	2.50	6.05	8.50	2.00	76.8
20	35.00	0	4.00	6.69	9.40	2.00	74.3
21	35.00	10	4.00	6.69	9.40	2.00	97.8
22	35.00	20	4.00	6.69	9.40	2.00	> 100.0
23	35.00	30	6.35	6.69	9.40	2.00	> 100.0
24	35.00	40	4.00	6.69	9.40	2.00	> 100.0
25	35.00	50	4.00	6.69	9.40	2.00	> 100.0
26	35.00	60	4.00	6.69	9.40	2.00	> 100.0
27	35.00	70	4.00	6.69	9.40	2.00	> 100.0
28	35.00	80	4.00	6.69	9.40	2.00	> 100.0
29	35.00	90	4.00	6.69	9.40	2.00	> 100.0
30	35.00	100	4.00	6.69	9.40	2.00	> 100.0
31	35.00	110	4.00	6.69	9.40	2.00	> 100.0
32	35.00	120	4.00	6.69	9.40	2.00	> 100.0
33	35.00	130	4.00	6.69	9.40	2.00	> 100.0
34	35.00	140	4.00	6.69	9.40	2.00	> 100.0

35	35.00	150	4.00	6.69	9.40	2.00	> 100.0
36	35.00	160	4.00	6.69	9.40	2.00	99.4
37	35.00	170	4.00	6.69	9.40	2.00	87.6
38	35.00	180	4.00	6.69	9.40	2.00	79.0
39	35.00	60	0.00	0.00	0.00	0.00	61.7

Table 2: Limiting conditions at most unfavourable directions.

Note! *In normal operating conditions, the thrust is reduced due to current, waves and proximity to the hull. Approximations for the thrust losses are taken into account in the simulations. See section 4.6.*

Note! *A certain amount of dynamic load allowance is included in the simulations. The dynamic allowance is the 'spare' thrust required to compensate for the dynamic effects of the wind and wave drift loads, see section 3.4.*

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2 Coordinate system

The coordinate system used is the orthogonal right-handed system shown in Figure 1 with the positive z-axis pointing downwards. The origin of the coordinate system can be offset a longitudinal distance X_0 from $L_{pp}/2$. The origin of y- and z-axis is centreline and keel.

The directions of the wind, waves and current are defined by means of coming-from directions and are considered positive when turning clockwise, e.g. a wind direction equal to 0 degrees exerts a negative longitudinal force on the vessel.

Unless otherwise stated, the directions of the wind, waves and current are coincident in the analyses.

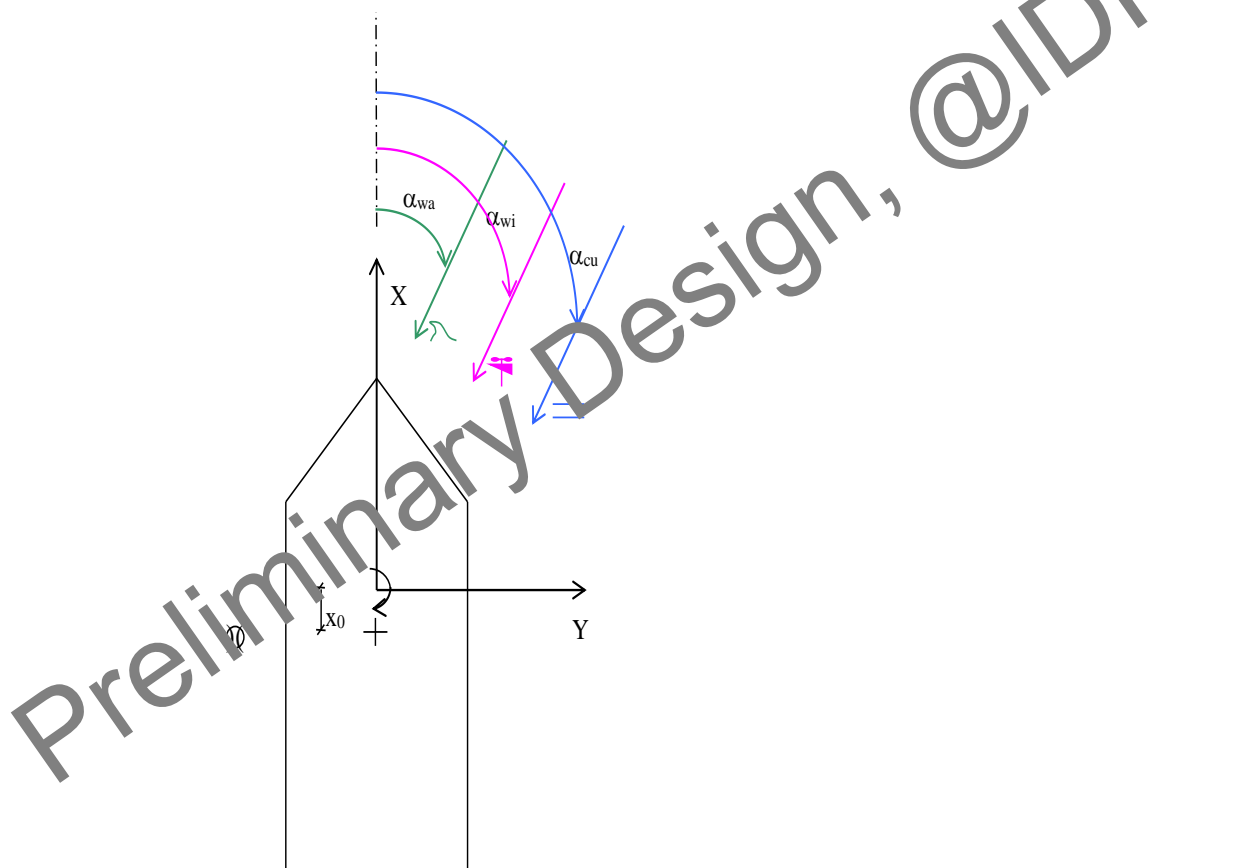


Figure 1: Coordinate system and sign conventions.

3 DP capability

3.1 Definition

DP capability defines a DP vessel's station-keeping ability under given environmental and operational conditions.

3.2 Wind speed envelopes

DP capability analyses are generally used to establish the maximum weather conditions in which a DP vessel can maintain its position and heading for a proposed thruster configuration. The environmental forces and moments are increased until they are exactly balanced by the maximum available thrust offered by the thruster configuration. Thus, a limiting weather condition is obtained as a combination of a mean wind speed, significant wave height and a sea current speed. Wind, current and waves are normally taken as coming from the same direction. By allowing the environmental components to rotate in steps around the vessel, the results of a DP capability analysis can be presented by means of a limiting mean wind speed for a discrete number of wind angles of attack. The resulting polar plot is often referred to as a DP capability envelope.

Limiting weather conditions are limited to 100 kts wind speed to avoid conditions without sufficient statistical data about corresponding sea states.

3.3 Thrust utilisation envelopes

When a design sea state is determined by the client, DP capability can be presented by means of a thrust utilisation envelope instead of a limiting wind speed envelope. The required thrust to maintain position and heading in the design sea state is calculated and compared to the vessel's maximum available thrust. The ratio between the two is plotted as a function of wind direction. A thrust utilisation less than or equal to 100% means that the vessel is able to hold position and heading in the specified design sea state. If the ratio exceeds 100%, the vessel will experience poor positioning performance or drift off.

3.4 Dynamic allowance

A DP vessel needs a certain amount of 'spare' thrust to compensate for the dynamic behaviour of the wind and wave drift loads. The 'spare' thrust is calculated from the spectral densities of the wind and wave drift loads and the controller's restoring and damping characteristics ($1.0 \cdot \text{STD}$ of thrust demand).

The dynamic variations in wind, represented as wind spectra, influences the dynamic allowance. The NPD spectrum is used in the calculations. For descriptions of the wind spectrum refer to the literature, e.g. see Reference 11.

4 Input data

The input data for the calculations are based upon the information given in Reference 1 and Reference 2.

4.1 Main particulars

The vessel main particulars are listed below in Table 3:

Length over all	111.3 m
Length between perpendiculars	102.1 m
Breadth	24.4 m
Draught	9.6 m
Displacement	13 500.0 t
Longitudinal radius of inertia (0.25 * Lpp)	25.5 m
Position of origin ahead of Lpp/2 (Xo)	0.0 m
Wind load coefficients	Calculated (Blendermann)
Current load coefficients	Calculated (Strip-theory)
Wave-drift load coefficients	Database (Scaled by Breadth/Length)

Table 3: Main particulars.

4.2 Wind load coefficients

Blendermann's method is used for obtaining wind load coefficients. The method describes wind loading functions which can be combined with the vessel's wind resistance in head, stern and beam wind. Typical wind resistance for a number of relevant offshore ship types is also described. See Reference 4.

The wind affected areas are calculated on the basis of Reference 1. The wind area projections are presented in Figure 3 and Figure 4. The resulting areas are listed in Table 4.

Vessel type	Research vessel
Area of frontal projection (36 points)	606.0 m ²
Area of lateral projection (67 points)	1,851.6 m ²
Mean height of lateral projection	16.6 m
Dist. to centroid of lateral position	7.0 m

Table 4: Wind area projections.

The wind load coefficients are presented in Figure 2.

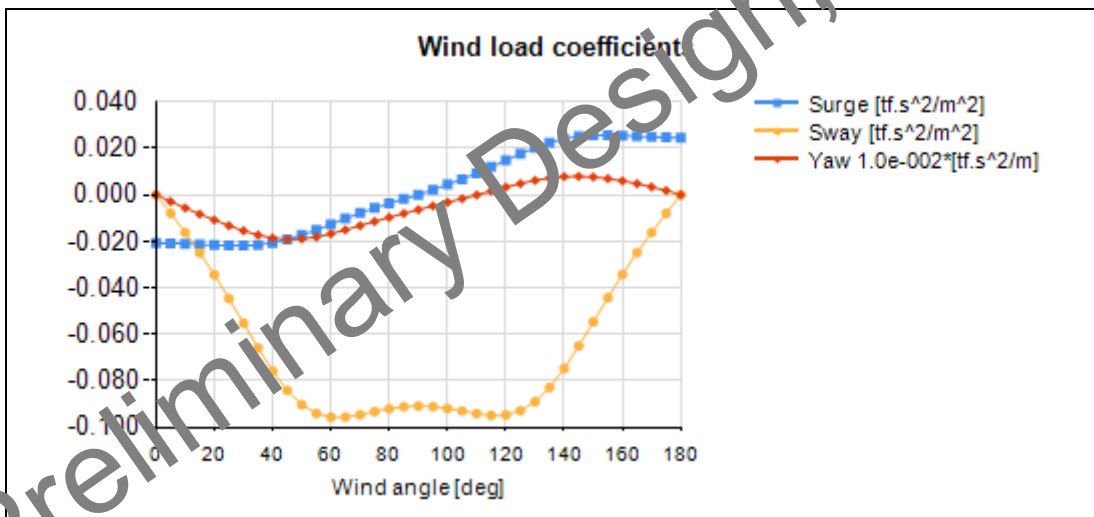


Figure 2: Wind load coefficients.

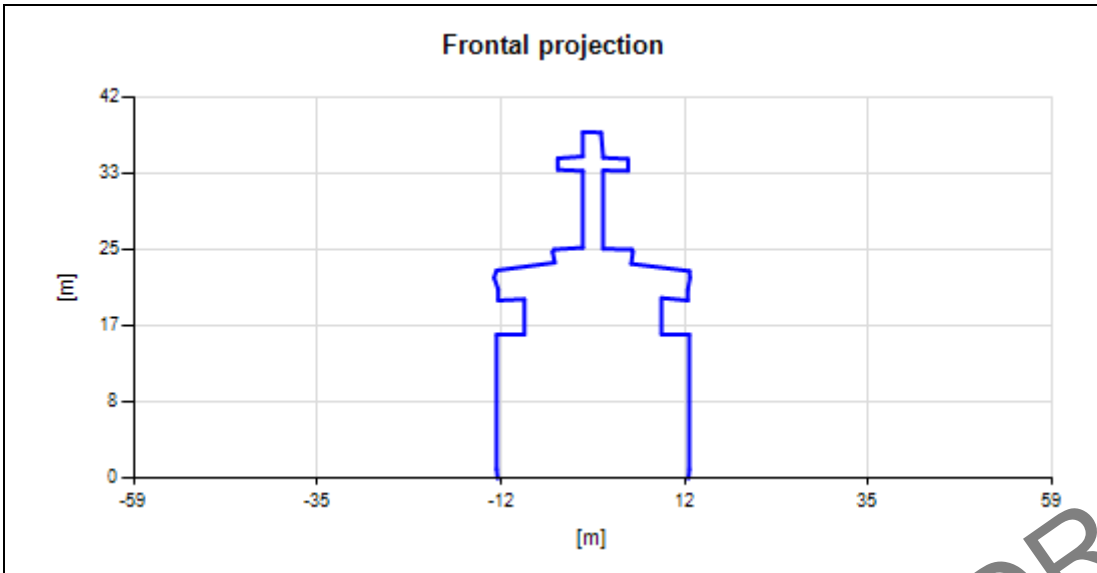


Figure 3: Frontal wind area projections.

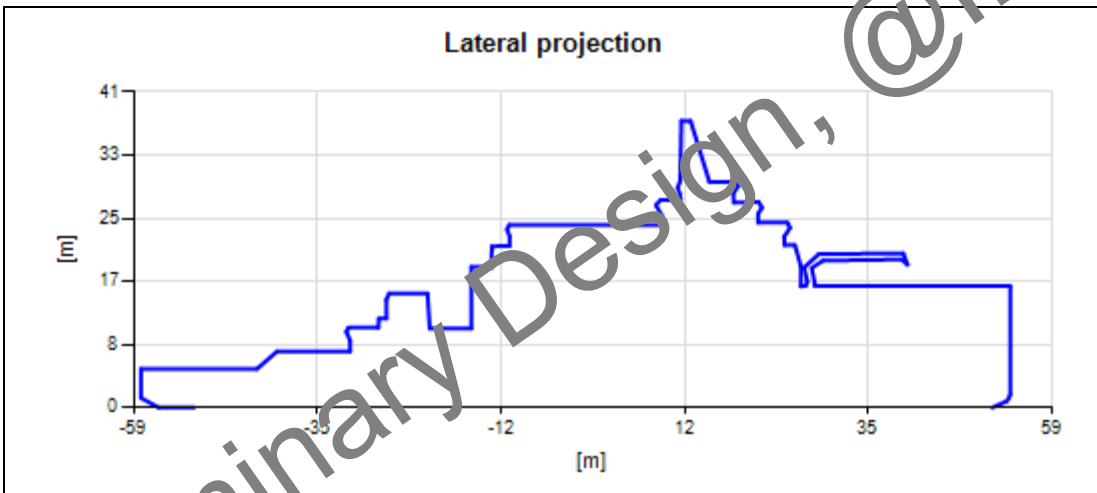


Figure 4: Lateral wind area projections.

4.3 Current load coefficients

A simplified strip-theory approach is applied in order to calculate the transverse and yawing moment current load coefficients. For a description of the strip-theory approach, see Reference 5.

The longitudinal load coefficient is calculated using the method described in Reference 5. However, the longitudinal coefficient has been adjusted for improved match against a number of model test results in the Kongsberg Maritime database.

The current load coefficients are presented in Figure 5.

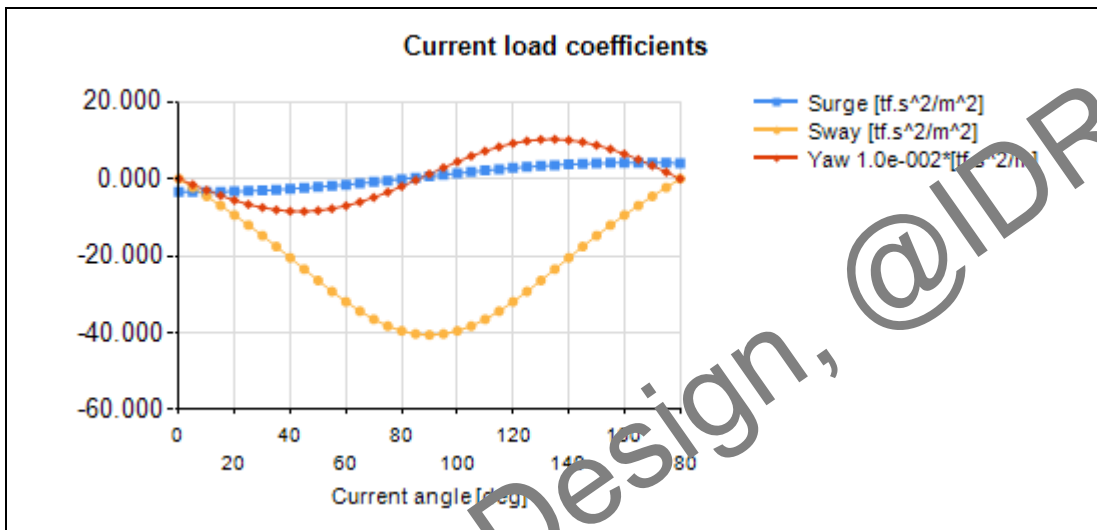


Figure 5: Current load coefficients.

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4.4 Wave-drift load coefficients

StatCap offers two methods to arrive at wave-drift load coefficients, see Table 5. The method used is indicated in 4.1 Main particulars. See Reference 6.

<i>Method</i>	<i>Applicable to</i>	<i>Description</i>
Database scaling	Mono-hulls/semi-submersibles	The wave-drift load coefficients are obtained through scaling of data for a similar vessel in the Kongsberg Maritime database. The coefficients are scaled with respect to length and breadth, length or displacement.
External file input	Mono-hulls/semi-submersibles	Specific wave-drift load coefficients, supplied by the client, are read up and used by StatCap.

Table 5: Methods for obtaining wave-drift load coefficients

The wave-drift load coefficients are presented in Figure 6, Figure 7 and Figure 8.

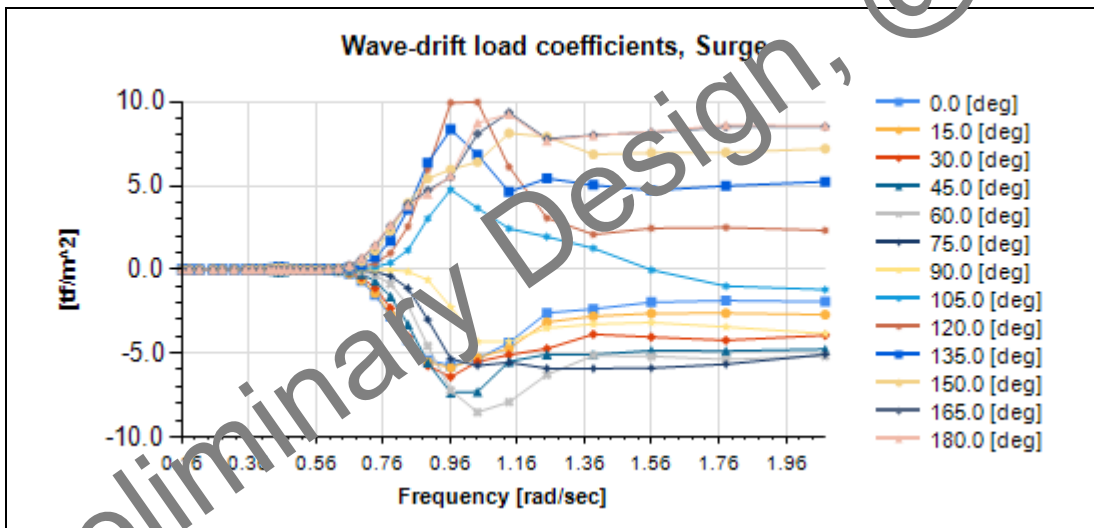


Figure 6: Wave-drift load coefficients for surge.

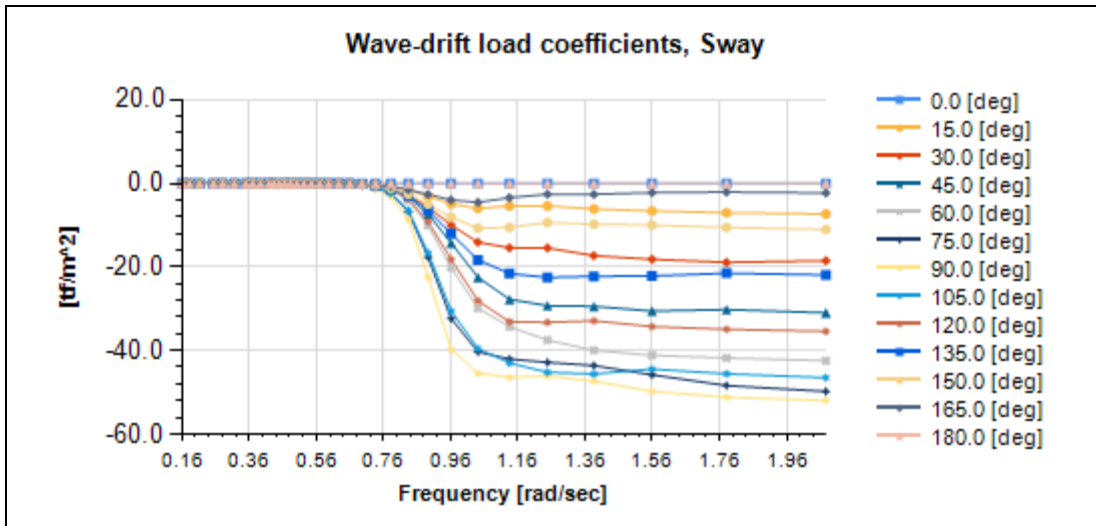


Figure 7: Wave-drift load coefficients for sway.

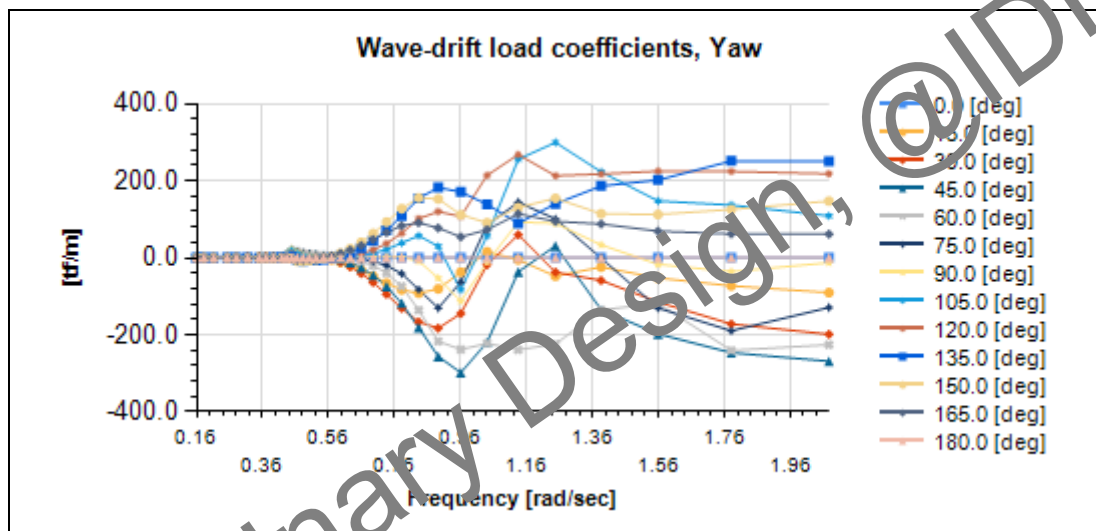


Figure 8: Wave-drift load coefficients for yaw.

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4.5 Wind speed and wave height relationship

Several wind and wave spectrum types are available in StatCap. Each of the wave spectrum types is listed in Table 6 together with a short description. The wind spectrum type selected does not affect the wind loads as such, but has an influence on the dynamic allowance. See section 3.4. The wave spectrum type used in each case are indicated on the capability envelope sheets.

Wave spectrum	Applicable to	Description
Pierson-Moskowitz	North Atlantic	Wave spectrum for fully developed sea and open sea conditions, see Reference 10.
JONSWAP	North Sea	Joint North Sea Wave Project, see Reference 10, valid for sea not fully developed (the fetch has limited length).
Doubly-Peaked	Norwegian Sea	Wave spectrum for wind-generated sea and swell. A modified JONSWAP model is used for both peaks. See Reference 10.

Table 6: Wave spectrum types.

The relationship between wind speed and wave height used in the analyses is defined in Reference 12. The relationship between wind speed and significant wave height is presented in Figure 9.

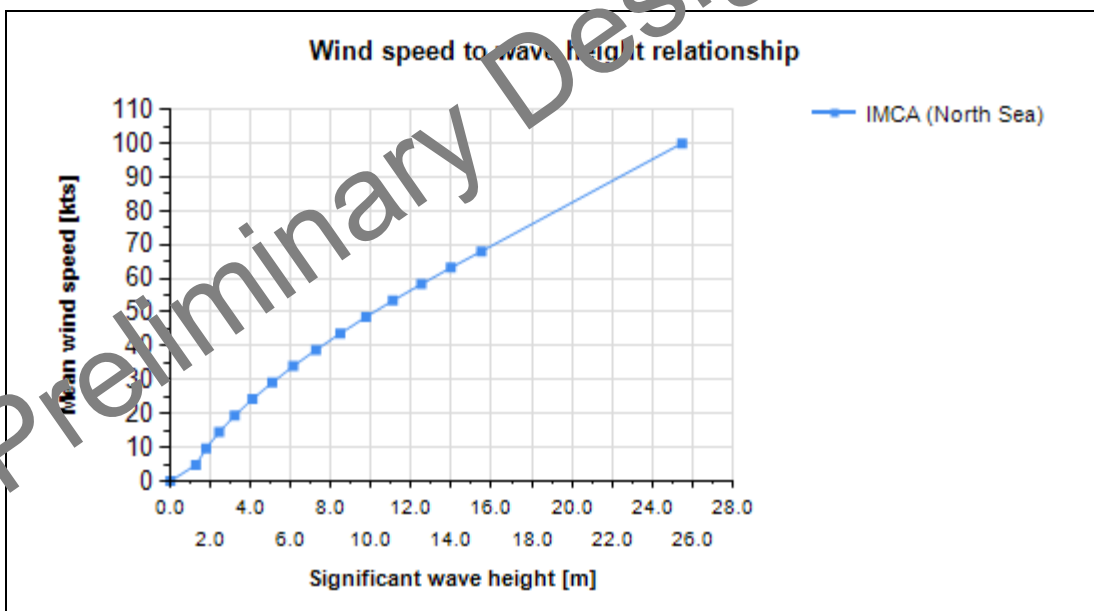


Figure 9: Wind speed to wave height relationship.

4.6 Thruster data

General thruster data is shown below in Table 7. Their locations on the hull can be found in Figure 10. See Reference 2.

Thr. ID	Maker's name	Thruster type	Max power [kW]	Diameter [m]	Ducted
T1		Azimuth	9,500.0	4.60	No
T2		Azimuth	9,500.0	4.60	No
T3		Tunnel	2,126.0	2.70	No

Table 7: General thruster data.



Thr. ID	X-coordinate [m]	Y-coordinate [m]	Z-coordinate [m]
T1	-46.7	-5.5	-3.5
T2	-46.7	5.5	-3.5
T3	30.2	0	-5.0

Figure 10: Thruster layout

The available thrust force is calculated according to Reference 7 based on the information given in Reference 2. The results are given in Table 8 below.

Thr. ID	Effective thrust	
	Forward thrust [tf]	Reversed thrust [tf]
T1	112.20	0.00
T2	112.20	0.00
T3	31.80	-31.80

Table 8: Available thrust forces.

In order to reduce thruster-thruster interaction, azimuth restrictions are imposed, see Table 9. The centre angles are those of the force vectors. The thruster dependency column denotes the thruster on which the zone is dependent. If this particular thruster is not in use, the zone is neglected in the thruster allocation.

Thr. ID	Zone 1			Zone 2			Zone 3		
	Centre angle [deg]	Beam [deg]	Thruster dependency	Centre angle [deg]	Beam [deg]	Thruster dependency	Centre angle [deg]	Beam [deg]	Thruster dependency
T1	-90.0	±29.8	T2	-	-	-	-	-	-
T2	90.0	±29.8	T1	-	-	-	-	-	-

Table 9: Thruster azimuth forbidden zones.

Thrust losses are accounted for. The thrusters' efficiencies are calculated considering the following: thrust loss due to axial and transverse current, thrust loss due to the Coanda effect and thrust loss in waves. For tunnel thrusters the effects of tunnel length, shape of the tunnel inlet and grids are also taken into account. The thrust loss calculations are based on the literature listed under Reference 8.

Each capability envelope sheet states whether power limitations are taken into account. When power limitations are included, the thrusters' power consumption is limited by the total generator capacity on the power bus to which they are connected. The power configurations are listed for each case in section 5. For cases without power limitations, thrusters are assumed to always be able to produce maximum thrust simultaneously at all times irrespective of power used.

5 Results

A capability envelope sheet for each case is presented in Figures *11* to *49*.

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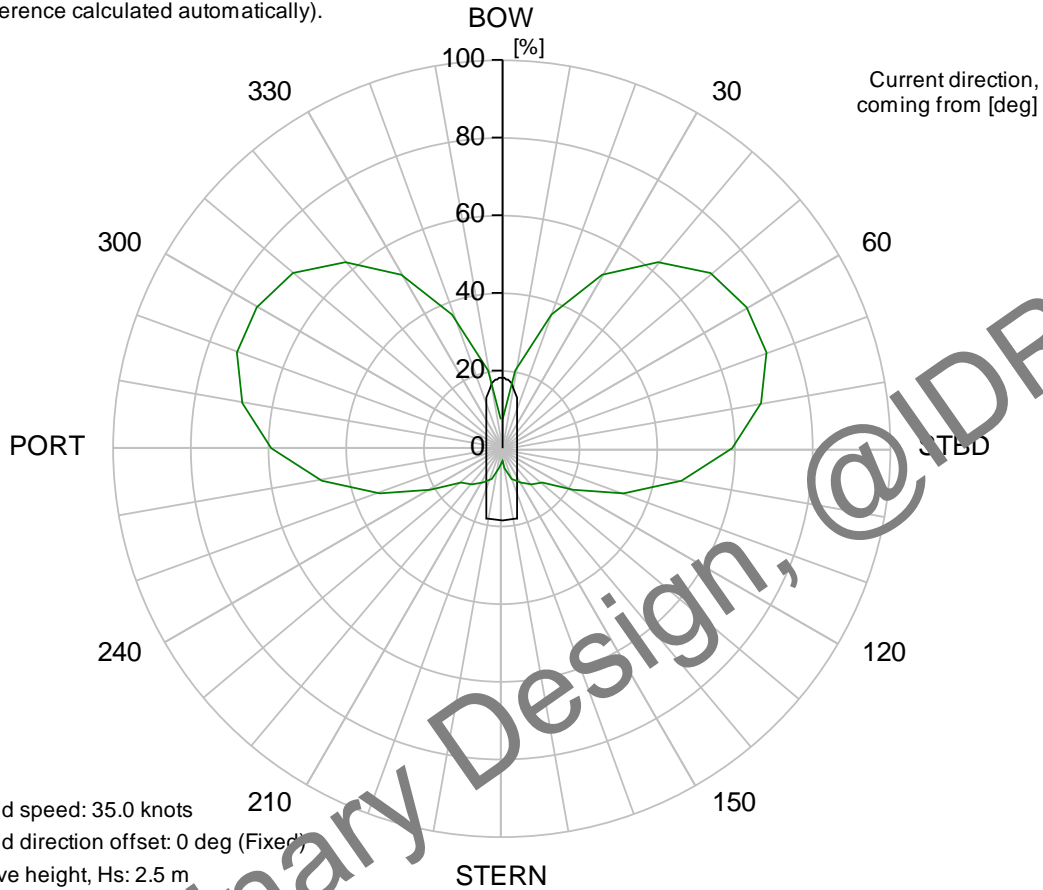
5.1 Case 1 - Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 0 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 0 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 11: DP capability envelope for case 1.

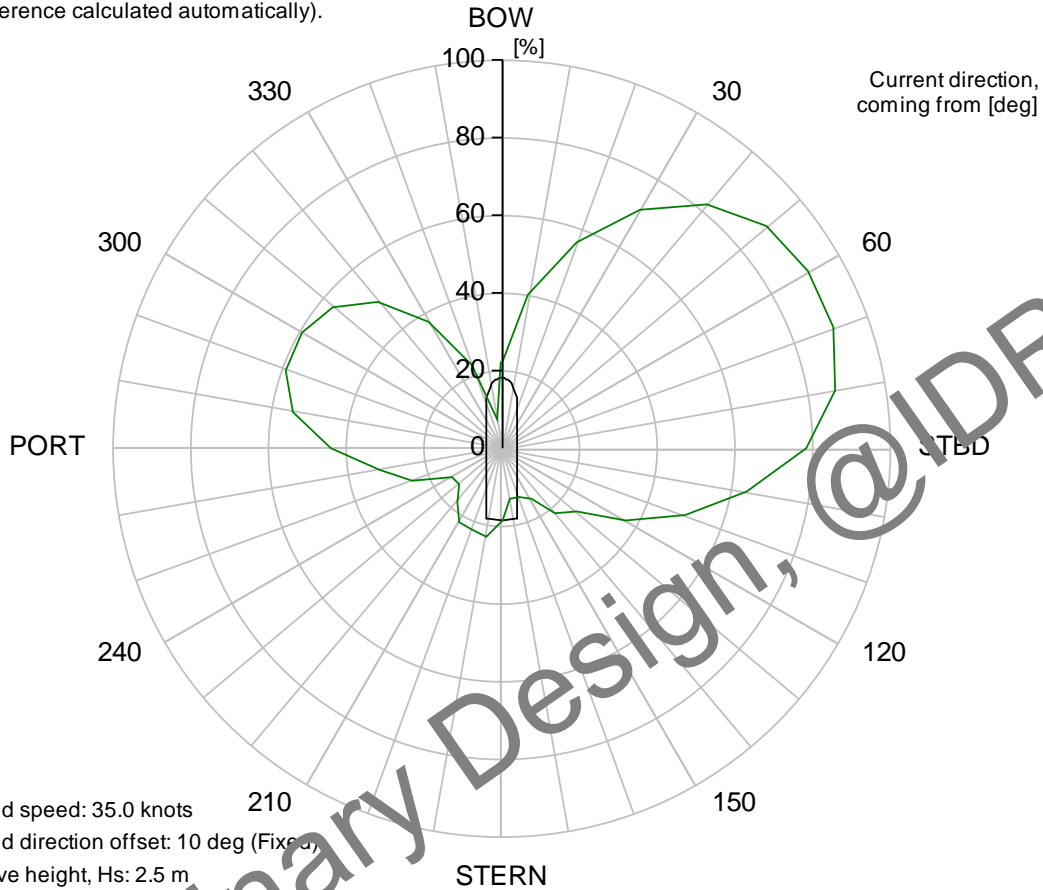
5.2 Case 2 - Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 10 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 10 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 12: DP capability envelope for case 2.

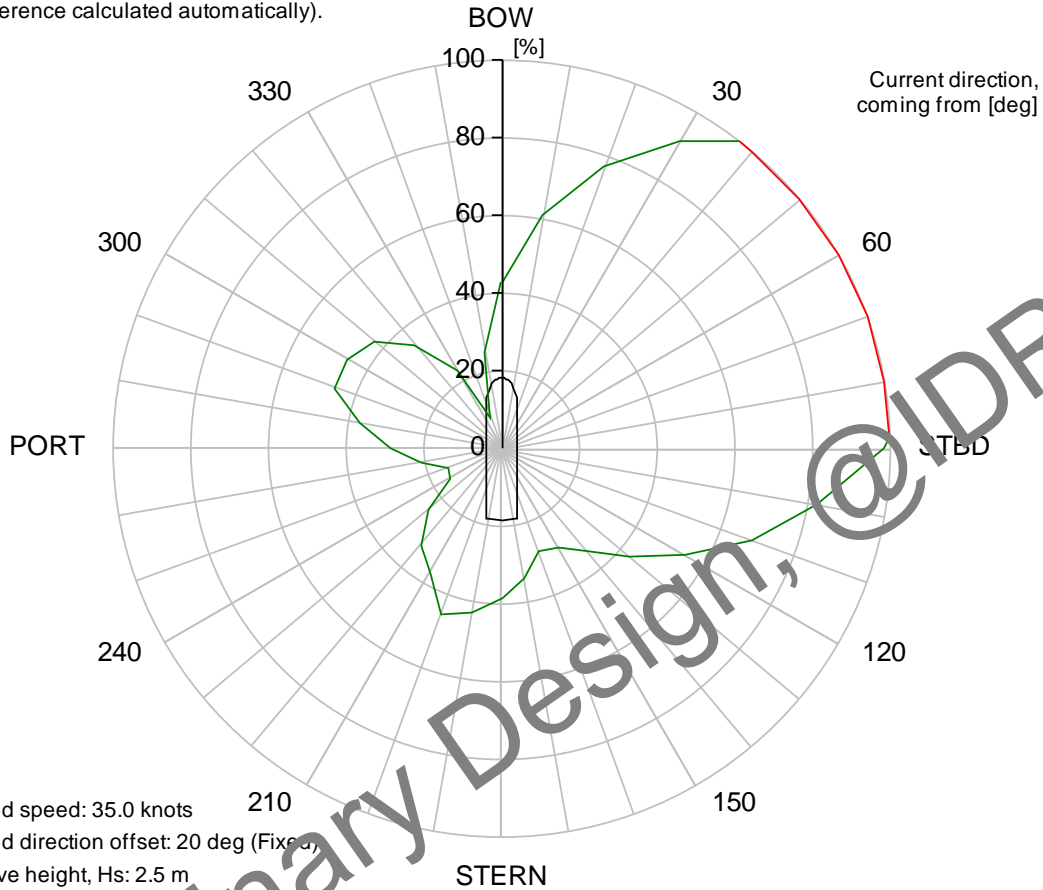
5.3 Case 3 - Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 20 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 20 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 13: DP capability envelope for case 3.

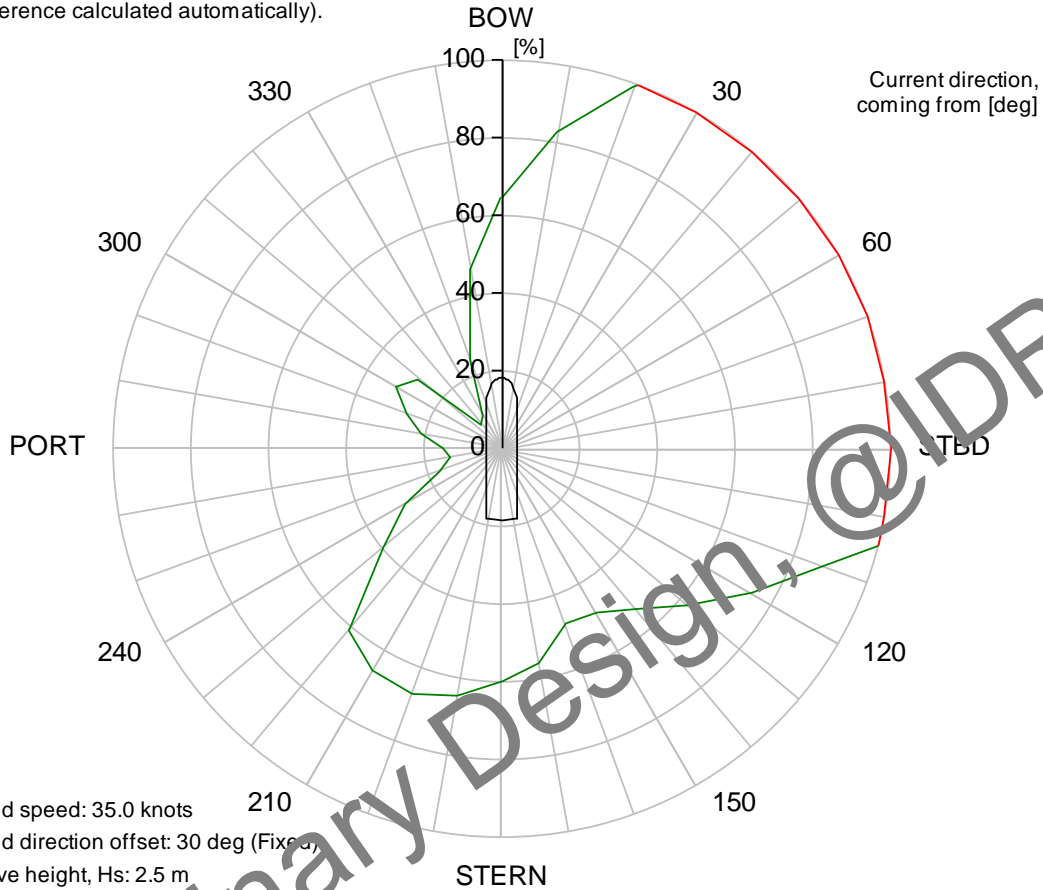
5.4 Case 4 - Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 30 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 30 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 14: DP capability envelope for case 4.

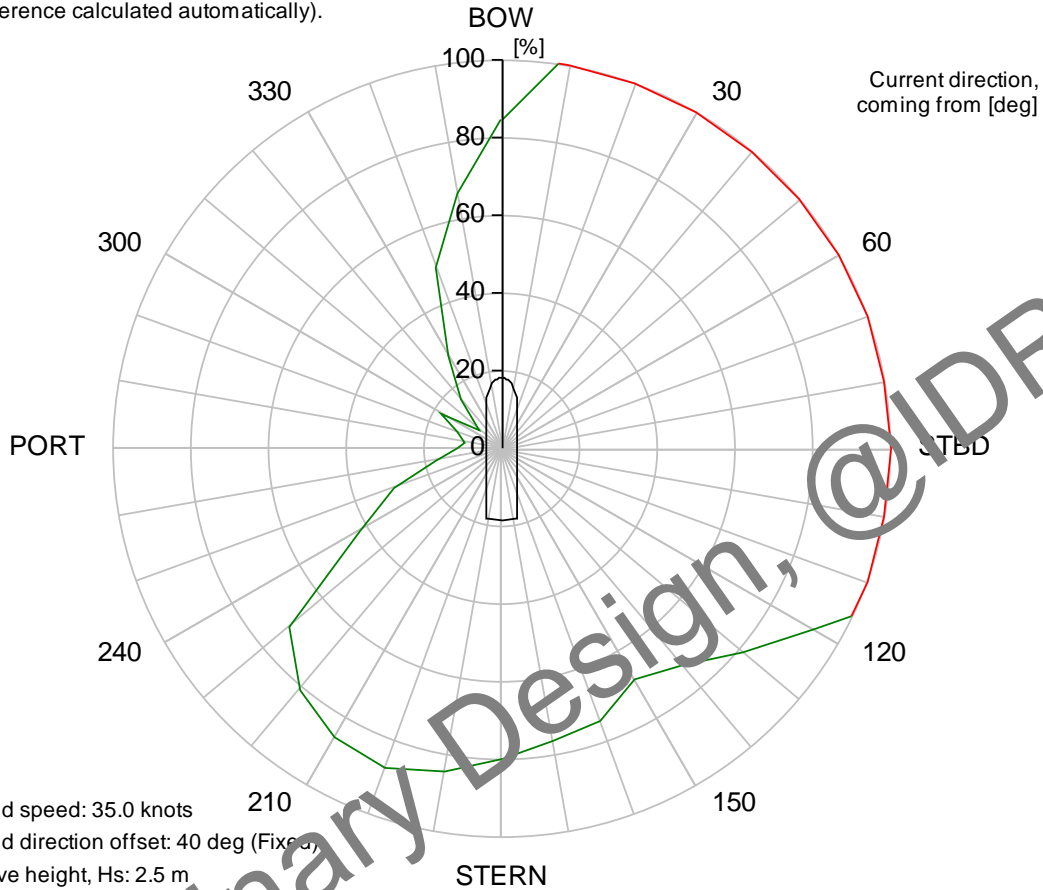
5.5 Case 5 - Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 40 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 40 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 15: DP capability envelope for case 5.

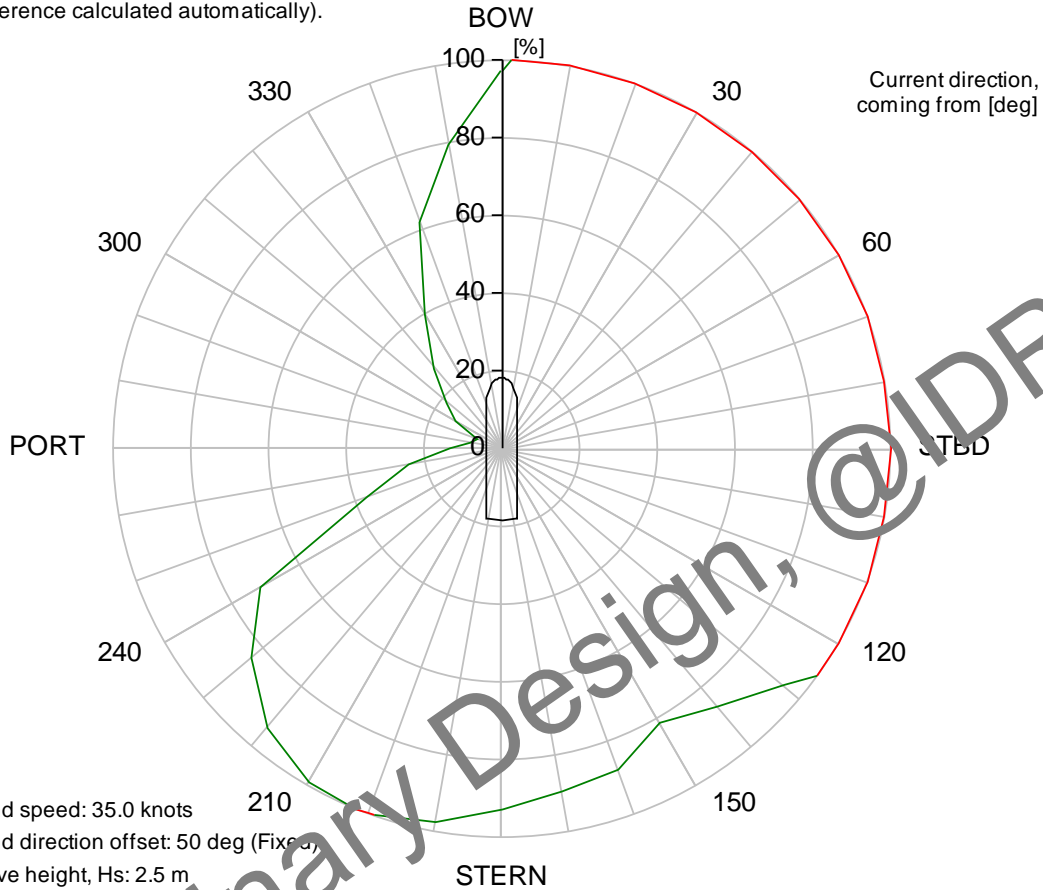
5.6 Case 6 - Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 50 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 30 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 16: DP capability envelope for case 6.

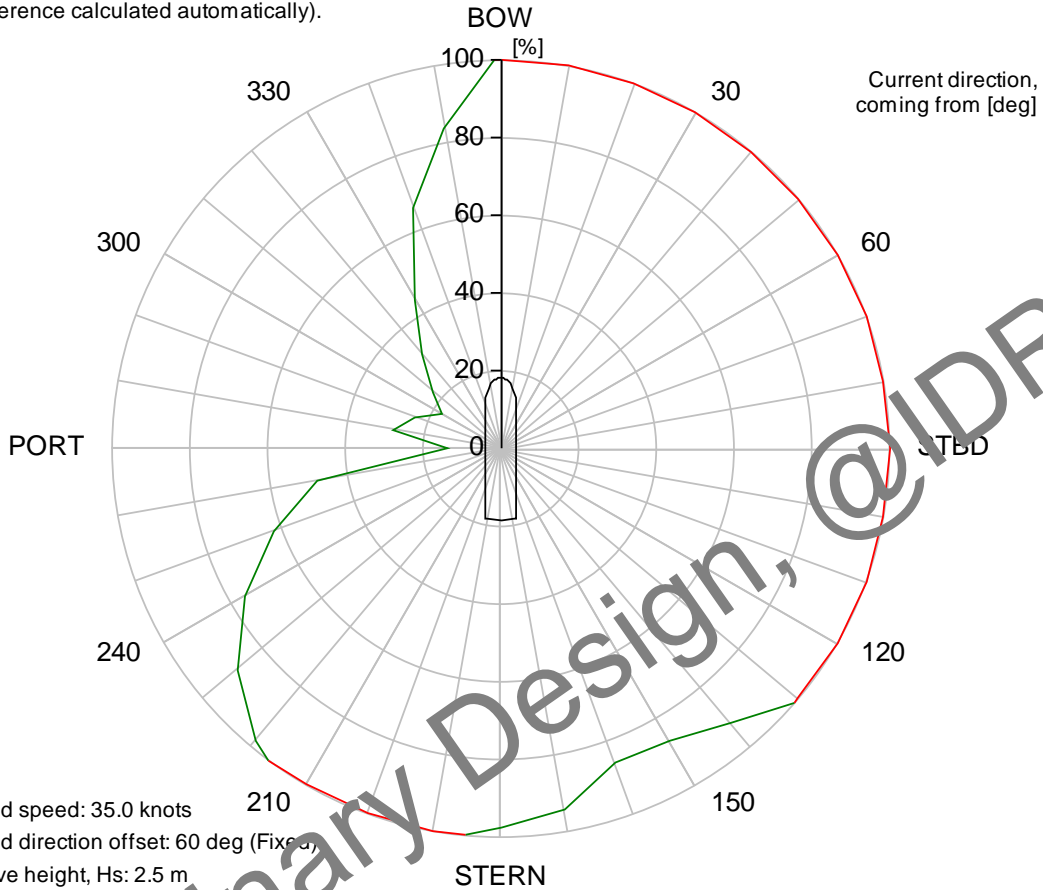
5.7 Case 7 - Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 60 deg (Fixed)
 Wave height, Hs: 2.5 m
 Wave period, Tz: 6.0 s (Tp 8.5 s)
 Wave direction offset: 60 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 17: DP capability envelope for case 7.

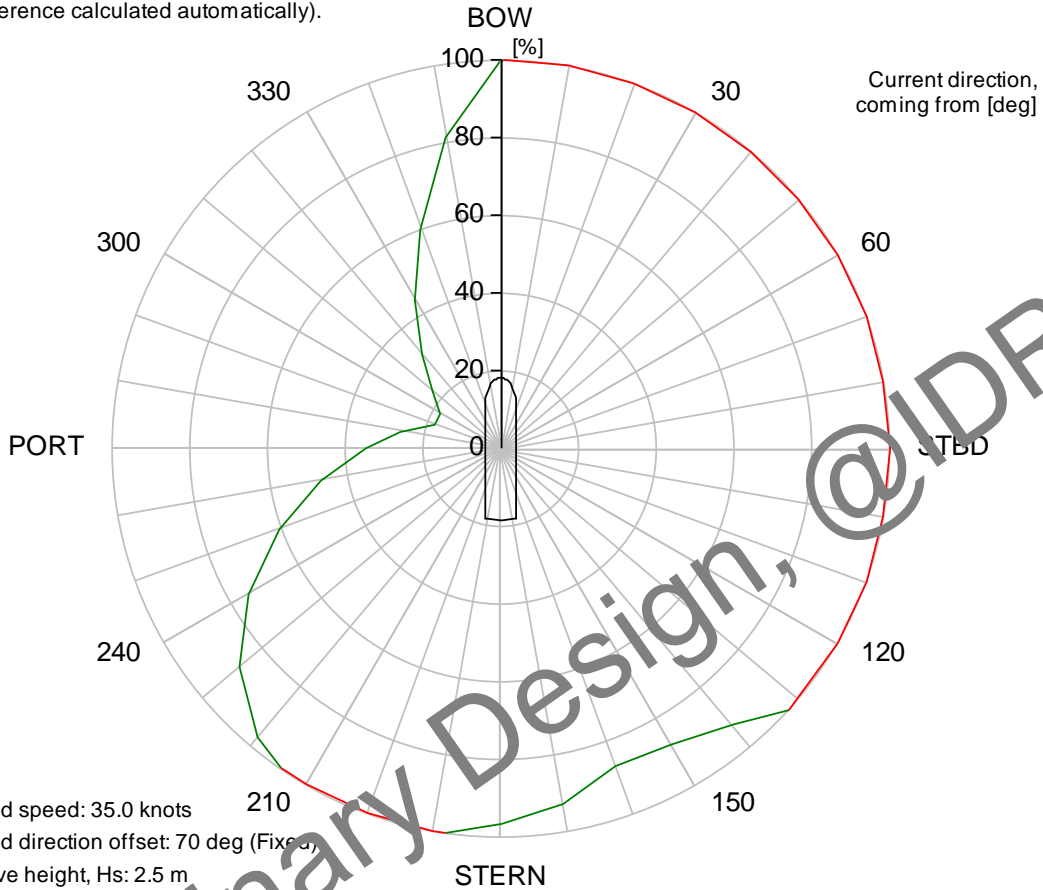
5.8 Case 8 - Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 70 deg (Fixed)
 Wave height, Hs: 2.5 m
 Wave period, Tz: 6.0 s (Tp 8.5 s)
 Wave direction offset: 70 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 18: DP capability envelope for case 8.

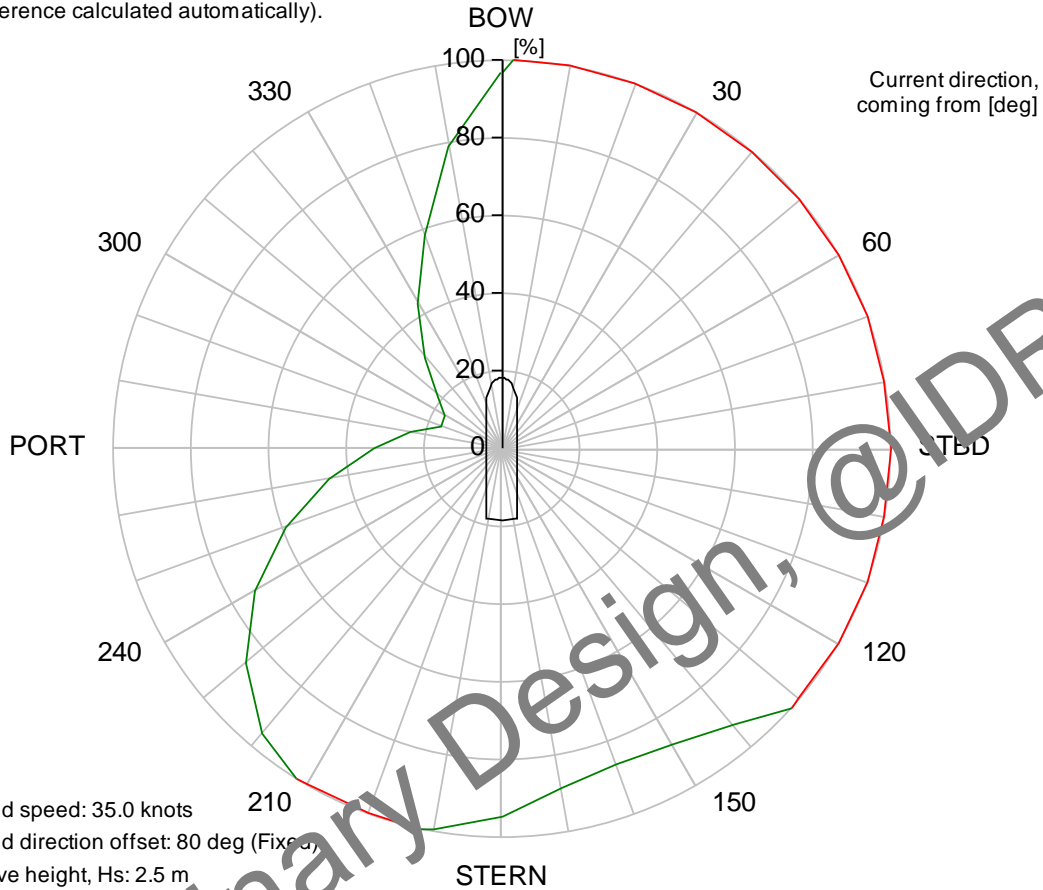
5.9 Case 9 - Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 80 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 80 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 19: DP capability envelope for case 9.

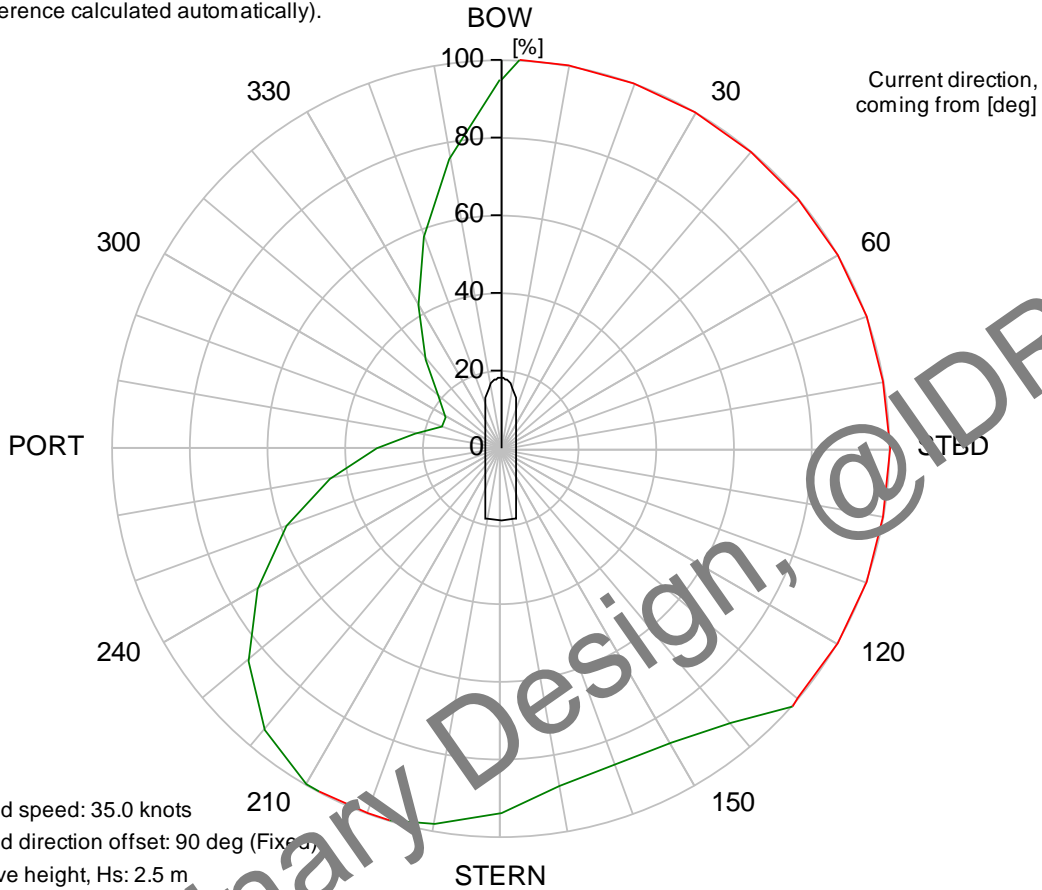
5.10 Case 10 - Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 90 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 90 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 20: DP capability envelope for case 10.

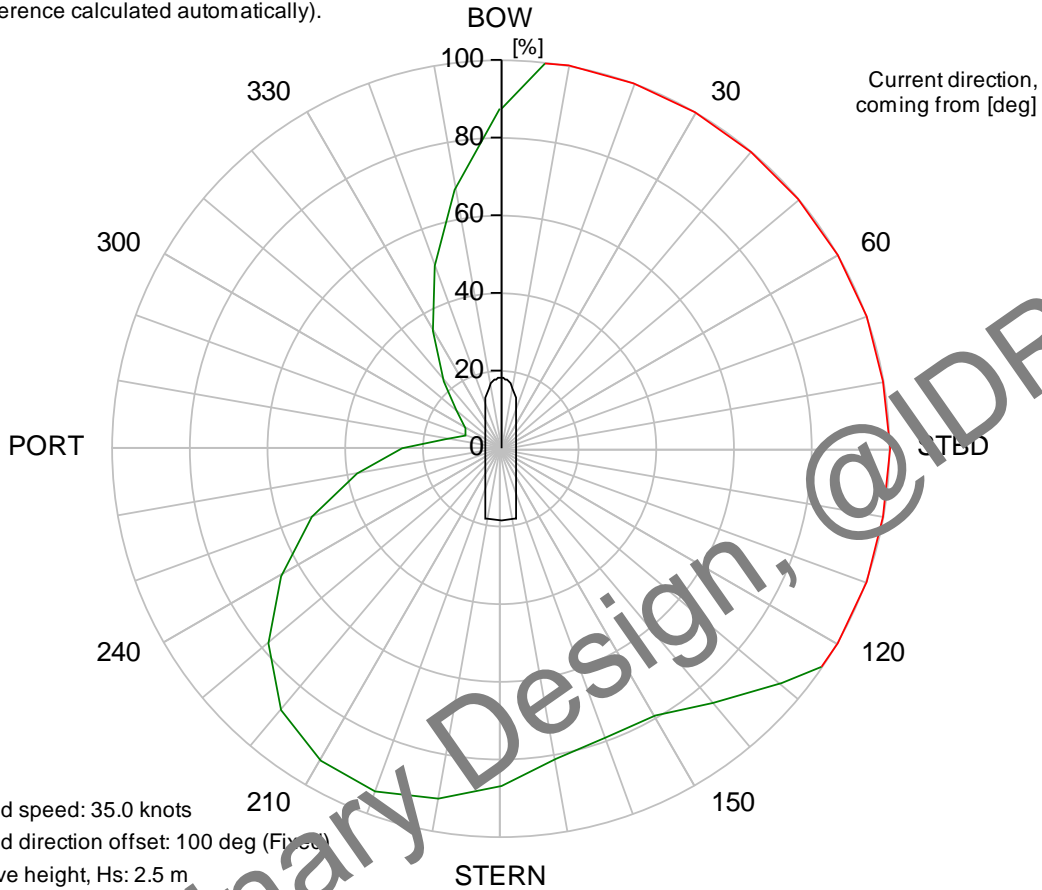
5.11 Case 11 - Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 100 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 100 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 21: DP capability envelope for case 11.

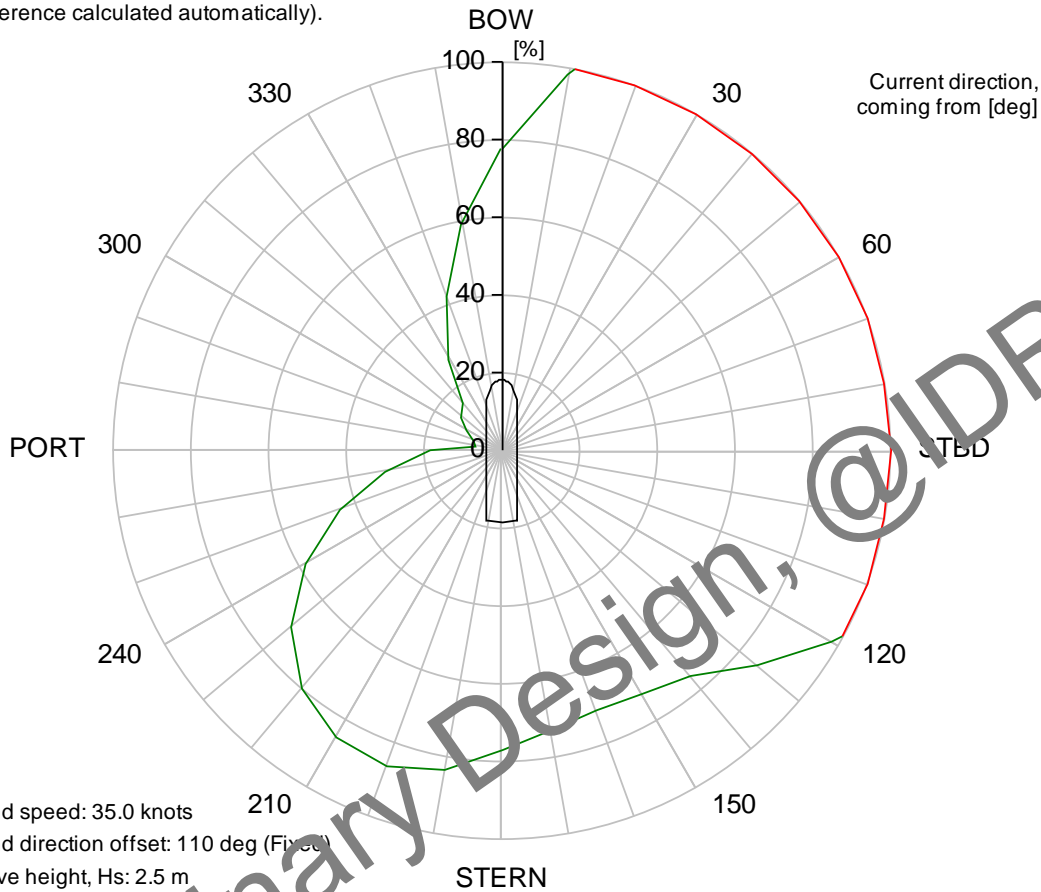
5.12 Case 12 - Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 110 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 110 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 22: DP capability envelope for case 12.

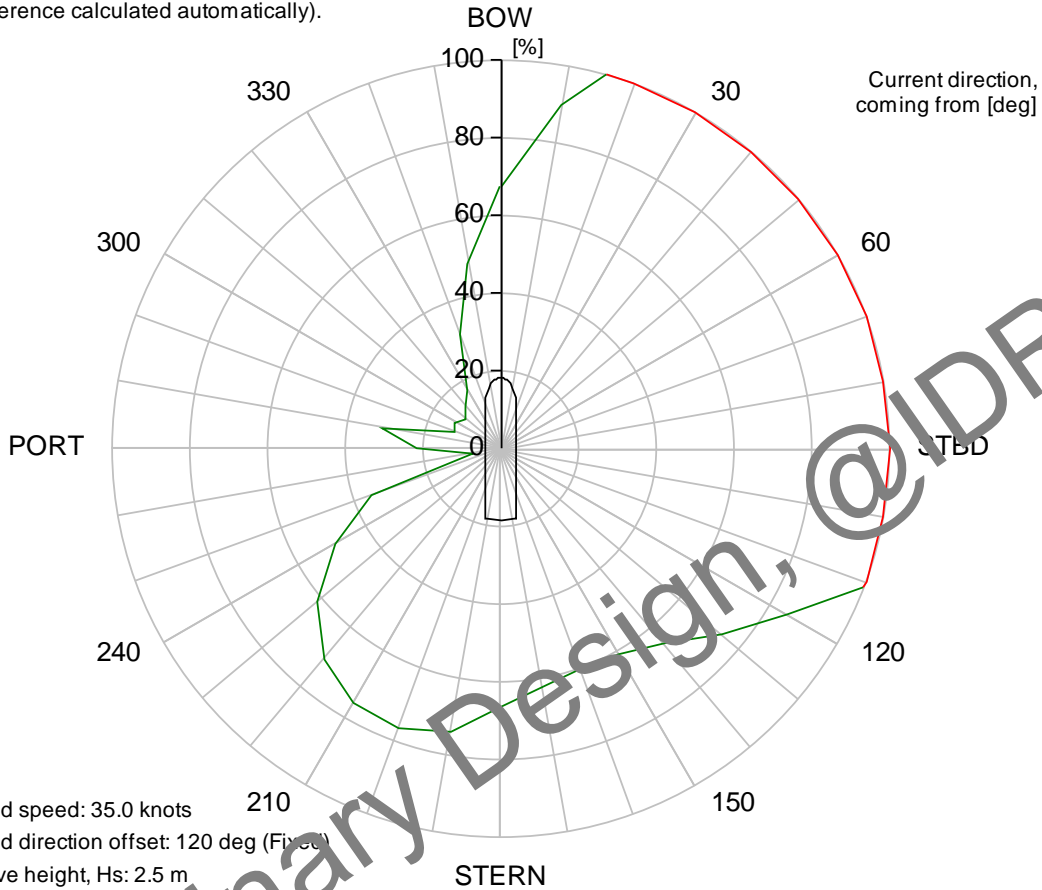
5.13 Case 13 - Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 120 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 120 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 23: DP capability envelope for case 13.

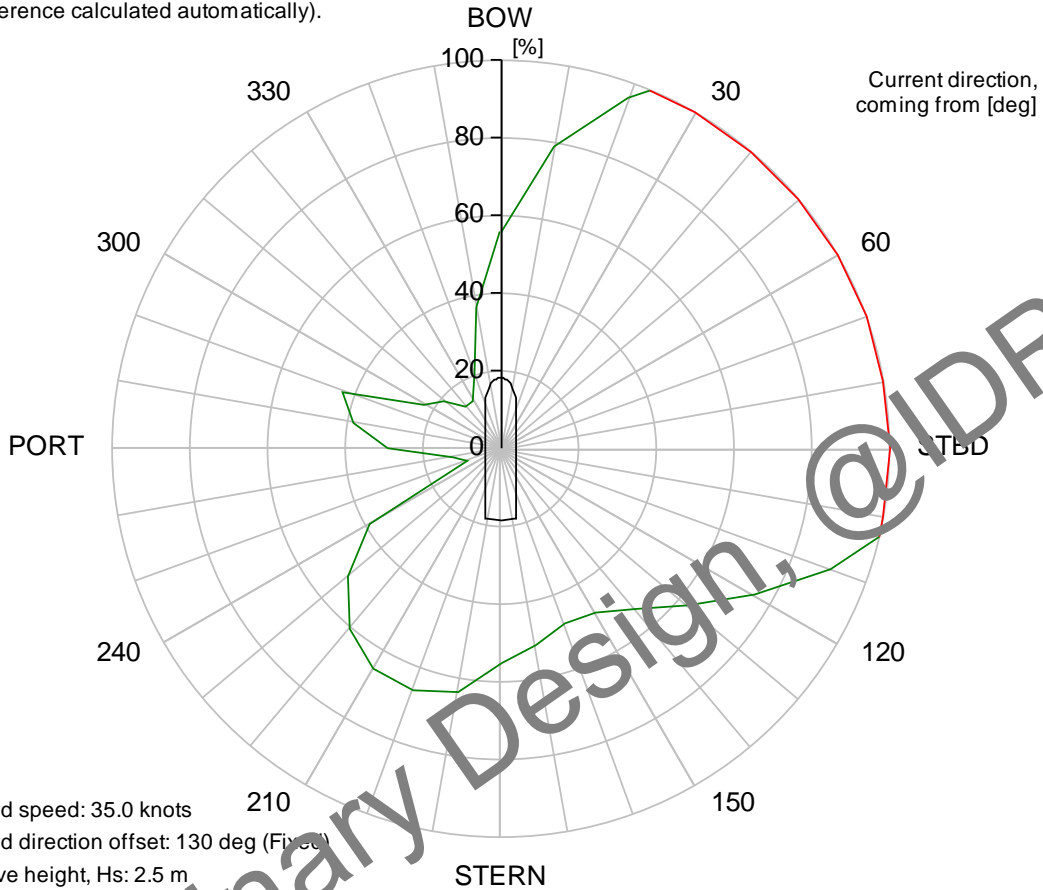
5.14 Case 14 - Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 130 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 130 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
T. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 24: DP capability envelope for case 14.

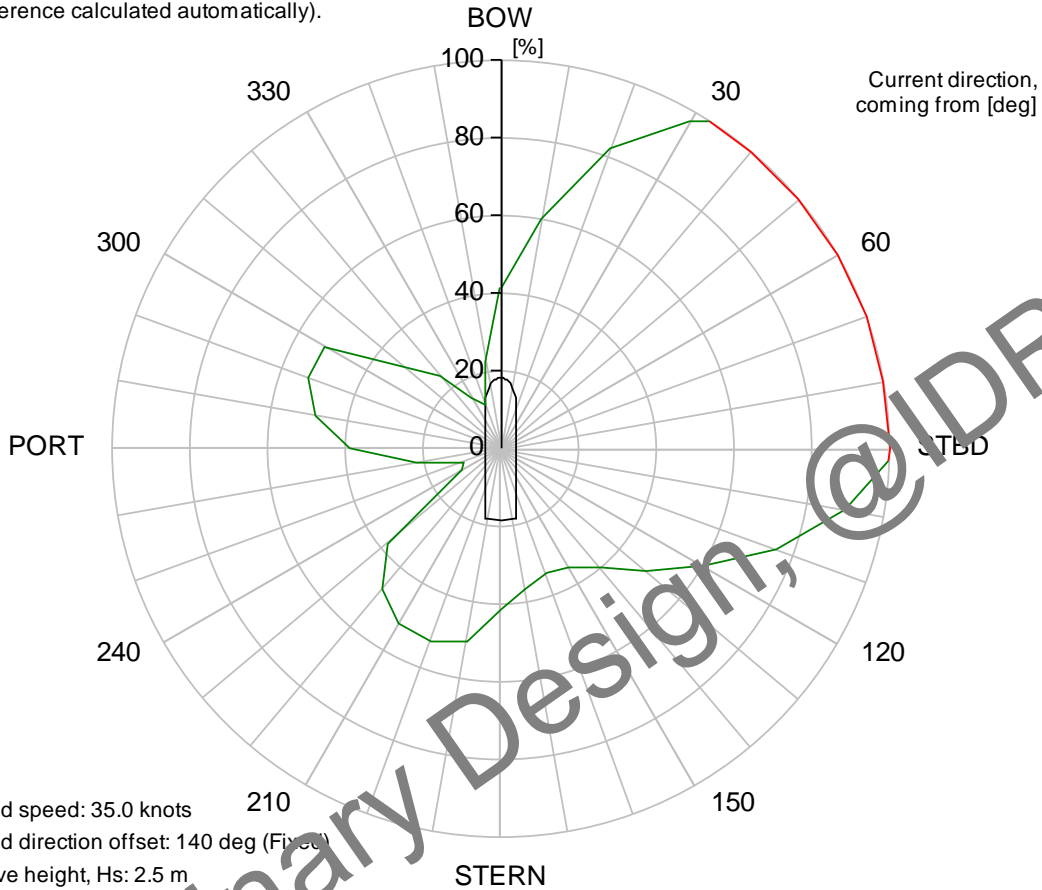
5.15 Case 15 - Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 140 deg (Fixed)
 Wave height, Hs: 2.5 m
 Wave period, Tz: 6.0 s (Tp 8.5 s)
 Wave direction offset: 140 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 25: DP capability envelope for case 15.

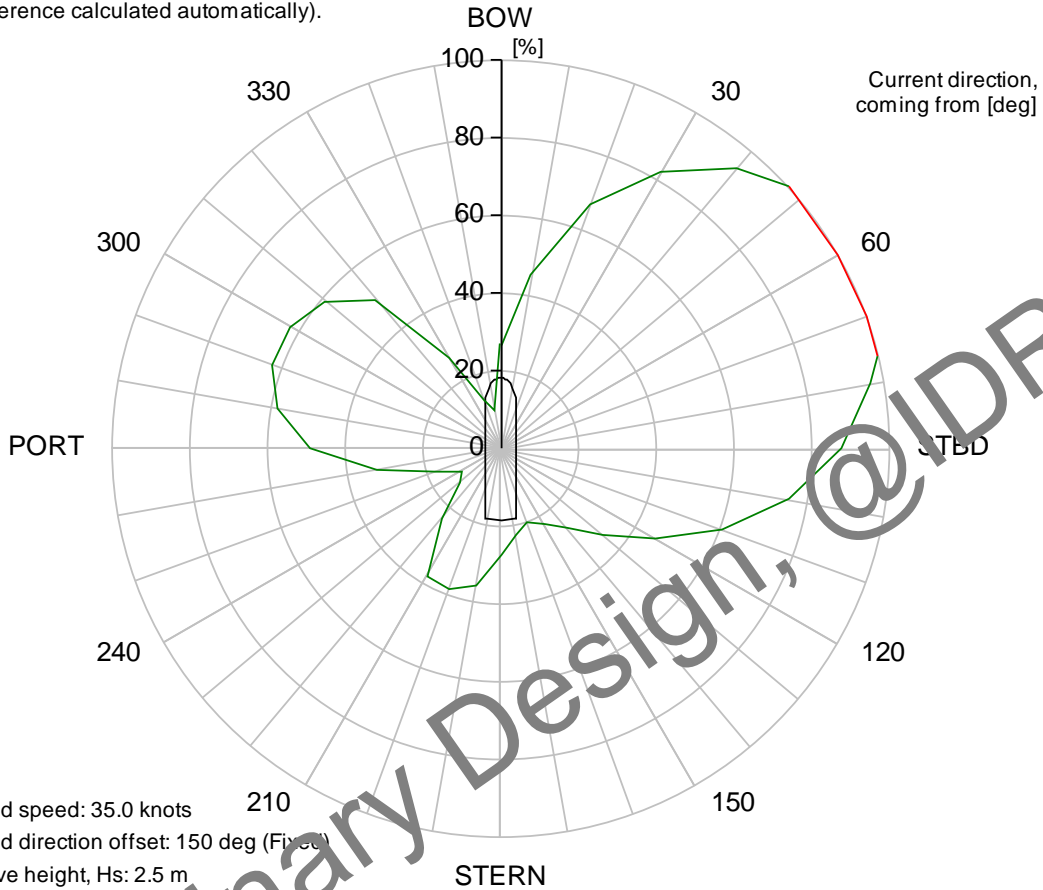
5.16 Case 16 - Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 150 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 150 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 26: DP capability envelope for case 16.

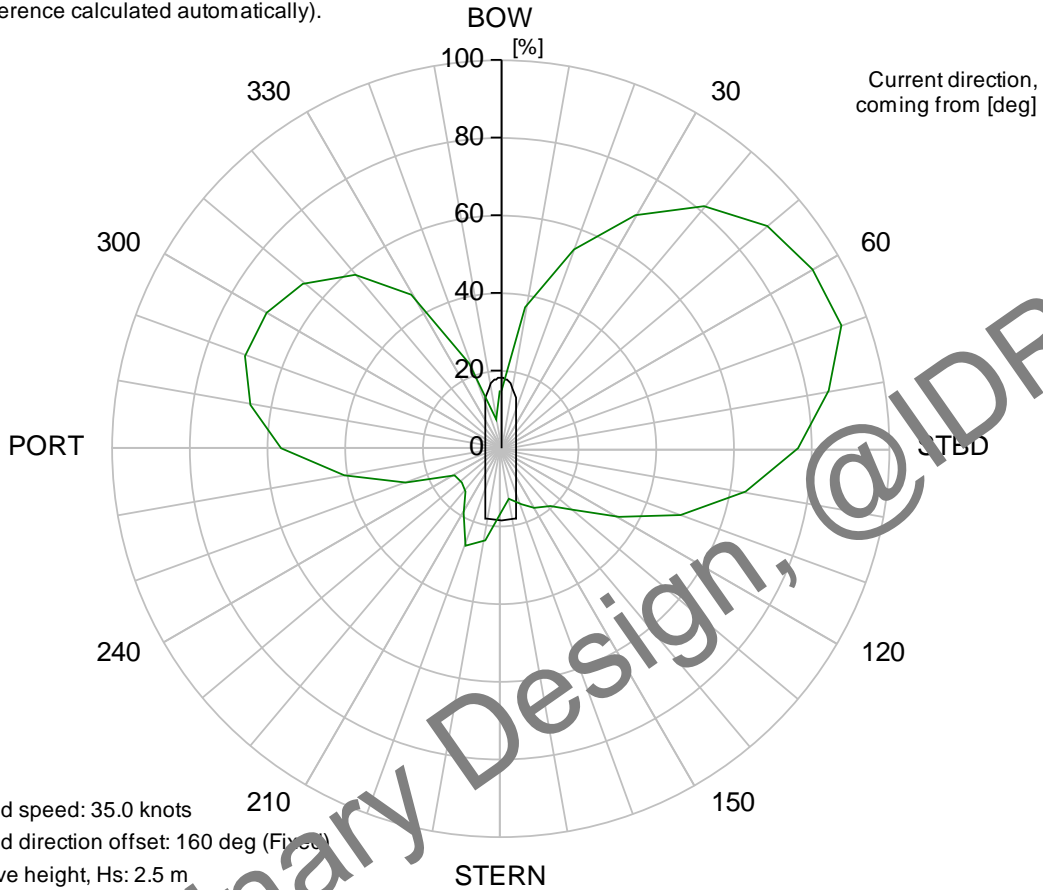
5.17 Case 17 - Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 160 deg (Fixed)
 Wave height, Hs: 2.5 m
 Wave period, Tz: 6.0 s (Tp 8.5 s)
 Wave direction offset: 160 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 27: DP capability envelope for case 17.

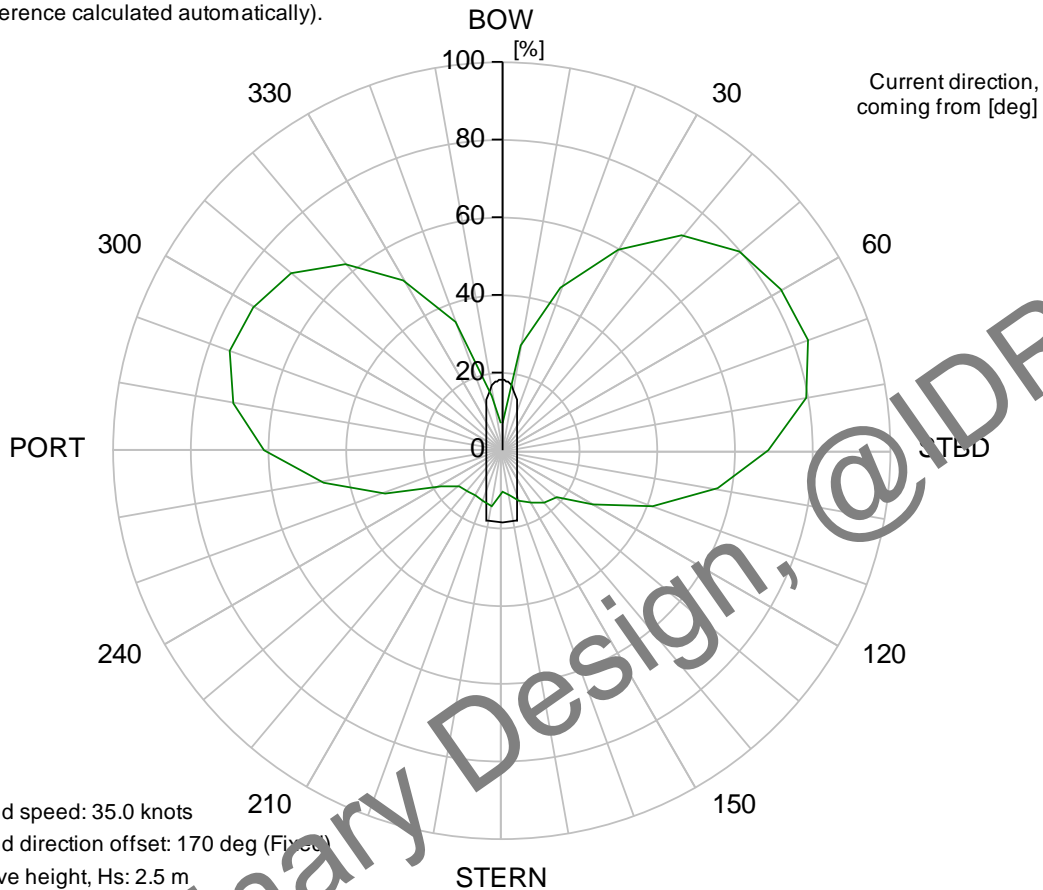
5.18 Case 18 - Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 170 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 170 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 28: DP capability envelope for case 18.

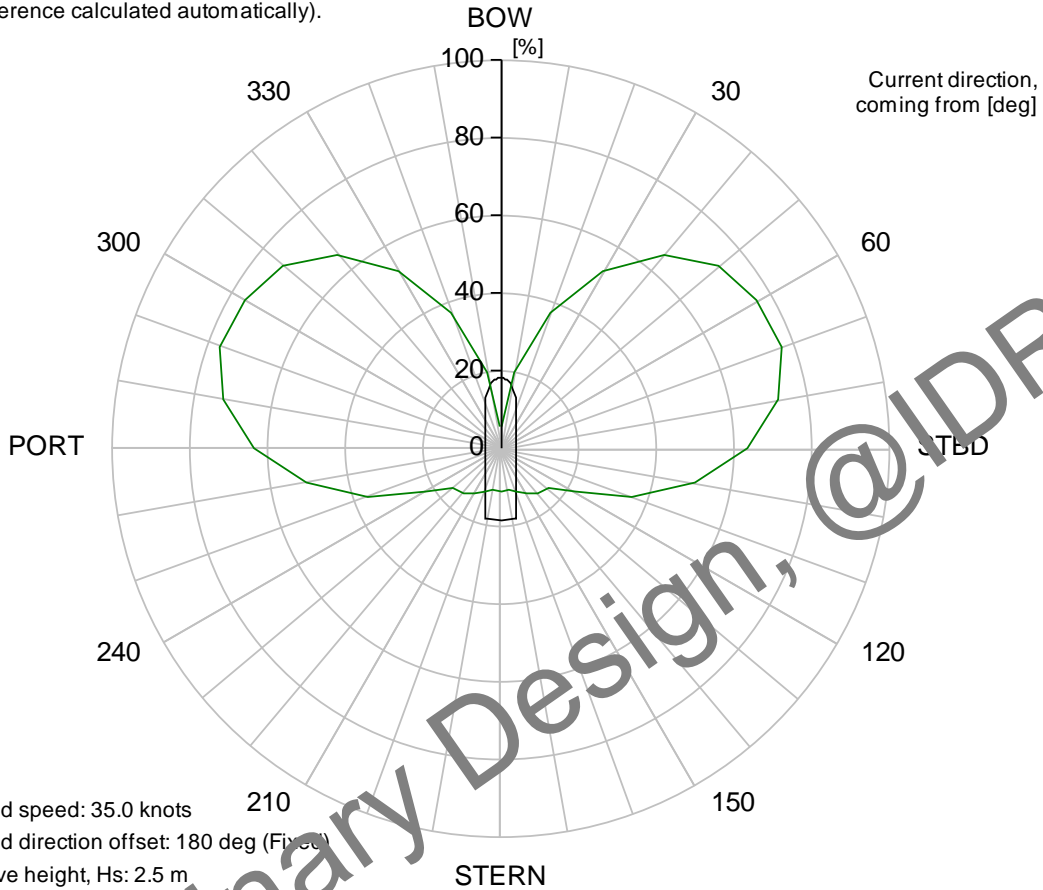
5.19 Case 19 - Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 180 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 180 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 29: DP capability envelope for case 19.

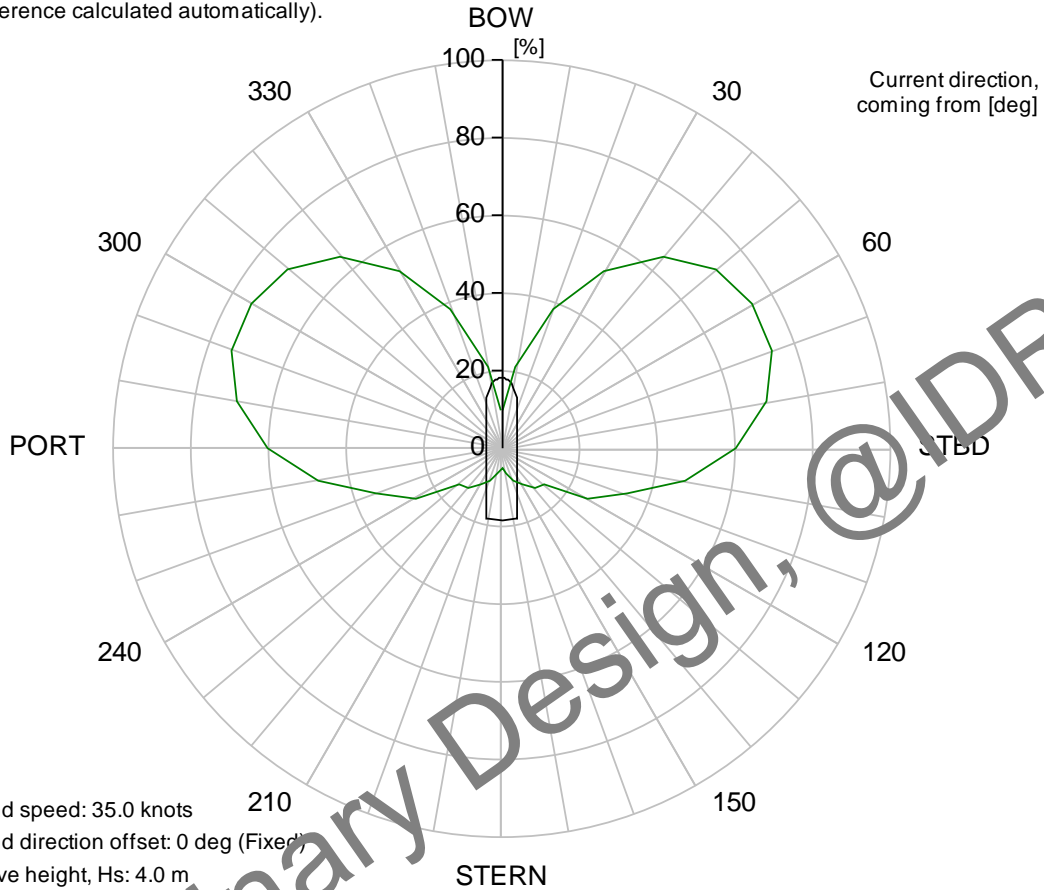
5.20 Case 20 - Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 0 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 0 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 30: DP capability envelope for case 20.

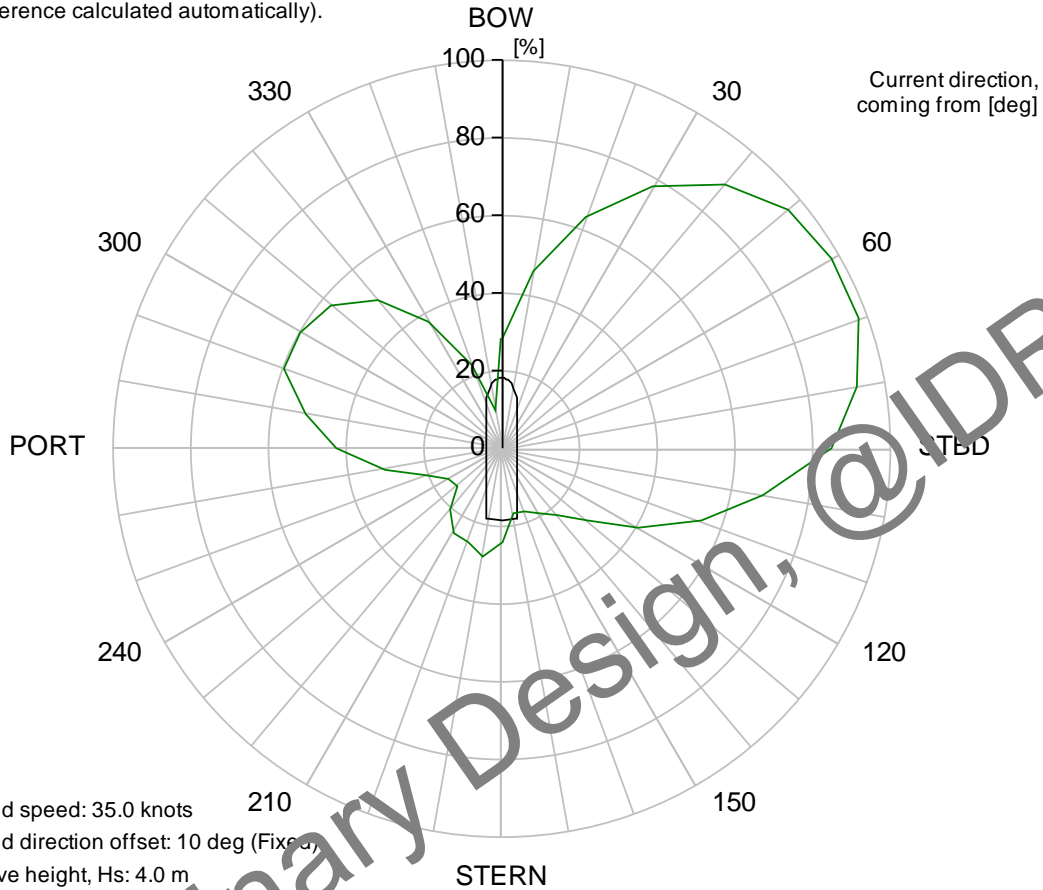
5.21 Case 21 - Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 10 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 10 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 31: DP capability envelope for case 21.

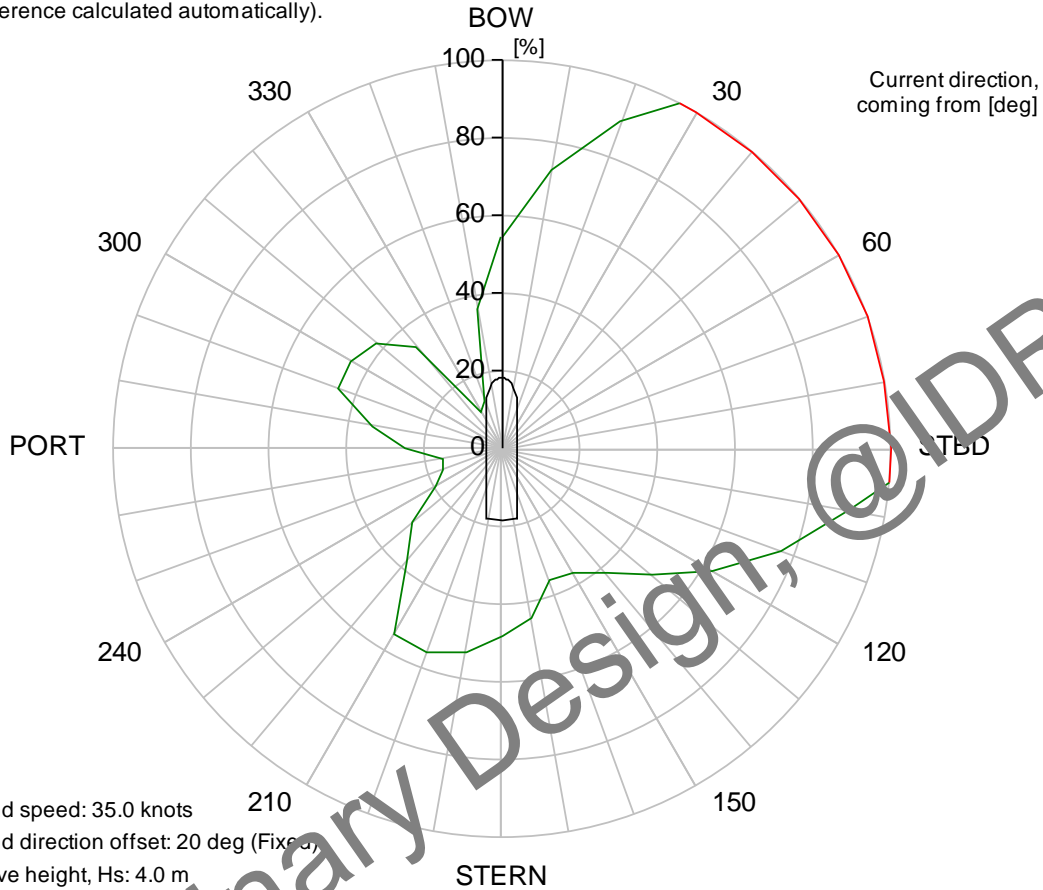
5.22 Case 22 - Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 20 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 20 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 32: DP capability envelope for case 22.

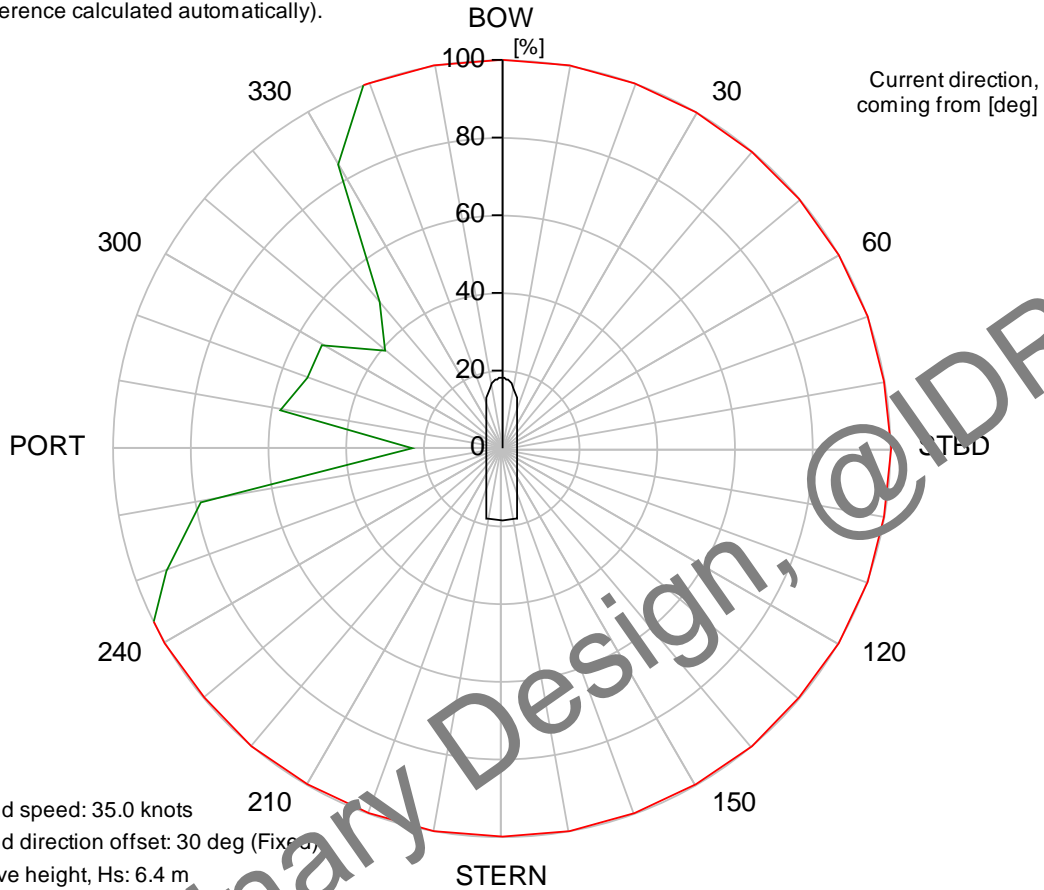
5.23 Case 23 - Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 30 deg (Fixed)

Wave height, Hs: 6.4 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 30 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 33: DP capability envelope for case 23.

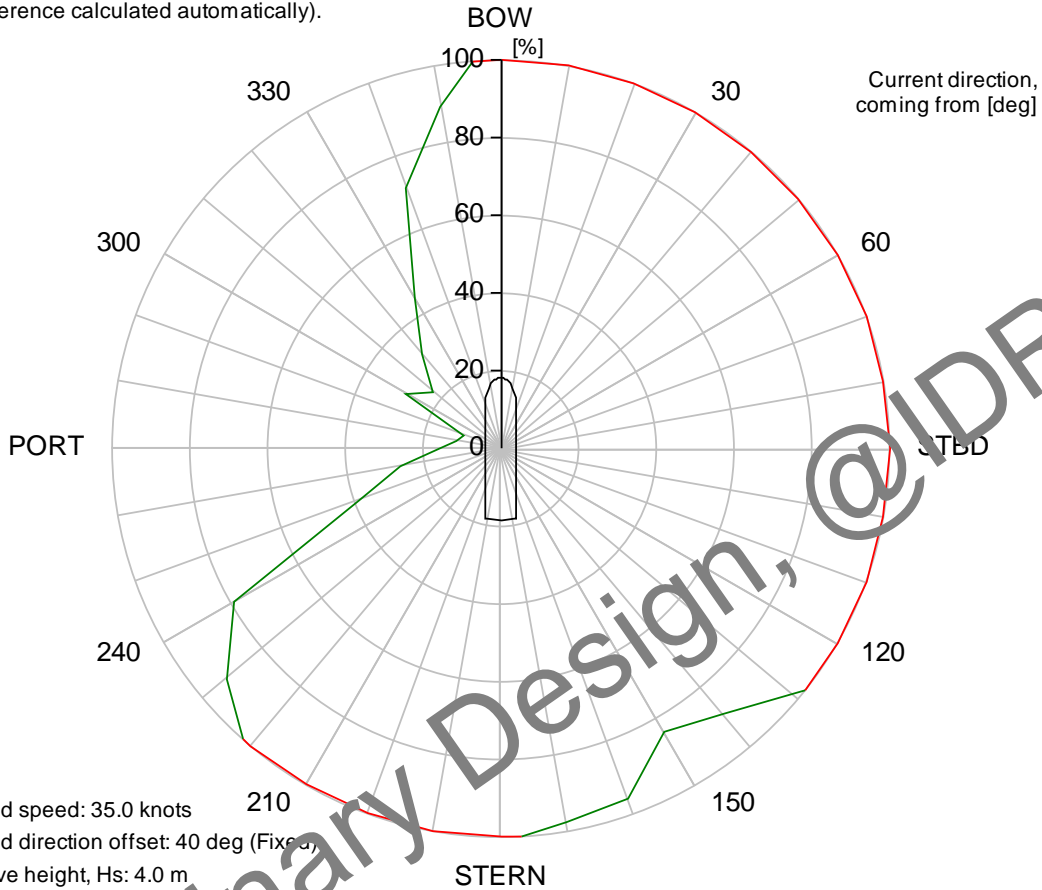
5.24 Case 24 - Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 40 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 40 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 34: DP capability envelope for case 24.

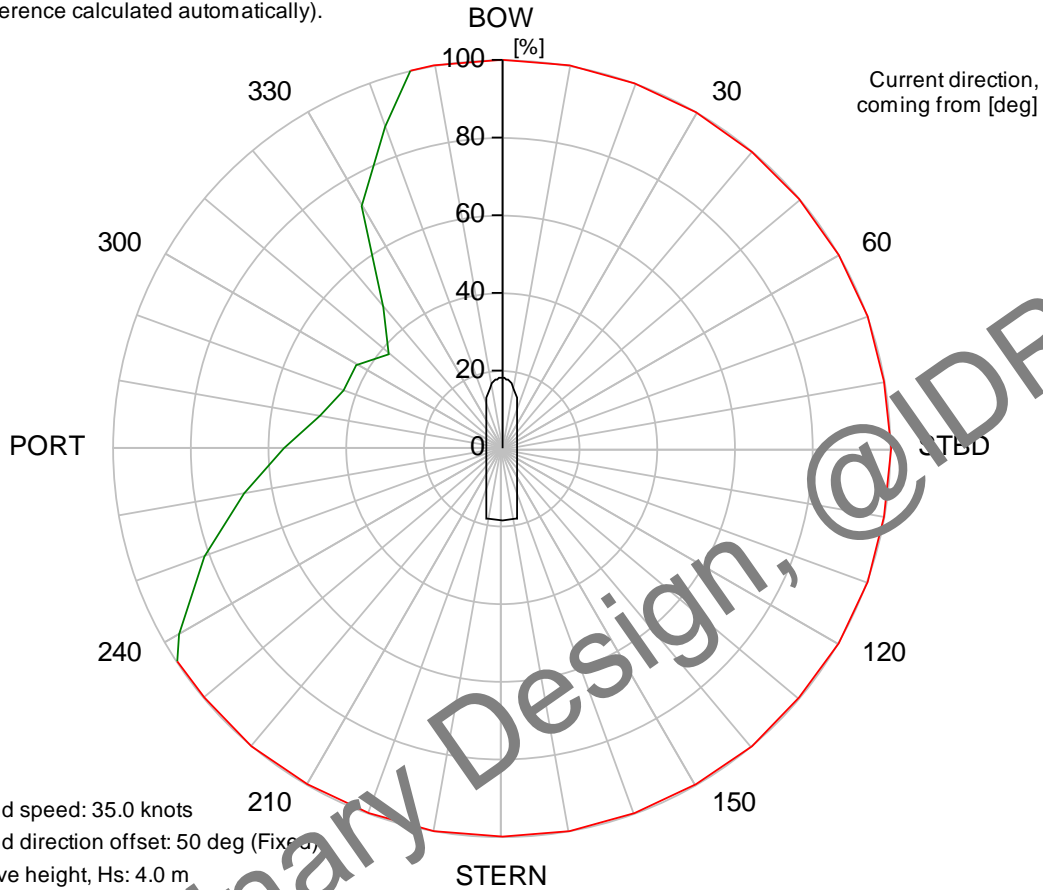
5.25 Case 25 - Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 50 deg (Fixed)
 Wave height, Hs: 4.0 m
 Wave period, Tz: 6.7 s (Tp 9.4 s)
 Wave direction offset: 30 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 35: DP capability envelope for case 25.

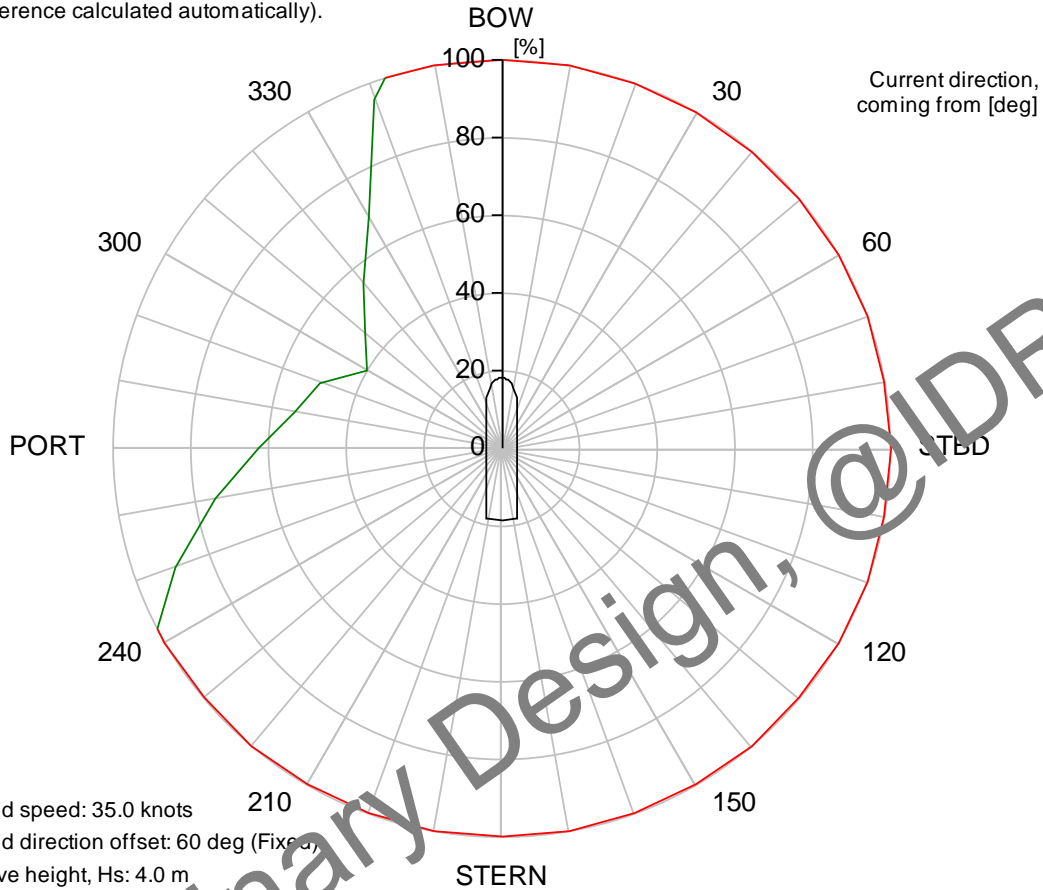
5.26 Case 26 - Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 60 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 60 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 36: DP capability envelope for case 26.

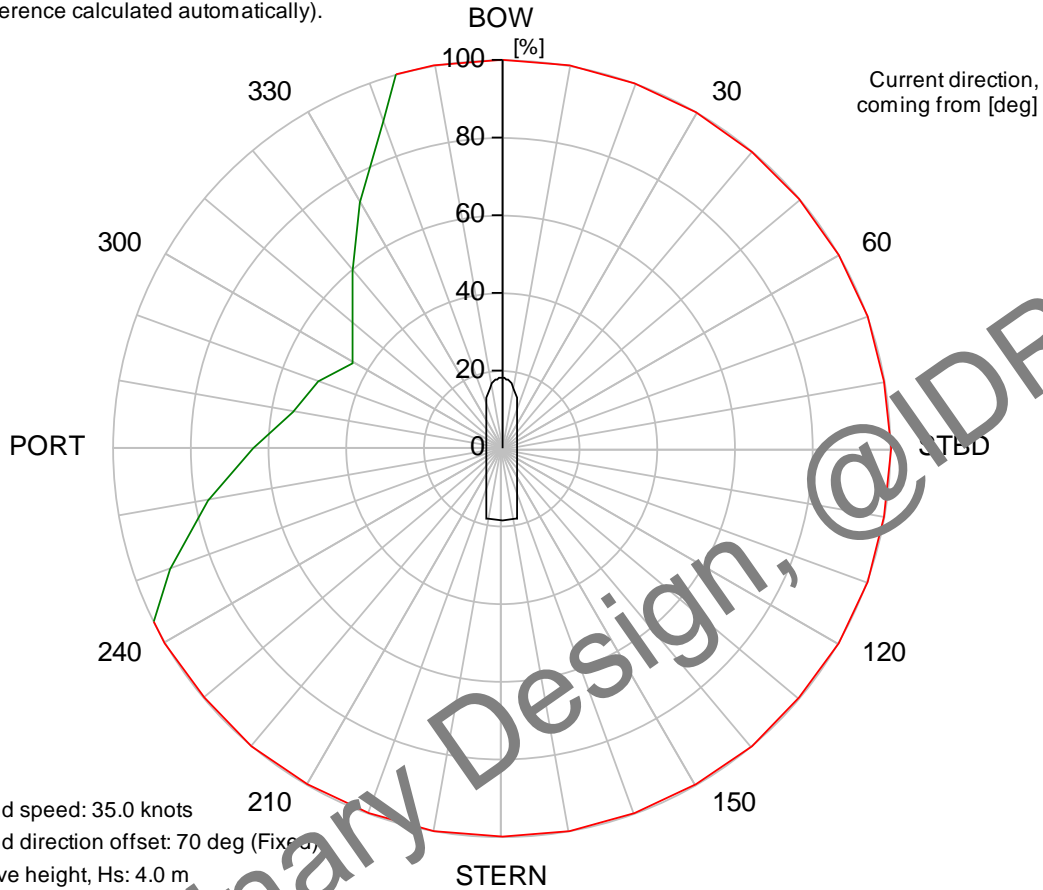
5.27 Case 27 - Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 70 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 70 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 37: DP capability envelope for case 27.

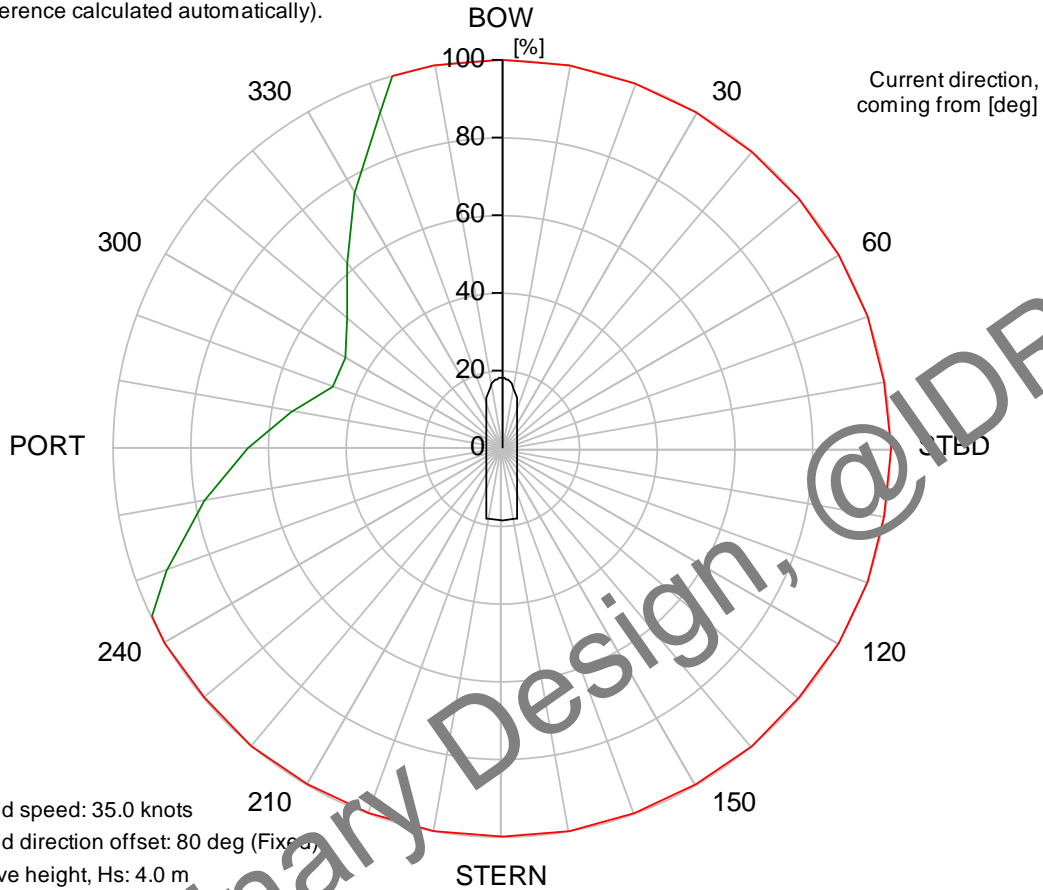
5.28 Case 28 - Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 80 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 80 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 38: DP capability envelope for case 28.

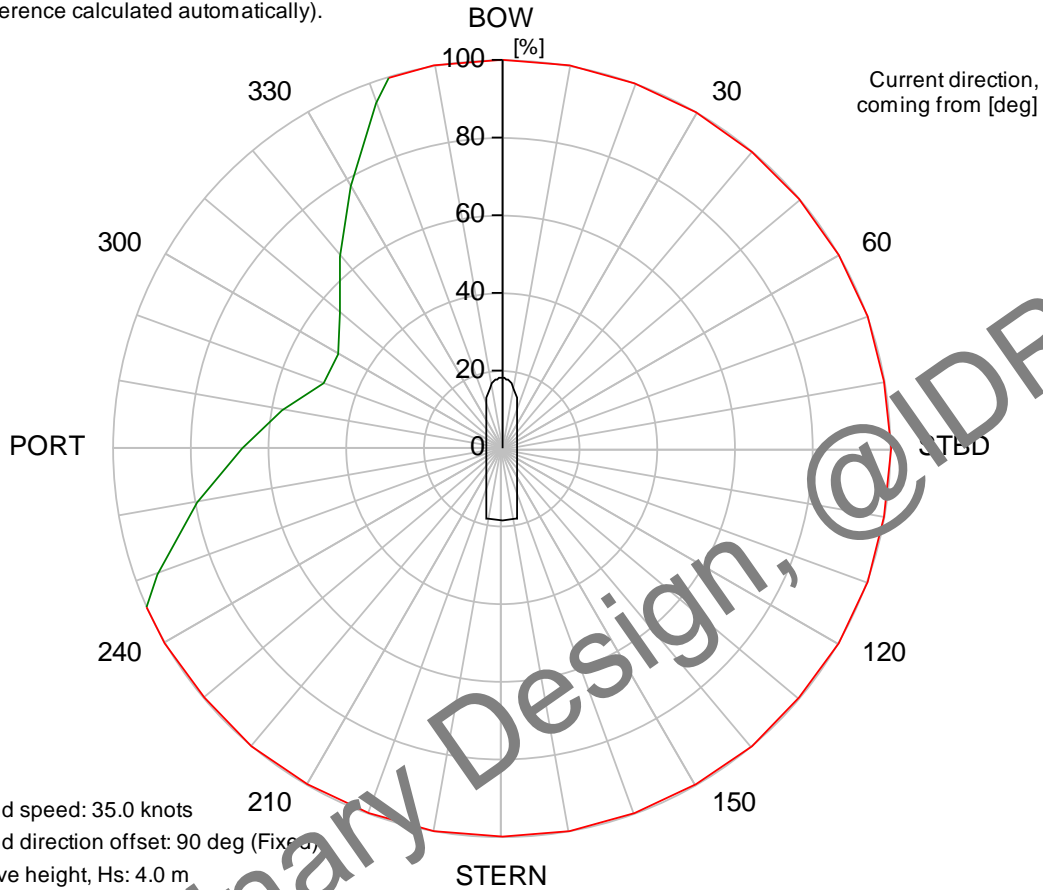
5.29 Case 29 - Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 90 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 90 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 39: DP capability envelope for case 29.

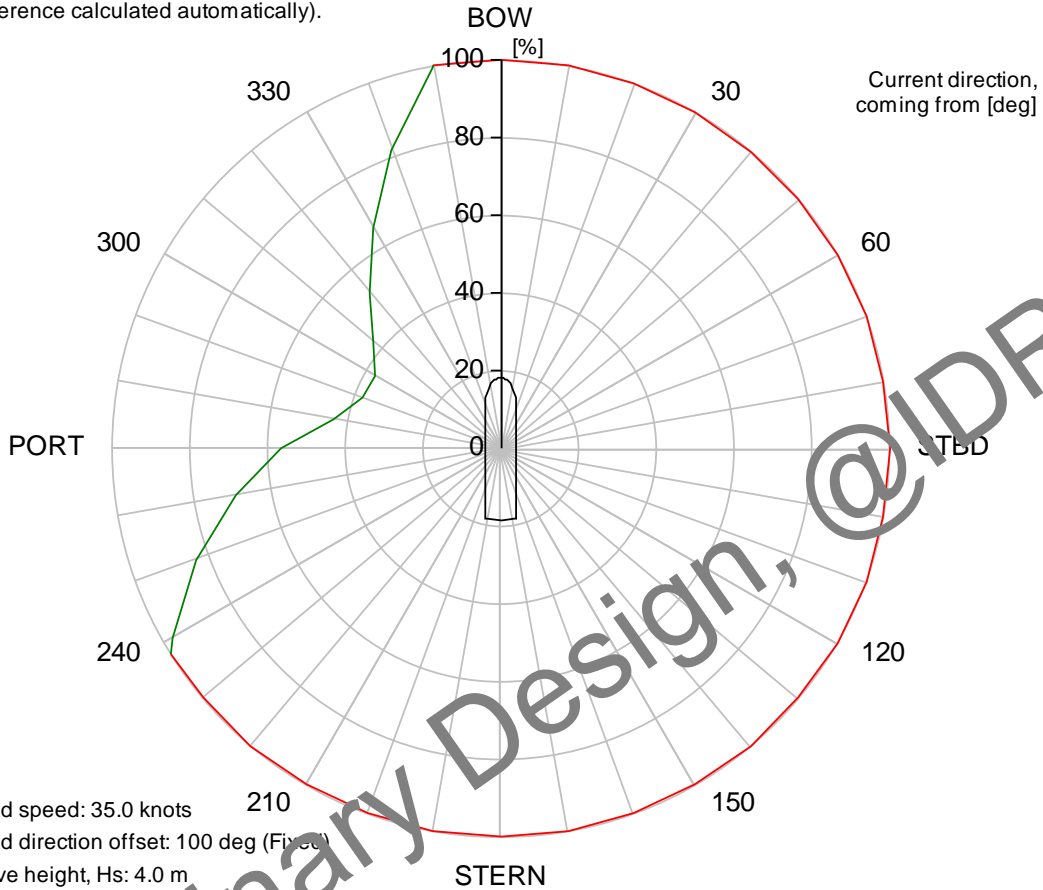
5.30 Case 30 - Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 100 deg (Fixed)
 Wave height, Hs: 4.0 m
 Wave period, Tz: 6.7 s (To 9.4 s)
 Wave direction offset: 100 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 40: DP capability envelope for case 30.

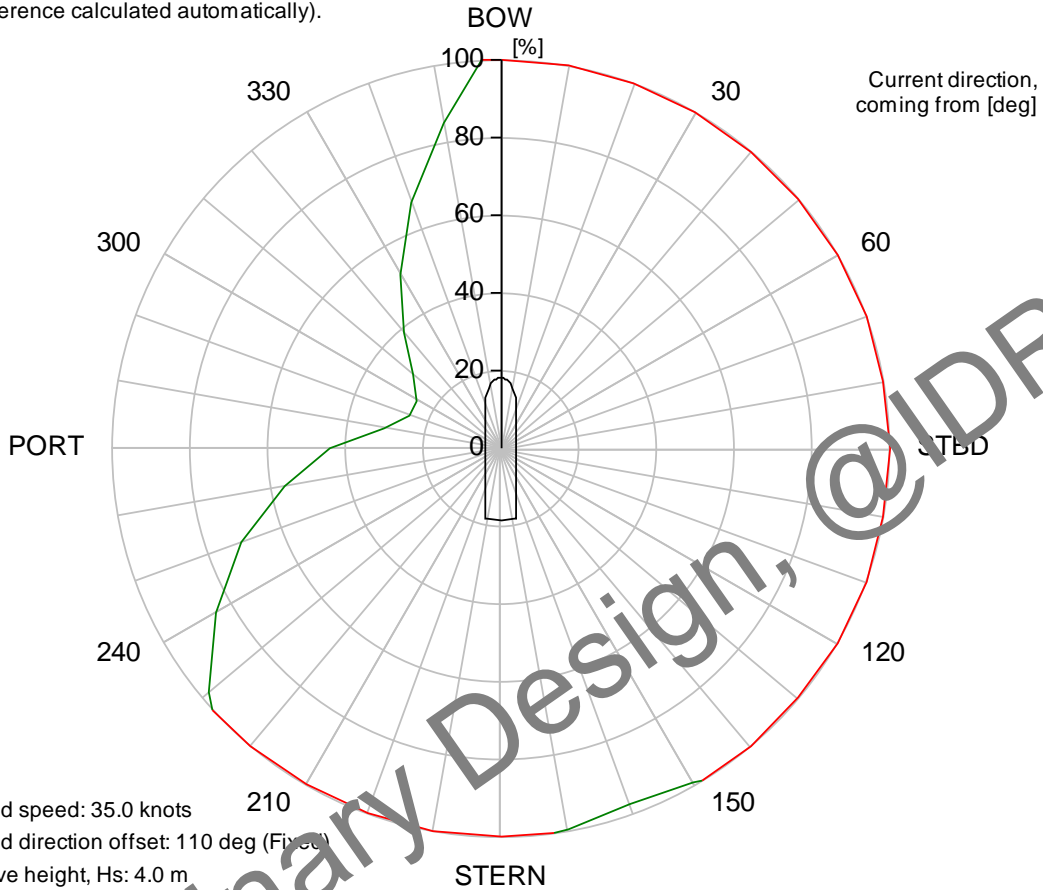
5.31 Case 31 - Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 110 deg (Fixed)
 Wave height, Hs: 4.0 m
 Wave period, Tz: 6.7 s (Tp 9.4 s)
 Wave direction offset: 110 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 41: DP capability envelope for case 31.

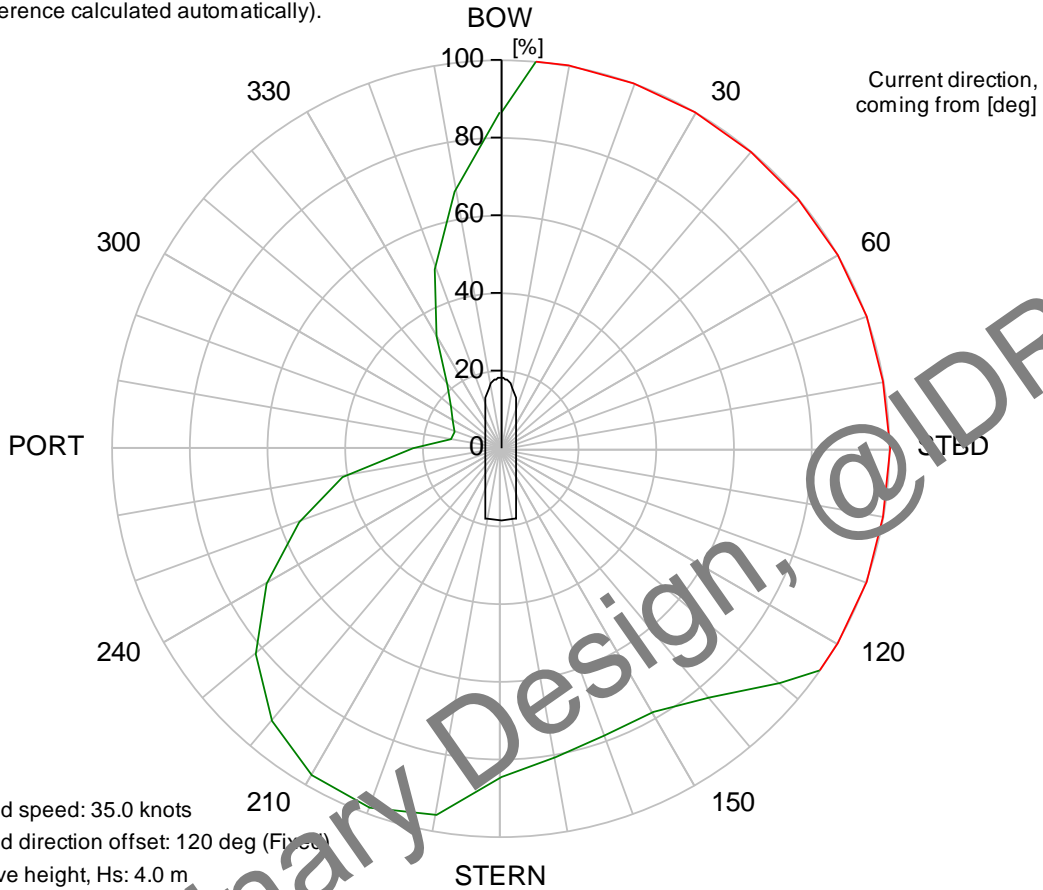
5.32 Case 32 - Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 120 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 120 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 42: DP capability envelope for case 32.

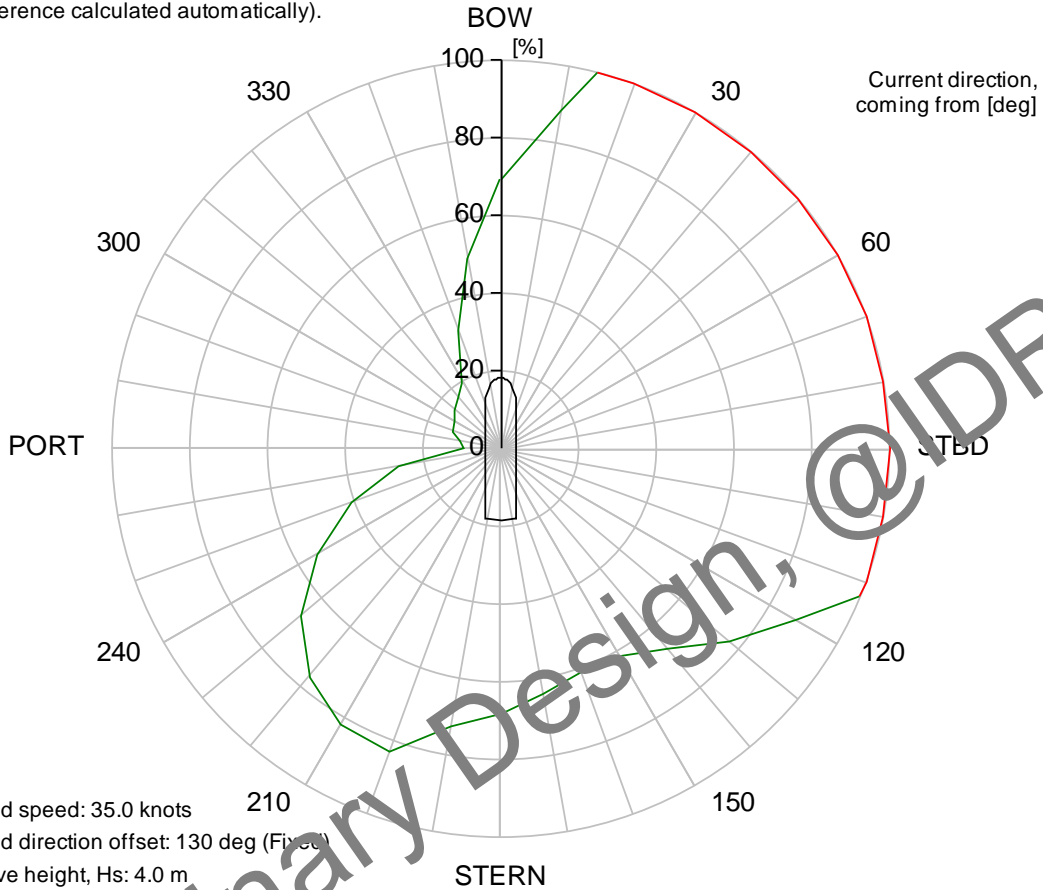
5.33 Case 33 - Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 130 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 130 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 43: DP capability envelope for case 33.

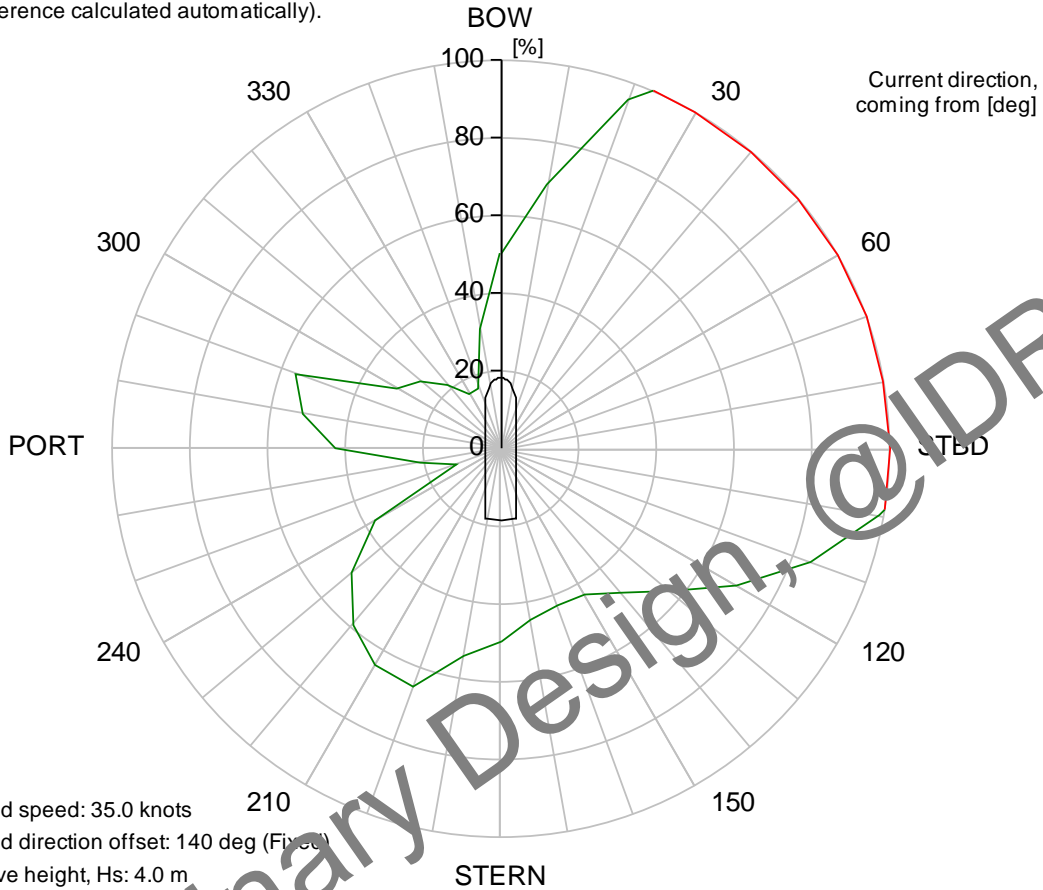
5.34 Case 34 - Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 140 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 140 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 44: DP capability envelope for case 34.

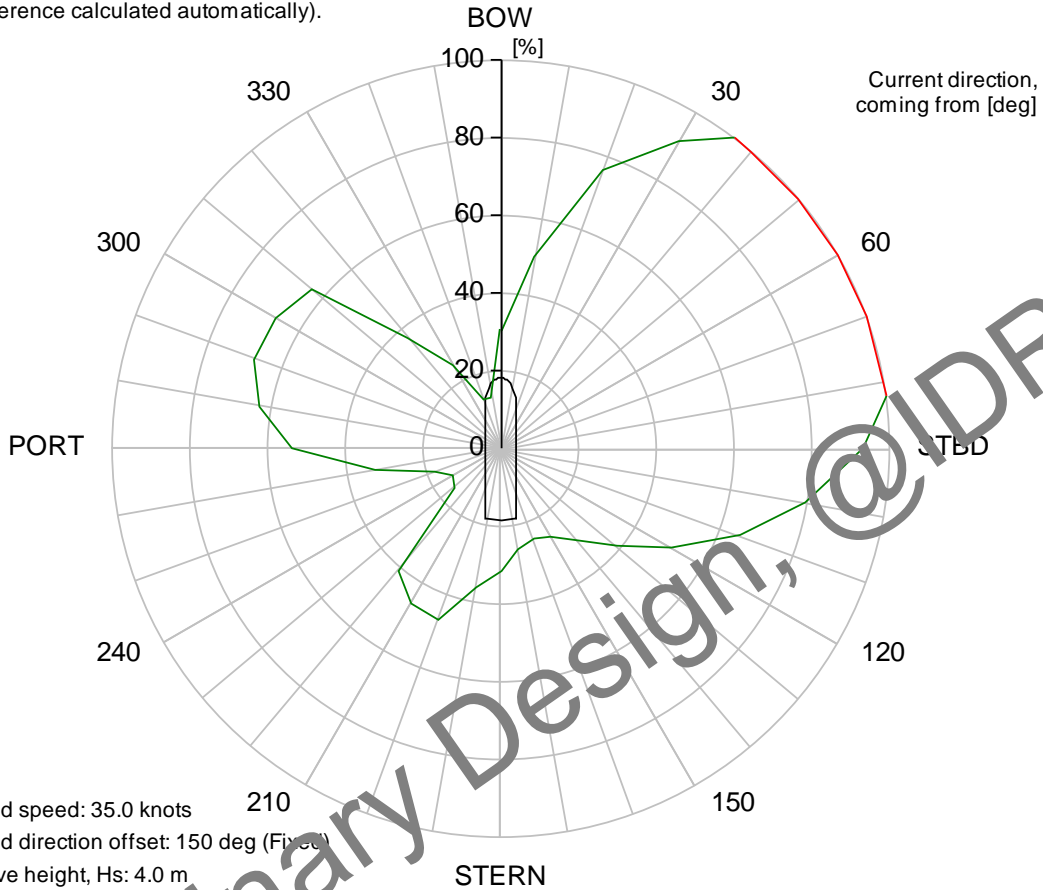
5.35 Case 35 - Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 150 deg (Fixed)
 Wave height, Hs: 4.0 m
 Wave period, Tz: 6.7 s (To 9.4 s)
 Wave direction offset: 150 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 45: DP capability envelope for case 35.

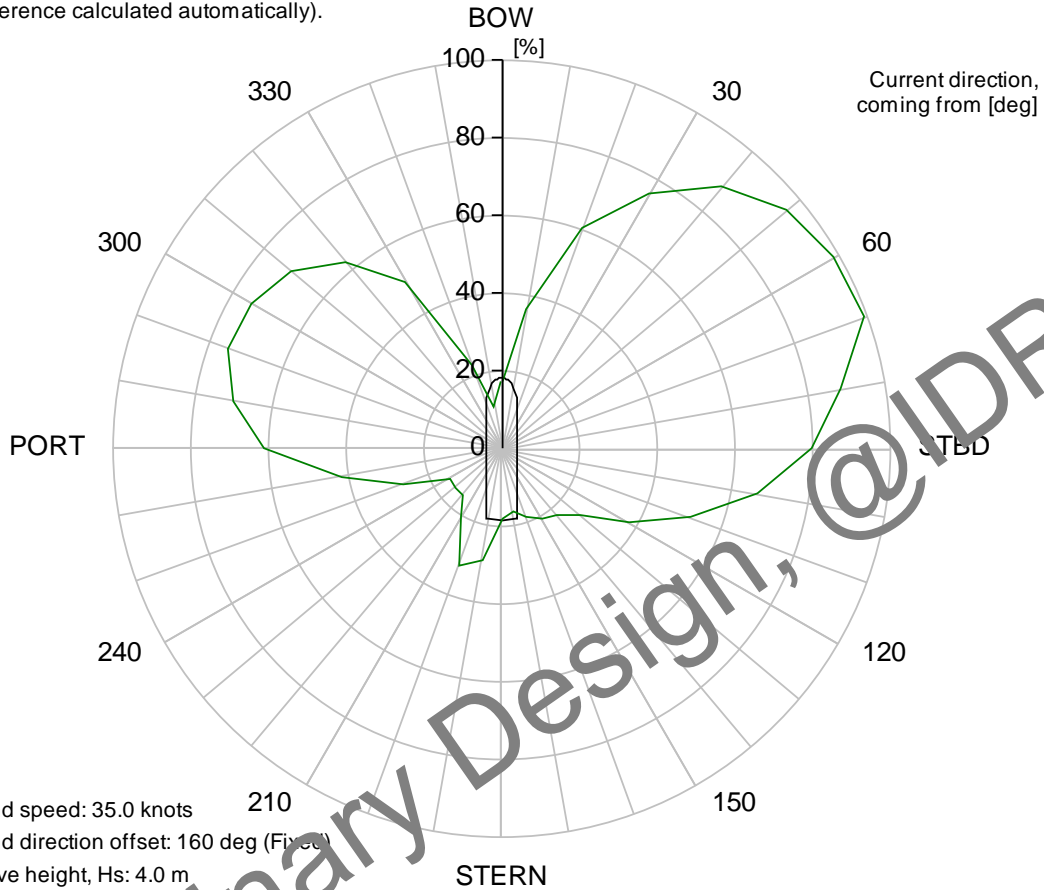
5.36 Case 36 - Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 160 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 160 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 46: DP capability envelope for case 36.

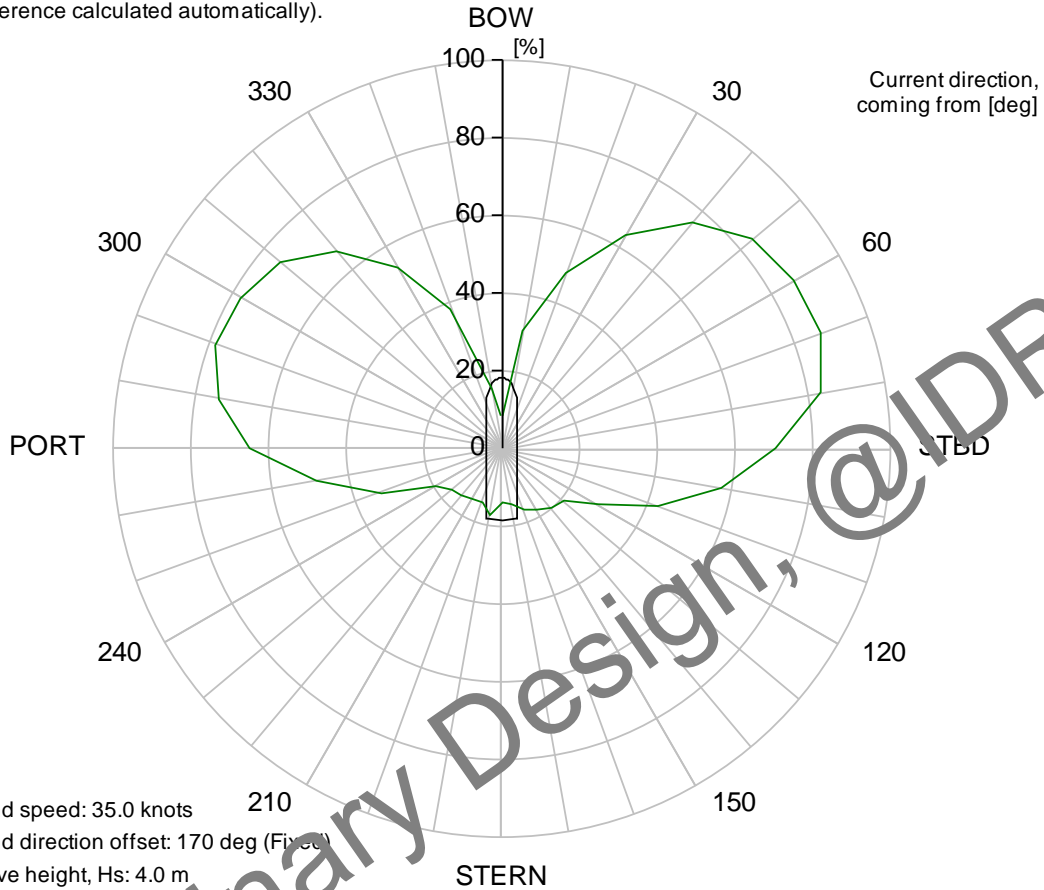
5.37 Case 37 - Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 170 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 170 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 47: DP capability envelope for case 37.

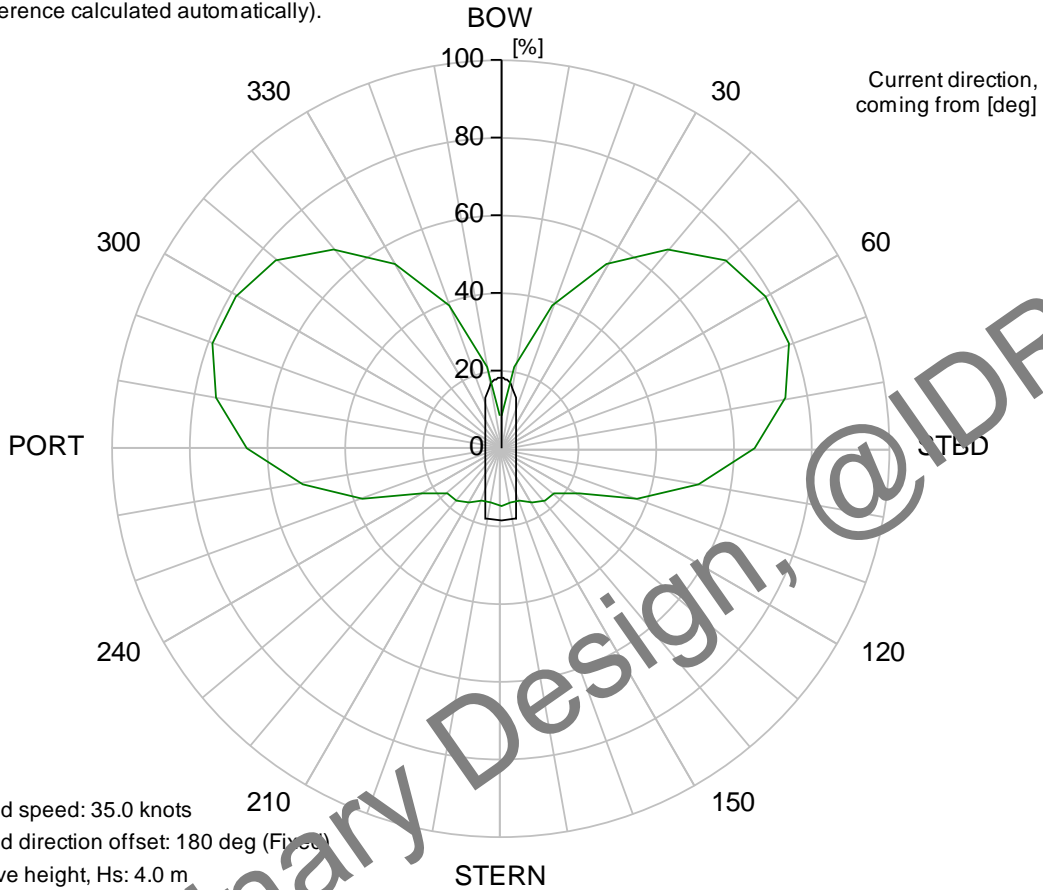
5.38 Case 38 - Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 180 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 180 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	100	31.8	-31.8	2126.0			

Figure 48: DP capability envelope for case 38.

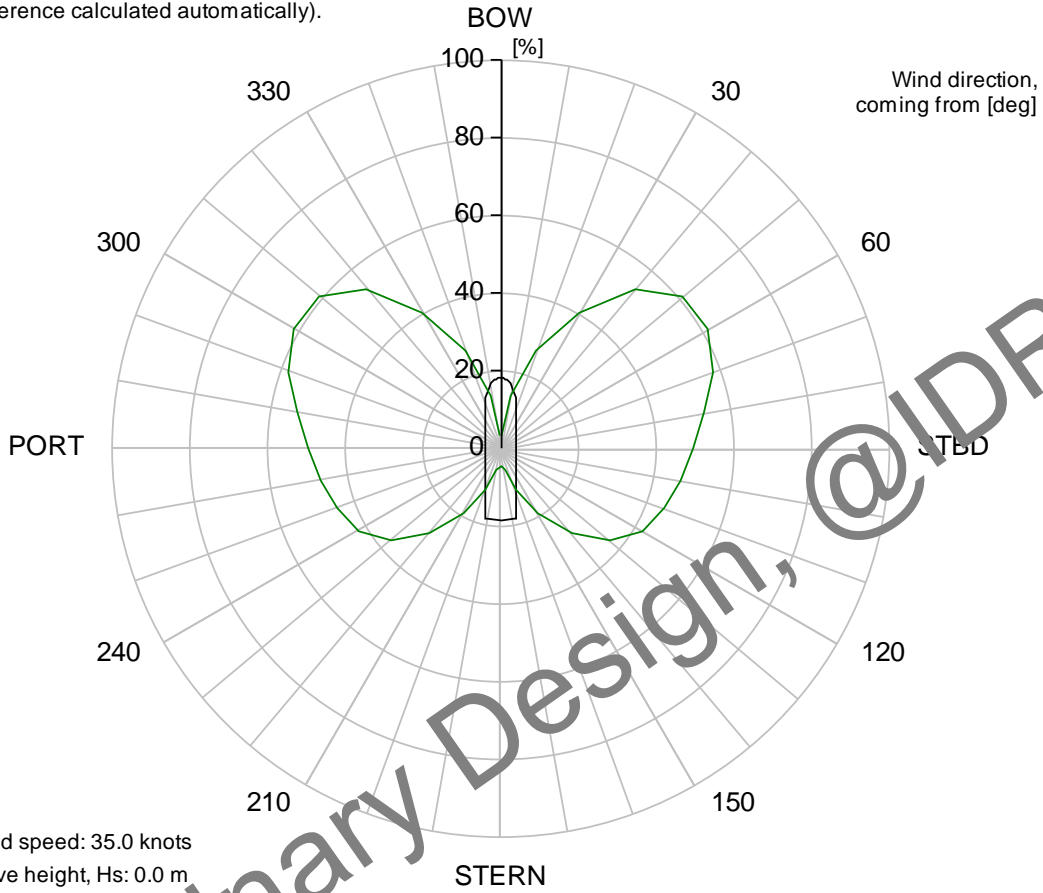
5.39 Case 39 - Thrust Utilization: 35 knots wind. 0 current, 0 waves

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wave height, Hs: 0.0 m
 Wave period, Tz: 0.0 s (Tp 0.0 s)
 Wave direction offset: 0 deg
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 0.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration				
T1	T2	T3	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	T2	T3	100	112.2	0.0	9500.0			
			100	112.2	0.0	9500.0			
			100	31.8	-31.8	2126.0			

Figure 49: DP capability envelope for case 39.

6 Simulation printouts

6.1 Case 1 - Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 4

6.1.1 Environment and thrust utilisation

Case 1 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	0.0	0.0	0.0	35.0	2.5	6.0	8.5	2.00	7.4
10.0	0.0	0.0	10.0	35.0	2.5	6.0	8.5	2.00	20.3
20.0	0.0	0.0	20.0	35.0	2.5	6.0	8.5	2.00	36.9
30.0	0.0	0.0	30.0	35.0	2.5	6.0	8.5	2.00	51.5
40.0	0.0	0.0	40.0	35.0	2.5	6.0	8.5	2.00	62.9
50.0	0.0	0.0	50.0	35.0	2.5	6.0	8.5	2.00	70.2
60.0	0.0	0.0	60.0	35.0	2.5	6.0	8.5	2.00	72.6
70.0	0.0	0.0	70.0	35.0	2.5	6.0	8.5	2.00	72.4
80.0	0.0	0.0	80.0	35.0	2.5	6.0	8.5	2.00	67.6
90.0	0.0	0.0	90.0	35.0	2.5	6.0	8.5	2.00	59.3
100.0	0.0	0.0	100.0	35.0	2.5	6.0	8.5	2.00	47.0
110.0	0.0	0.0	110.0	35.0	2.5	6.0	8.5	2.00	33.4
120.0	0.0	0.0	120.0	35.0	2.5	6.0	8.5	2.00	21.2
130.0	0.0	0.0	130.0	35.0	2.5	6.0	8.5	2.00	13.5
140.0	0.0	0.0	140.0	35.0	2.5	6.0	8.5	2.00	12.2
150.0	0.0	0.0	150.0	35.0	2.5	6.0	8.5	2.00	9.9
160.0	0.0	0.0	160.0	35.0	2.5	6.0	8.5	2.00	8.1
170.0	0.0	0.0	170.0	35.0	2.5	6.0	8.5	2.00	5.3
180.0	0.0	0.0	180.0	35.0	2.5	6.0	8.5	2.00	3.1
190.0	0.0	0.0	190.0	35.0	2.5	6.0	8.5	2.00	5.3
200.0	0.0	0.0	200.0	35.0	2.5	6.0	8.5	2.00	8.1
210.0	0.0	0.0	210.0	35.0	2.5	6.0	8.5	2.00	9.9
220.0	0.0	0.0	220.0	35.0	2.5	6.0	8.5	2.00	12.2
230.0	0.0	0.0	230.0	35.0	2.5	6.0	8.5	2.00	13.5
240.0	0.0	0.0	240.0	35.0	2.5	6.0	8.5	2.00	21.2
250.0	0.0	0.0	250.0	35.0	2.5	6.0	8.5	2.00	33.4
260.0	0.0	0.0	260.0	35.0	2.5	6.0	8.5	2.00	47.0
270.0	0.0	0.0	270.0	35.0	2.5	6.0	8.5	2.00	59.3
280.0	0.0	0.0	280.0	35.0	2.5	6.0	8.5	2.00	67.6
290.0	0.0	0.0	290.0	35.0	2.5	6.0	8.5	2.00	72.4
300.0	0.0	0.0	300.0	35.0	2.5	6.0	8.5	2.00	72.6
310.0	0.0	0.0	310.0	35.0	2.5	6.0	8.5	2.00	70.2
320.0	0.0	0.0	320.0	35.0	2.5	6.0	8.5	2.00	62.9
330.0	0.0	0.0	330.0	35.0	2.5	6.0	8.5	2.00	51.5
340.0	0.0	0.0	340.0	35.0	2.5	6.0	8.5	2.00	36.9
350.0	0.0	0.0	350.0	35.0	2.5	6.0	8.5	2.00	20.3
360.0	0.0	0.0	360.0	35.0	2.5	6.0	8.5	2.00	7.4

6.1.2 Relative contributions of force components

Case 1 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	45.8	15.5	24.4	0.0	14.3	100.0
10.0	41.3	14.0	31.8	0.0	12.9	100.0
20.0	31.5	10.7	48.1	0.0	9.8	100.0
30.0	21.5	7.3	64.5	0.0	6.7	100.0
40.0	14.1	4.8	76.7	0.0	4.4	100.0
50.0	9.4	3.2	84.5	0.0	2.9	100.0
60.0	6.6	2.2	89.2	0.0	2.1	100.0
70.0	4.9	1.7	91.8	0.0	1.5	100.0
80.0	4.0	1.4	93.4	0.0	1.3	100.0
90.0	3.6	1.2	94.1	0.0	1.1	100.0
100.0	3.5	1.2	94.2	0.0	1.1	100.0
110.0	3.8	1.3	93.7	0.0	1.2	100.0
120.0	4.5	1.5	92.5	0.0	1.4	100.0
130.0	6.1	2.1	89.9	0.0	1.9	100.0
140.0	9.2	3.1	84.8	0.0	2.9	100.0
150.0	15.8	5.4	73.8	0.0	5.0	100.0
160.0	31.2	10.6	48.4	0.0	9.8	100.0
170.0	66.2	22.4	-9.3	0.0	20.7	100.0
180.0	98.9	33.5	-63.3	0.0	30.9	100.0
190.0	66.2	22.4	-9.3	0.0	20.7	100.0
200.0	31.2	10.6	48.4	0.0	9.8	100.0
210.0	15.8	5.4	73.8	0.0	5.0	100.0
220.0	9.2	3.1	84.8	0.0	2.9	100.0
230.0	6.1	2.1	89.9	0.0	1.9	100.0
240.0	4.5	1.5	92.5	0.0	1.4	100.0
250.0	3.8	1.3	93.7	0.0	1.2	100.0
260.0	3.5	1.2	94.2	0.0	1.1	100.0
270.0	3.6	1.2	94.1	0.0	1.1	100.0
280.0	4.0	1.4	93.4	0.0	1.3	100.0
290.0	4.9	1.7	91.8	0.0	1.5	100.0
300.0	6.6	2.2	89.2	0.0	2.1	100.0
310.0	9.4	3.2	84.5	0.0	2.9	100.0
320.0	14.1	4.8	76.7	0.0	4.4	100.0
330.0	21.5	7.3	64.5	0.0	6.7	100.0
340.0	31.5	10.7	48.1	0.0	9.8	100.0
350.0	41.3	14.0	31.8	0.0	12.9	100.0
360.0	45.8	15.5	24.4	0.0	14.3	100.0

6.1.3 Environment forces

Case 1 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	-2.3	-3.6	0.0	-2.1	-14.7
10.0	-6.7	-2.3	-3.6	0.0	-2.1	-14.7
20.0	-6.7	-2.3	-3.5	0.0	-2.1	-14.6
30.0	-6.7	-2.3	-3.2	0.0	-2.1	-14.3
40.0	-6.7	-2.3	-2.8	0.0	-2.1	-13.9
50.0	-6.7	-2.3	-2.3	0.0	-2.1	-13.4
60.0	-6.7	-2.3	-1.6	0.0	-2.1	-12.7
70.0	-6.7	-2.3	-0.9	0.0	-2.1	-12.0
80.0	-6.7	-2.3	-0.1	0.0	-2.1	-11.2
90.0	-6.7	-2.3	0.7	0.0	-2.1	-10.4
100.0	-6.7	-2.3	1.5	0.0	-2.1	-9.6
110.0	-6.7	-2.3	2.3	0.0	-2.1	-8.8
120.0	-6.7	-2.3	3.0	0.0	-2.1	-8.2
130.0	-6.7	-2.3	3.5	0.0	-2.1	-7.6
140.0	-6.7	-2.3	4.0	0.0	-2.1	-7.2
150.0	-6.7	-2.3	4.3	0.0	-2.1	-6.9
160.0	-6.7	-2.3	4.4	0.0	-2.1	-6.7
170.0	-6.7	-2.3	4.4	0.0	-2.1	-6.7
180.0	-6.7	-2.3	4.3	0.0	-2.1	-6.8
190.0	-6.7	-2.3	4.4	0.0	-2.1	-6.7
200.0	-6.7	-2.3	4.4	0.0	-2.1	-6.7
210.0	-6.7	-2.3	4.3	0.0	-2.1	-6.9
220.0	-6.7	-2.3	4.0	0.0	-2.1	-7.2
230.0	-6.7	-2.3	3.5	0.0	-2.1	-7.6
240.0	-6.7	-2.3	3.0	0.0	-2.1	-8.2
250.0	-6.7	-2.3	2.3	0.0	-2.1	-8.8
260.0	-6.7	-2.3	1.5	0.0	-2.1	-9.6
270.0	-6.7	-2.3	0.7	0.0	-2.1	-10.4
280.0	-6.7	-2.3	-0.1	0.0	-2.1	-11.2
290.0	-6.7	-2.3	-0.9	0.0	-2.1	-12.0
300.0	-6.7	-2.3	-1.6	0.0	-2.1	-12.7
310.0	-6.7	-2.3	-2.3	0.0	-2.1	-13.4
320.0	-6.7	-2.3	-2.8	0.0	-2.1	-13.9
330.0	-6.7	-2.3	-3.2	0.0	-2.1	-14.3
340.0	-6.7	-2.3	-3.5	0.0	-2.1	-14.6
350.0	-6.7	-2.3	-3.6	0.0	-2.1	-14.7
360.0	-6.7	-2.3	-3.6	0.0	-2.1	-14.7

Case 1 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-4.8	0.0	0.0	-4.8
20.0	0.0	0.0	-10.0	0.0	0.0	-10.0
30.0	0.0	0.0	-15.6	0.0	0.0	-15.6
40.0	0.0	0.0	-21.7	0.0	0.0	-21.7
50.0	0.0	0.0	-28.0	0.0	0.0	-28.0
60.0	0.0	0.0	-33.8	0.0	0.0	-33.8
70.0	0.0	0.0	-38.7	0.0	0.0	-38.7
80.0	0.0	0.0	-41.9	0.0	0.0	-41.9
90.0	0.0	0.0	-43.0	0.0	0.0	-43.0
100.0	0.0	0.0	-41.9	0.0	0.0	-41.9
110.0	0.0	0.0	-38.7	0.0	0.0	-38.7
120.0	0.0	0.0	-33.8	0.0	0.0	-33.8
130.0	0.0	0.0	-28.0	0.0	0.0	-28.0
140.0	0.0	0.0	-21.7	0.0	0.0	-21.7
150.0	0.0	0.0	-15.6	0.0	0.0	-15.6
160.0	0.0	0.0	-10.0	0.0	0.0	-10.0
170.0	0.0	0.0	-4.8	0.0	0.0	-4.8
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	4.8	0.0	0.0	4.8
200.0	0.0	0.0	10.0	0.0	0.0	10.0
210.0	0.0	0.0	15.6	0.0	0.0	15.6
220.0	0.0	0.0	21.7	0.0	0.0	21.7
230.0	0.0	0.0	28.0	0.0	0.0	28.0
240.0	0.0	0.0	33.8	0.0	0.0	33.8
250.0	0.0	0.0	38.7	0.0	0.0	38.7
260.0	0.0	0.0	41.9	0.0	0.0	41.9
270.0	0.0	0.0	43.0	0.0	0.0	43.0
280.0	0.0	0.0	41.9	0.0	0.0	41.9
290.0	0.0	0.0	38.7	0.0	0.0	38.7
300.0	0.0	0.0	33.8	0.0	0.0	33.8
310.0	0.0	0.0	28.0	0.0	0.0	28.0
320.0	0.0	0.0	21.7	0.0	0.0	21.7
330.0	0.0	0.0	15.6	0.0	0.0	15.6
340.0	0.0	0.0	10.0	0.0	0.0	10.0
350.0	0.0	0.0	4.8	0.0	0.0	4.8
360.0	0.0	0.0	0.0	0.0	0.0	0.0

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Case 1 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-316.6	0.0	0.0	-316.6
20.0	0.0	0.0	-593.0	0.0	0.0	-593.0
30.0	0.0	0.0	-793.7	0.0	0.0	-793.7
40.0	0.0	0.0	-892.8	0.0	0.0	-892.8
50.0	0.0	0.0	-876.4	0.0	0.0	-876.4
60.0	0.0	0.0	-745.2	0.0	0.0	-745.2
70.0	0.0	0.0	-513.8	0.0	0.0	-513.8
80.0	0.0	0.0	-209.2	0.0	0.0	-209.2
90.0	0.0	0.0	132.4	0.0	0.0	132.4
100.0	0.0	0.0	470.0	0.0	0.0	470.0
110.0	0.0	0.0	762.6	0.0	0.0	762.6
120.0	0.0	0.0	974.5	0.0	0.0	974.5
130.0	0.0	0.0	1079.2	0.0	0.0	1079.2
140.0	0.0	0.0	1063.0	0.0	0.0	1063.0
150.0	0.0	0.0	926.1	0.0	0.0	926.1
160.0	0.0	0.0	683.5	0.0	0.0	683.5
170.0	0.0	0.0	362.6	0.0	0.0	362.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	-362.6	0.0	0.0	-362.6
200.0	0.0	0.0	-683.5	0.0	0.0	-683.5
210.0	0.0	0.0	-926.1	0.0	0.0	-926.1
220.0	0.0	0.0	-1063.0	0.0	0.0	-1063.0
230.0	0.0	0.0	-1079.2	0.0	0.0	-1079.2
240.0	0.0	0.0	-974.5	0.0	0.0	-974.5
250.0	0.0	0.0	-762.6	0.0	0.0	-762.6
260.0	0.0	0.0	-470.0	0.0	0.0	-470.0
270.0	0.0	0.0	-132.4	0.0	0.0	-132.4
280.0	0.0	0.0	209.2	0.0	0.0	209.2
290.0	0.0	0.0	513.8	0.0	0.0	513.8
300.0	0.0	0.0	745.2	0.0	0.0	745.2
310.0	0.0	0.0	876.4	0.0	0.0	876.4
320.0	0.0	0.0	892.8	0.0	0.0	892.8
330.0	0.0	0.0	793.7	0.0	0.0	793.7
340.0	0.0	0.0	593.0	0.0	0.0	593.0
350.0	0.0	0.0	316.6	0.0	0.0	316.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.1.4 Thruster use

Case 1 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	7.4	0.0	7.4	0.0	0.0	90.0	14.7	360.0
10.0	9.3	354.0	5.6	349.9	6.8	90.0	15.5	18.2
20.0	11.0	351.5	4.1	335.9	13.3	90.0	17.7	34.4
30.0	12.4	352.2	2.7	318.9	19.1	90.0	21.2	47.5
40.0	13.4	355.5	1.2	295.7	23.9	90.0	25.8	57.4
50.0	16.5	1.8	3.1	171.2	27.0	90.0	31.0	64.4
60.0	23.8	7.5	11.2	164.7	27.8	90.0	36.2	69.4
70.0	25.9	12.8	14.3	157.3	27.4	90.0	40.5	72.7
80.0	17.2	32.4	6.7	119.8	26.9	90.0	43.3	75.0
90.0	19.3	41.2	8.3	119.8	23.0	90.0	44.2	76.4
100.0	14.6	71.5	10.0	60.2	19.3	90.0	43.0	77.1
110.0	15.1	78.3	11.6	60.2	13.8	90.0	39.7	77.1
120.0	14.9	82.5	12.5	60.2	8.2	90.0	34.8	76.4
130.0	13.8	84.4	12.6	60.2	3.3	90.0	29.0	74.8
140.0	11.9	83.6	11.7	60.2	-0.3	90.0	22.9	71.8
150.0	9.4	78.6	10.0	60.2	-2.3	90.0	17.1	66.3
160.0	6.9	70.5	7.6	54.6	-2.7	90.0	12.0	56.1
170.0	4.3	50.5	5.1	39.1	-1.7	90.0	6.3	35.8
180.0	3.4	0.0	3.4	0.0	0.0	90.0	6.8	360.0
190.0	5.1	320.9	4.3	309.5	1.7	90.0	8.3	324.2
200.0	7.6	305.4	6.9	289.5	2.7	90.0	12.0	303.9
210.0	10.0	299.8	9.4	281.4	2.3	90.0	17.1	293.7
220.0	11.7	299.8	11.9	275.4	0.3	90.0	22.9	288.2
230.0	12.6	299.8	13.6	275.6	-3.3	90.0	29.0	285.2
240.0	12.5	299.8	14.9	277.5	-8.2	90.0	34.8	283.6
250.0	11.6	299.8	15.1	281.7	-13.8	90.0	39.7	282.9
260.0	10.0	299.8	14.6	288.5	-19.3	90.0	43.0	282.9
270.0	7.9	299.8	13.6	298.5	-24.2	90.0	44.2	283.6
280.0	6.5	240.2	17.2	327.6	-26.9	90.0	43.4	285.0
290.0	14.3	202.7	25.9	347.2	-27.4	90.0	40.5	287.3
300.0	11.2	195.3	23.8	352.5	-27.8	90.0	36.2	290.6
310.0	2.3	189.5	15.5	358.5	-27.0	90.0	30.8	295.6
320.0	1.2	64.3	13.4	4.5	-23.9	90.0	25.8	302.6
330.0	2.7	41.1	12.4	7.8	-19.1	90.0	21.2	312.5
340.0	4.1	24.1	11.0	8.5	-13.3	90.0	17.7	325.6
350.0	5.6	10.1	9.3	6.0	-6.8	90.0	15.5	341.8
360.0	7.4	0.0	7.4	0.0	0.0	90.0	14.7	360.0

6.1.5 Thruster loss

Case 1 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.87	1.00
10.0	0.85	0.86	0.81
20.0	0.85	0.87	0.81
30.0	0.86	0.91	0.82
40.0	0.88	0.94	0.83
50.0	0.89	0.83	0.85
60.0	0.89	0.85	0.87
70.0	0.89	0.87	0.86
80.0	0.88	0.83	0.85
90.0	0.88	0.82	0.84
100.0	0.86	0.83	0.85
110.0	0.86	0.84	0.85
120.0	0.87	0.85	0.86
130.0	0.87	0.86	0.86
140.0	0.89	0.88	0.92
150.0	0.91	0.89	0.92
160.0	0.93	0.89	0.91
170.0	0.94	0.90	0.91
180.0	0.97	0.97	1.00
190.0	0.90	0.94	0.91
200.0	0.89	0.93	0.91
210.0	0.89	0.91	0.92
220.0	0.88	0.89	0.92
230.0	0.86	0.87	0.86
240.0	0.85	0.87	0.86
250.0	0.84	0.86	0.85
260.0	0.83	0.86	0.85
270.0	0.82	0.86	0.84
280.0	0.83	0.88	0.85
290.0	0.87	0.89	0.86
300.0	0.85	0.89	0.87
310.0	0.84	0.89	0.85
320.0	0.94	0.88	0.83
330.0	0.91	0.86	0.82
340.0	0.87	0.85	0.81
350.0	0.86	0.85	0.81
360.0	0.87	0.87	1.00

Preliminary Design, @IDR5

6.2 Case 2 - Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 4

6.2.1 Environment and thrust utilisation

Case 2 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	10.0	10.0	0.0	35.0	2.5	6.0	8.5	2.00	22.2
10.0	10.0	10.0	10.0	35.0	2.5	6.0	8.5	2.00	40.0
20.0	10.0	10.0	20.0	35.0	2.5	6.0	8.5	2.00	56.6
30.0	10.0	10.0	30.0	35.0	2.5	6.0	8.5	2.00	71.1
40.0	10.0	10.0	40.0	35.0	2.5	6.0	8.5	2.00	82.2
50.0	10.0	10.0	50.0	35.0	2.5	6.0	8.5	2.00	89.2
60.0	10.0	10.0	60.0	35.0	2.5	6.0	8.5	2.00	91.1
70.0	10.0	10.0	70.0	35.0	2.5	6.0	8.5	2.00	91.0
80.0	10.0	10.0	80.0	35.0	2.5	6.0	8.5	2.00	87.2
90.0	10.0	10.0	90.0	35.0	2.5	6.0	8.5	2.00	78.4
100.0	10.0	10.0	100.0	35.0	2.5	6.0	8.5	2.00	64.1
110.0	10.0	10.0	110.0	35.0	2.5	6.0	8.5	2.00	50.2
120.0	10.0	10.0	120.0	35.0	2.5	6.0	8.5	2.00	36.6
130.0	10.0	10.0	130.0	35.0	2.5	6.0	8.5	2.00	25.2
140.0	10.0	10.0	140.0	35.0	2.5	6.0	8.5	2.00	21.5
150.0	10.0	10.0	150.0	35.0	2.5	6.0	8.5	2.00	15.0
160.0	10.0	10.0	160.0	35.0	2.5	6.0	8.5	2.00	13.3
170.0	10.0	10.0	170.0	35.0	2.5	6.0	8.5	2.00	13.0
180.0	10.0	10.0	180.0	35.0	2.5	6.0	8.5	2.00	18.7
190.0	10.0	10.0	190.0	35.0	2.5	6.0	8.5	2.00	22.8
200.0	10.0	10.0	200.0	35.0	2.5	6.0	8.5	2.00	22.2
210.0	10.0	10.0	210.0	35.0	2.5	6.0	8.5	2.00	21.7
220.0	10.0	10.0	220.0	35.0	2.5	6.0	8.5	2.00	17.8
230.0	10.0	10.0	230.0	35.0	2.5	6.0	8.5	2.00	14.0
240.0	10.0	10.0	240.0	35.0	2.5	6.0	8.5	2.00	14.7
250.0	10.0	10.0	250.0	35.0	2.5	6.0	8.5	2.00	24.5
260.0	10.0	10.0	260.0	35.0	2.5	6.0	8.5	2.00	32.0
270.0	10.0	10.0	270.0	35.0	2.5	6.0	8.5	2.00	44.0
280.0	10.0	10.0	280.0	35.0	2.5	6.0	8.5	2.00	54.4
290.0	10.0	10.0	290.0	35.0	2.5	6.0	8.5	2.00	59.3
300.0	10.0	10.0	300.0	35.0	2.5	6.0	8.5	2.00	59.5
310.0	10.0	10.0	310.0	35.0	2.5	6.0	8.5	2.00	56.8
320.0	10.0	10.0	320.0	35.0	2.5	6.0	8.5	2.00	49.3
330.0	10.0	10.0	330.0	35.0	2.5	6.0	8.5	2.00	37.7
340.0	10.0	10.0	340.0	35.0	2.5	6.0	8.5	2.00	23.0
350.0	10.0	10.0	350.0	35.0	2.5	6.0	8.5	2.00	7.8
360.0	10.0	10.0	360.0	35.0	2.5	6.0	8.5	2.00	22.2

6.2.2 Relative contributions of force components

Case 2 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	50.4	16.3	18.8	0.0	14.5	100.0
10.0	43.9	13.8	30.0	0.0	12.3	100.0
20.0	36.2	11.2	42.7	0.0	9.9	100.0
30.0	29.1	8.9	54.2	0.0	7.8	100.0
40.0	23.4	7.0	63.5	0.0	6.1	100.0
50.0	19.1	5.7	70.3	0.0	4.9	100.0
60.0	16.1	4.7	75.1	0.0	4.1	100.0
70.0	14.1	4.1	78.2	0.0	3.6	100.0
80.0	13.0	3.8	80.0	0.0	3.3	100.0
90.0	12.6	3.6	80.7	0.0	3.1	100.0
100.0	12.8	3.7	80.4	0.0	3.2	100.0
110.0	13.6	3.9	79.1	0.0	3.4	100.0
120.0	15.2	4.4	76.6	0.0	3.8	100.0
130.0	17.9	5.2	72.5	0.0	4.5	100.0
140.0	22.1	6.4	66.0	0.0	5.5	100.0
150.0	28.4	8.3	56.0	0.0	7.3	100.0
160.0	38.4	11.4	40.4	0.0	9.9	100.0
170.0	54.3	16.4	14.9	0.0	14.4	100.0
180.0	80.2	24.9	-27.1	0.0	22.0	100.0
190.0	111.6	36.3	-80.3	0.0	32.5	100.0
200.0	34.3	14.2	2.7	0.0	29.8	100.0
210.0	-3.6	1.2	84.5	0.0	17.9	100.0
220.0	-11.2	2.1	102.0	0.0	11.1	100.0
230.0	-17.5	-2.5	106.3	0.0	7.7	100.0
240.0	-21.6	-2.4	107.0	0.0	6.0	100.0
250.0	-23.9	-2.3	106.8	0.0	5.0	100.0
260.0	-25.0	-2.1	106.3	0.0	4.6	100.0
270.0	-25.0	-1.9	105.7	0.0	4.5	100.0
280.0	-23.6	-1.8	104.9	0.0	4.7	100.0
290.0	-21.3	-1.5	103.6	0.0	5.3	100.0
300.0	-18.3	-1.1	101.0	0.0	6.4	100.0
310.0	-13.7	-0.1	95.7	0.0	8.1	100.0
320.0	-7.7	2.1	84.9	0.0	10.7	100.0
330.0	-1.5	6.2	65.5	0.0	13.8	100.0
340.0	4.8	11.8	40.4	0.0	15.5	100.0
350.0	14.5	17.0	16.7	0.0	15.3	100.0
360.0	50.4	16.3	18.8	0.0	14.5	100.0

6.2.3 Environment forces

Case 2 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.8	-2.3	-3.6	0.0	-2.1	-14.9
10.0	-6.8	-2.3	-3.6	0.0	-2.1	-14.9
20.0	-6.8	-2.3	-3.5	0.0	-2.1	-14.8
30.0	-6.8	-2.3	-3.2	0.0	-2.1	-14.5
40.0	-6.8	-2.3	-2.8	0.0	-2.1	-14.1
50.0	-6.8	-2.3	-2.3	0.0	-2.1	-13.5
60.0	-6.8	-2.3	-1.6	0.0	-2.1	-12.9
70.0	-6.8	-2.3	-0.9	0.0	-2.1	-12.2
80.0	-6.8	-2.3	-0.1	0.0	-2.1	-11.4
90.0	-6.8	-2.3	0.7	0.0	-2.1	-10.6
100.0	-6.8	-2.3	1.5	0.0	-2.1	-9.8
110.0	-6.8	-2.3	2.3	0.0	-2.1	-9.0
120.0	-6.8	-2.3	3.0	0.0	-2.1	-8.3
130.0	-6.8	-2.3	3.5	0.0	-2.1	-7.8
140.0	-6.8	-2.3	4.0	0.0	-2.1	-7.3
150.0	-6.8	-2.3	4.3	0.0	-2.1	-7.0
160.0	-6.8	-2.3	4.4	0.0	-2.1	-6.9
170.0	-6.8	-2.3	4.4	0.0	-2.1	-6.8
180.0	-6.8	-2.3	4.3	0.0	-2.1	-7.0
190.0	-6.8	-2.3	4.4	0.0	-2.1	-6.8
200.0	-6.8	-2.3	4.4	0.0	-2.1	-6.9
210.0	-6.8	-2.3	4.3	0.0	-2.1	-7.0
220.0	-6.8	-2.3	4.0	0.0	-2.1	-7.3
230.0	-6.8	-2.3	3.5	0.0	-2.1	-7.8
240.0	-6.8	-2.3	3.0	0.0	-2.1	-8.3
250.0	-6.8	-2.3	2.3	0.0	-2.1	-9.0
260.0	-6.8	-2.3	1.5	0.0	-2.1	-9.8
270.0	-6.8	-2.3	0.7	0.0	-2.1	-10.6
280.0	-6.8	-2.3	-0.1	0.0	-2.1	-11.4
290.0	-6.8	-2.3	-0.9	0.0	-2.1	-12.2
300.0	-6.8	-2.3	-1.6	0.0	-2.1	-12.9
310.0	-6.8	-2.3	-2.3	0.0	-2.1	-13.5
320.0	-6.8	-2.3	-2.8	0.0	-2.1	-14.1
330.0	-6.8	-2.3	-3.2	0.0	-2.1	-14.5
340.0	-6.8	-2.3	-3.5	0.0	-2.1	-14.8
350.0	-6.8	-2.3	-3.6	0.0	-2.1	-14.9
360.0	-6.8	-2.3	-3.6	0.0	-2.1	-14.9

Case 2 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.3	-1.4	0.0	0.0	-1.2	-7.9
10.0	-5.3	-1.4	-4.8	0.0	-1.2	-12.7
20.0	-5.3	-1.4	-10.0	0.0	-1.2	-17.9
30.0	-5.3	-1.4	-15.6	0.0	-1.2	-23.5
40.0	-5.3	-1.4	-21.7	0.0	-1.2	-29.6
50.0	-5.3	-1.4	-28.0	0.0	-1.2	-35.9
60.0	-5.3	-1.4	-33.8	0.0	-1.2	-41.8
70.0	-5.3	-1.4	-38.7	0.0	-1.2	-46.6
80.0	-5.3	-1.4	-41.9	0.0	-1.2	-49.8
90.0	-5.3	-1.4	-43.0	0.0	-1.2	-50.9
100.0	-5.3	-1.4	-41.9	0.0	-1.2	-49.8
110.0	-5.3	-1.4	-38.7	0.0	-1.2	-46.6
120.0	-5.3	-1.4	-33.8	0.0	-1.2	-41.8
130.0	-5.3	-1.4	-28.0	0.0	-1.2	-35.9
140.0	-5.3	-1.4	-21.7	0.0	-1.2	-29.6
150.0	-5.3	-1.4	-15.6	0.0	-1.2	-23.5
160.0	-5.3	-1.4	-10.0	0.0	-1.2	-17.9
170.0	-5.3	-1.4	-4.8	0.0	-1.2	-12.7
180.0	-5.3	-1.4	0.0	0.0	-1.2	-7.9
190.0	-5.3	-1.4	4.8	0.0	-1.2	-3.1
200.0	-5.3	-1.4	10.0	0.0	1.2	4.5
210.0	-5.3	-1.4	15.6	0.0	1.2	10.2
220.0	-5.3	-1.4	21.7	0.0	1.2	16.3
230.0	-5.3	-1.4	28.0	0.0	1.2	22.5
240.0	-5.3	-1.4	33.8	0.0	1.2	28.4
250.0	-5.3	-1.4	38.7	0.0	1.2	33.2
260.0	-5.3	-1.4	41.9	0.0	1.2	36.4
270.0	-5.3	-1.4	43.0	0.0	1.2	37.5
280.0	-5.3	-1.4	41.9	0.0	1.2	36.4
290.0	-5.3	-1.4	38.7	0.0	1.2	33.2
300.0	-5.3	-1.4	33.8	0.0	1.2	28.4
310.0	-5.3	-1.4	28.0	0.0	1.2	22.5
320.0	-5.3	-1.4	21.7	0.0	1.2	16.3
330.0	-5.3	-1.4	15.6	0.0	1.2	10.2
340.0	-5.3	-1.4	10.0	0.0	1.2	4.5
350.0	-5.3	-1.4	4.8	0.0	-1.2	-3.1
360.0	-5.3	-1.4	0.0	0.0	-1.2	-7.9

Case 2 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-184.0	-23.8	0.0	0.0	-30.6	-238.4
10.0	-184.0	-23.8	-316.6	0.0	-30.6	-555.0
20.0	-184.0	-23.8	-593.0	0.0	-30.6	-831.4
30.0	-184.0	-23.8	-793.7	0.0	-30.6	-1032.1
40.0	-184.0	-23.8	-892.8	0.0	-30.6	-1131.2
50.0	-184.0	-23.8	-876.4	0.0	-30.6	-1114.8
60.0	-184.0	-23.8	-745.2	0.0	-30.6	-983.6
70.0	-184.0	-23.8	-513.8	0.0	-30.6	-752.2
80.0	-184.0	-23.8	-209.2	0.0	-30.6	-447.6
90.0	-184.0	-23.8	132.4	0.0	-30.6	-106.0
100.0	-184.0	-23.8	470.0	0.0	30.6	292.8
110.0	-184.0	-23.8	762.6	0.0	30.6	585.4
120.0	-184.0	-23.8	974.5	0.0	30.6	797.3
130.0	-184.0	-23.8	1079.2	0.0	30.6	902.0
140.0	-184.0	-23.8	1063.0	0.0	30.6	885.7
150.0	-184.0	-23.8	926.1	0.0	30.6	748.9
160.0	-184.0	-23.8	683.5	0.0	30.6	506.3
170.0	-184.0	-23.8	362.6	0.0	30.6	185.4
180.0	-184.0	-23.8	0.0	0.0	-30.6	-238.4
190.0	-184.0	-23.8	-362.6	0.0	-30.6	-601.0
200.0	-184.0	-23.8	-683.5	0.0	-30.6	-921.9
210.0	-184.0	-23.8	-926.1	0.0	-30.6	-1164.5
220.0	-184.0	-23.8	-1079.2	0.0	-30.6	-1301.4
230.0	-184.0	-23.8	-1079.2	0.0	-30.6	-1317.6
240.0	-184.0	-23.8	-974.5	0.0	-30.6	-1212.9
250.0	-184.0	-23.8	-762.6	0.0	-30.6	-1001.0
260.0	-184.0	-23.8	-470.0	0.0	-30.6	-708.4
270.0	-184.0	-23.8	-132.4	0.0	-30.6	-370.8
280.0	-184.0	-23.8	209.2	0.0	30.6	32.0
290.0	-184.0	-23.8	513.8	0.0	30.6	336.6
300.0	-184.0	-23.8	745.2	0.0	30.6	568.0
310.0	-184.0	-23.8	876.4	0.0	30.6	699.2
320.0	-184.0	-23.8	892.8	0.0	30.6	715.6
330.0	-184.0	-23.8	793.7	0.0	30.6	616.5
340.0	-184.0	-23.8	593.0	0.0	30.6	415.7
350.0	-184.0	-23.8	316.6	0.0	30.6	139.4
360.0	-184.0	-23.8	0.0	0.0	-30.6	-238.4

6.2.4 Thruster use

Case 2 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	9.5	0.9	5.4	1.6	7.6	90.0	16.9	28.0
10.0	11.4	355.8	3.6	346.8	14.4	90.0	19.6	40.6
20.0	13.1	353.6	2.3	318.9	20.9	90.0	23.2	50.5
30.0	19.3	356.4	4.9	194.6	26.0	90.0	27.6	58.4
40.0	51.3	1.9	37.2	177.6	26.4	90.0	32.8	64.6
50.0	72.0	3.7	58.4	175.8	27.0	90.0	38.4	69.3
60.0	79.2	5.3	66.3	174.3	27.8	90.0	43.7	72.8
70.0	81.2	7.1	69.0	172.4	27.4	90.0	48.2	75.4
80.0	69.3	9.8	57.9	169.2	27.1	90.0	51.1	77.1
90.0	45.0	16.2	34.6	160.6	26.9	90.0	52.0	78.3
100.0	21.7	46.1	10.6	119.8	25.0	90.0	50.7	78.9
110.0	16.4	77.9	11.2	60.2	20.8	90.0	47.5	79.1
120.0	16.2	81.7	12.1	60.2	15.3	90.0	42.6	78.7
130.0	15.1	83.4	12.1	60.2	10.4	90.0	36.7	77.8
140.0	13.2	82.6	11.3	60.2	6.8	90.0	30.5	76.1
150.0	10.7	77.9	9.6	60.2	4.7	90.0	24.6	73.4
160.0	8.1	65.9	7.1	60.2	4.3	90.0	19.2	69.0
170.0	6.0	40.3	4.3	58.4	5.2	90.0	14.5	61.8
180.0	5.5	1.6	1.5	5.8	7.6	90.0	10.1	48.6
190.0	6.7	332.8	3.3	285.4	9.3	90.0	7.3	24.2
200.0	9.0	312.6	6.8	276.5	8.9	90.0	8.2	326.7
210.0	11.3	303.9	9.4	274.4	8.6	90.0	12.3	304.6
220.0	12.9	299.8	11.7	271.4	6.7	90.0	17.8	294.2
230.0	13.8	299.8	13.6	275.8	3.0	90.0	23.8	289.0
240.0	13.7	299.8	14.7	275.9	-1.8	90.0	29.6	286.4
250.0	12.8	299.8	17.9	280.2	-7.4	90.0	34.4	285.2
260.0	11.2	299.8	14.3	287.0	-13.0	90.0	37.7	285.0
270.0	9.1	299.8	13.2	297.2	-17.8	90.0	39.0	285.7
280.0	6.9	299.8	12.0	313.3	-22.2	90.0	38.1	287.4
290.0	4.1	299.8	11.7	330.6	-24.0	90.0	35.4	290.1
300.0	2.1	299.8	12.1	347.3	-23.8	90.0	31.2	294.5
310.0	1.0	343.5	12.6	358.6	-21.9	90.0	26.3	301.0
320.0	2.4	28.3	12.0	5.2	-18.5	90.0	21.5	310.9
330.0	4.0	26.6	11.1	9.0	-13.7	90.0	17.7	325.0
340.0	5.5	17.8	9.6	9.8	-7.8	90.0	15.4	343.0
350.0	7.6	11.6	7.6	11.3	0.1	90.0	15.2	11.7
360.0	9.5	0.9	5.4	1.6	7.6	90.0	16.9	28.0

6.2.5 Thruster loss

Case 2 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.86	0.82
10.0	0.86	0.86	0.81
20.0	0.86	0.89	0.81
30.0	0.87	0.89	0.82
40.0	0.88	0.80	0.83
50.0	0.89	0.80	0.85
60.0	0.90	0.81	0.87
70.0	0.90	0.82	0.86
80.0	0.91	0.84	0.85
90.0	0.91	0.84	0.84
100.0	0.88	0.81	0.85
110.0	0.86	0.84	0.85
120.0	0.87	0.85	0.86
130.0	0.87	0.86	0.86
140.0	0.89	0.88	0.86
150.0	0.91	0.89	0.87
160.0	0.93	0.89	0.88
170.0	0.94	0.89	0.89
180.0	0.96	0.95	0.91
190.0	0.91	0.93	0.91
200.0	0.89	0.91	0.91
210.0	0.89	0.90	0.92
220.0	0.88	0.88	0.92
230.0	0.86	0.87	0.93
240.0	0.85	0.86	0.86
250.0	0.84	0.86	0.85
260.0	0.83	0.86	0.85
270.0	0.82	0.86	0.84
280.0	0.81	0.86	0.85
290.0	0.81	0.87	0.86
300.0	0.81	0.88	0.87
310.0	0.84	0.89	0.85
320.0	0.90	0.87	0.83
330.0	0.89	0.86	0.82
340.0	0.87	0.85	0.81
350.0	0.86	0.84	0.82
360.0	0.87	0.86	0.82

6.3 Case 3 - Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 4

6.3.1 Environment and thrust utilisation

Case 3 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	20.0	20.0	0.0	35.0	2.5	6.0	8.5	2.00	42.8
10.0	20.0	20.0	10.0	35.0	2.5	6.0	8.5	2.00	60.8
20.0	20.0	20.0	20.0	35.0	2.5	6.0	8.5	2.00	77.4
30.0	20.0	20.0	30.0	35.0	2.5	6.0	8.5	2.00	91.6
40.0	20.0	20.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	20.0	20.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	20.0	20.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	20.0	20.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	20.0	20.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	20.0	20.0	90.0	35.0	2.5	6.0	8.5	2.00	98.5
100.0	20.0	20.0	100.0	35.0	2.5	6.0	8.5	2.00	82.4
110.0	20.0	20.0	110.0	35.0	2.5	6.0	8.5	2.00	68.4
120.0	20.0	20.0	120.0	35.0	2.5	6.0	8.5	2.00	54.5
130.0	20.0	20.0	130.0	35.0	2.5	6.0	8.5	2.00	42.9
140.0	20.0	20.0	140.0	35.0	2.5	6.0	8.5	2.00	34.3
150.0	20.0	20.0	150.0	35.0	2.5	6.0	8.5	2.00	29.4
160.0	20.0	20.0	160.0	35.0	2.5	6.0	8.5	2.00	28.3
170.0	20.0	20.0	170.0	35.0	2.5	6.0	8.5	2.00	33.9
180.0	20.0	20.0	180.0	35.0	2.5	6.0	8.5	2.00	38.5
190.0	20.0	20.0	190.0	35.0	2.5	6.0	8.5	2.00	43.0
200.0	20.0	20.0	200.0	35.0	2.5	6.0	8.5	2.00	45.6
210.0	20.0	20.0	210.0	35.0	2.5	6.0	8.5	2.00	36.7
220.0	20.0	20.0	220.0	35.0	2.5	6.0	8.5	2.00	32.3
230.0	20.0	20.0	230.0	35.0	2.5	6.0	8.5	2.00	24.4
240.0	20.0	20.0	240.0	35.0	2.5	6.0	8.5	2.00	15.2
250.0	20.0	20.0	250.0	35.0	2.5	6.0	8.5	2.00	14.5
260.0	20.0	20.0	260.0	35.0	2.5	6.0	8.5	2.00	21.0
270.0	20.0	20.0	270.0	35.0	2.5	6.0	8.5	2.00	28.5
280.0	20.0	20.0	280.0	35.0	2.5	6.0	8.5	2.00	37.0
290.0	20.0	20.0	290.0	35.0	2.5	6.0	8.5	2.00	45.6
300.0	20.0	20.0	300.0	35.0	2.5	6.0	8.5	2.00	45.8
310.0	20.0	20.0	310.0	35.0	2.5	6.0	8.5	2.00	42.7
320.0	20.0	20.0	320.0	35.0	2.5	6.0	8.5	2.00	35.0
330.0	20.0	20.0	330.0	35.0	2.5	6.0	8.5	2.00	23.2
340.0	20.0	20.0	340.0	35.0	2.5	6.0	8.5	2.00	8.3
350.0	20.0	20.0	350.0	35.0	2.5	6.0	8.5	2.00	25.2
360.0	20.0	20.0	360.0	35.0	2.5	6.0	8.5	2.00	42.8

6.3.2 Relative contributions of force components

Case 3 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	57.1	17.5	10.6	0.0	14.9	100.0
10.0	49.6	15.0	22.7	0.0	12.7	100.0
20.0	42.7	12.8	33.7	0.0	10.8	100.0
30.0	36.5	10.8	43.5	0.0	9.2	100.0
40.0	31.3	9.2	51.7	0.0	7.8	100.0
50.0	27.1	7.9	58.3	0.0	6.7	100.0
60.0	23.9	7.0	63.2	0.0	5.9	100.0
70.0	21.8	6.3	66.6	0.0	5.3	100.0
80.0	20.5	6.0	68.5	0.0	5.0	100.0
90.0	20.1	5.8	69.2	0.0	4.9	100.0
100.0	20.4	5.9	68.7	0.0	4.9	100.0
110.0	21.6	6.2	67.0	0.0	5.2	100.0
120.0	23.6	6.8	63.8	0.0	5.7	100.0
130.0	26.8	7.8	59.0	0.0	6.5	100.0
140.0	31.2	9.1	52.2	0.0	7.6	100.0
150.0	37.2	10.8	42.9	0.0	9.1	100.0
160.0	45.2	13.2	30.5	0.0	11.1	100.0
170.0	55.8	16.4	14.0	0.0	13.8	100.0
180.0	70.7	20.9	-9.3	0.0	17.7	100.0
190.0	93.7	28.1	-45.7	0.0	23.8	100.0
200.0	128.2	39.4	-10.4	0.0	33.8	100.0
210.0	10.9	7.0	43.5	0.0	37.8	100.0
220.0	-36.8	8.1	118.2	0.0	26.9	100.0
230.0	-37.8	-9.6	129.3	0.0	18.2	100.0
240.0	-33.0	-8.7	128.1	0.0	13.5	100.0
250.0	-28.9	-7.7	125.5	0.0	11.1	100.0
260.0	-26.3	-7.0	123.3	0.0	9.9	100.0
270.0	-24.8	-6.6	121.8	0.0	9.6	100.0
280.0	-24.3	-6.4	120.7	0.0	9.9	100.0
290.0	-24.1	-6.2	119.3	0.0	11.0	100.0
300.0	-23.2	-5.7	115.9	0.0	13.0	100.0
310.0	-18.4	-3.9	106.5	0.0	15.9	100.0
320.0	-3.5	1.1	83.9	0.0	18.6	100.0
330.0	25.6	10.0	46.4	0.0	18.0	100.0
340.0	66.5	21.2	-6.2	0.0	18.4	100.0
350.0	64.0	19.9	-1.0	0.0	17.1	100.0
360.0	57.1	17.5	10.6	0.0	14.9	100.0

6.3.3 Environment forces

Case 3 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-7.0	-2.4	-3.6	0.0	-2.2	-15.2
10.0	-7.0	-2.4	-3.6	0.0	-2.2	-15.2
20.0	-7.0	-2.4	-3.5	0.0	-2.2	-15.1
30.0	-7.0	-2.4	-3.2	0.0	-2.2	-14.8
40.0	-7.0	-2.4	-2.8	0.0	-2.2	-14.4
50.0	-7.0	-2.4	-2.3	0.0	-2.2	-13.9
60.0	-7.0	-2.4	-1.6	0.0	-2.2	-13.2
70.0	-7.0	-2.4	-0.9	0.0	-2.2	-12.5
80.0	-7.0	-2.4	-0.1	0.0	-2.2	-11.7
90.0	-7.0	-2.4	0.7	0.0	-2.2	-10.9
100.0	-7.0	-2.4	1.5	0.0	-2.2	-10.1
110.0	-7.0	-2.4	2.3	0.0	-2.2	-9.3
120.0	-7.0	-2.4	3.0	0.0	-2.2	-8.6
130.0	-7.0	-2.4	3.5	0.0	-2.2	-8.1
140.0	-7.0	-2.4	4.0	0.0	-2.2	-7.6
150.0	-7.0	-2.4	4.3	0.0	-2.2	-7.3
160.0	-7.0	-2.4	4.4	0.0	-2.2	-7.2
170.0	-7.0	-2.4	4.4	0.0	-2.2	-7.2
180.0	-7.0	-2.4	4.3	0.0	-2.2	-7.3
190.0	-7.0	-2.4	4.4	0.0	-2.2	-7.2
200.0	-7.0	-2.4	4.4	0.0	-2.2	-7.2
210.0	-7.0	-2.4	4.3	0.0	-2.2	-7.3
220.0	-7.0	-2.4	4.0	0.0	-2.2	-7.6
230.0	-7.0	-2.4	3.5	0.0	-2.2	-8.1
240.0	-7.0	-2.4	3.0	0.0	-2.2	-8.6
250.0	-7.0	-2.4	2.3	0.0	-2.2	-9.3
260.0	-7.0	-2.4	1.5	0.0	-2.2	-10.1
270.0	-7.0	-2.4	0.7	0.0	-2.2	-10.9
280.0	-7.0	-2.4	-0.1	0.0	-2.2	-11.7
290.0	-7.0	-2.4	-0.9	0.0	-2.2	-12.5
300.0	-7.0	-2.4	-1.6	0.0	-2.2	-13.2
310.0	-7.0	-2.4	-2.3	0.0	-2.2	-13.9
320.0	-7.0	-2.4	-2.8	0.0	-2.2	-14.4
330.0	-7.0	-2.4	-3.2	0.0	-2.2	-14.8
340.0	-7.0	-2.4	-3.5	0.0	-2.2	-15.1
350.0	-7.0	-2.4	-3.6	0.0	-2.2	-15.2
360.0	-7.0	-2.4	-3.6	0.0	-2.2	-15.2

Case 3 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-11.2	-3.2	0.0	0.0	-2.6	-16.9
10.0	-11.2	-3.2	-4.8	0.0	-2.6	-21.8
20.0	-11.2	-3.2	-10.0	0.0	-2.6	-26.9
30.0	-11.2	-3.2	-15.6	0.0	-2.6	-32.6
40.0	-11.2	-3.2	-21.7	0.0	-2.6	-38.7
50.0	-11.2	-3.2	-28.0	0.0	-2.6	-44.9
60.0	-11.2	-3.2	-33.8	0.0	-2.6	-50.8
70.0	-11.2	-3.2	-38.7	0.0	-2.6	-55.6
80.0	-11.2	-3.2	-41.9	0.0	-2.6	-58.8
90.0	-11.2	-3.2	-43.0	0.0	-2.6	-59.9
100.0	-11.2	-3.2	-41.9	0.0	-2.6	-58.8
110.0	-11.2	-3.2	-38.7	0.0	-2.6	-55.6
120.0	-11.2	-3.2	-33.8	0.0	-2.6	-50.8
130.0	-11.2	-3.2	-28.0	0.0	-2.6	-44.9
140.0	-11.2	-3.2	-21.7	0.0	-2.6	-38.7
150.0	-11.2	-3.2	-15.6	0.0	-2.6	-32.6
160.0	-11.2	-3.2	-10.0	0.0	-2.6	-26.9
170.0	-11.2	-3.2	-4.8	0.0	-2.6	-21.8
180.0	-11.2	-3.2	0.0	0.0	-2.6	-16.9
190.0	-11.2	-3.2	4.8	0.0	-2.6	-12.1
200.0	-11.2	-3.2	10.0	0.0	-2.6	-6.9
210.0	-11.2	-3.2	15.6	0.0	2.6	3.9
220.0	-11.2	-3.2	21.7	0.0	2.6	10.0
230.0	-11.2	-3.2	28.0	0.0	2.6	16.3
240.0	-11.2	-3.2	33.8	0.0	2.6	22.1
250.0	-11.2	-3.2	38.7	0.0	2.6	27.0
260.0	-11.2	-3.2	41.9	0.0	2.6	30.2
270.0	-11.2	-3.2	43.0	0.0	2.6	31.3
280.0	-11.2	-3.2	41.9	0.0	2.6	30.2
290.0	-11.2	-3.2	38.7	0.0	2.6	27.0
300.0	-11.2	-3.2	33.8	0.0	2.6	22.1
310.0	-11.2	-3.2	28.0	0.0	2.6	16.3
320.0	-11.2	-3.2	21.7	0.0	2.6	10.0
330.0	-11.2	-3.2	15.6	0.0	2.6	3.9
340.0	-11.2	-3.2	10.0	0.0	-2.6	-6.9
350.0	-11.2	-3.2	4.8	0.0	-2.6	-12.1
360.0	-11.2	-3.2	0.0	0.0	-2.6	-16.9

Case 3 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-351.6	-45.7	0.0	0.0	-58.5	-455.8
10.0	-351.6	-45.7	-316.6	0.0	-58.5	-772.4
20.0	-351.6	-45.7	-593.0	0.0	-58.5	-1048.8
30.0	-351.6	-45.7	-793.7	0.0	-58.5	-1249.5
40.0	-351.6	-45.7	-892.8	0.0	-58.5	-1348.6
50.0	-351.6	-45.7	-876.4	0.0	-58.5	-1332.2
60.0	-351.6	-45.7	-745.2	0.0	-58.5	-1201.0
70.0	-351.6	-45.7	-513.8	0.0	-58.5	-969.6
80.0	-351.6	-45.7	-209.2	0.0	-58.5	-665.0
90.0	-351.6	-45.7	132.4	0.0	-58.5	-323.4
100.0	-351.6	-45.7	470.0	0.0	58.5	131.2
110.0	-351.6	-45.7	762.6	0.0	58.5	423.8
120.0	-351.6	-45.7	974.5	0.0	58.5	635.7
130.0	-351.6	-45.7	1079.2	0.0	58.5	740.4
140.0	-351.6	-45.7	1063.0	0.0	58.5	721.1
150.0	-351.6	-45.7	926.1	0.0	58.5	537.2
160.0	-351.6	-45.7	683.5	0.0	58.5	244.7
170.0	-351.6	-45.7	362.6	0.0	-58.5	-93.2
180.0	-351.6	-45.7	0.0	0.0	-58.5	-455.8
190.0	-351.6	-45.7	-362.6	0.0	-58.5	-818.4
200.0	-351.6	-45.7	-683.5	0.0	-58.5	-1139.3
210.0	-351.6	-45.7	-926.1	0.0	-58.5	-1381.9
220.0	-351.6	-45.7	-1063.0	0.0	-58.5	-1518.8
230.0	-351.6	-45.7	-1079.2	0.0	-58.5	-1535.0
240.0	-351.6	-45.7	-974.5	0.0	-58.5	-1430.3
250.0	-351.6	-45.7	-762.6	0.0	-58.5	-1218.4
260.0	-351.6	-45.7	-470.0	0.0	-58.5	-925.8
270.0	-351.6	-45.7	-132.4	0.0	-58.5	-588.2
280.0	-351.6	-45.7	209.2	0.0	-58.5	-246.6
290.0	-351.6	-45.7	513.8	0.0	58.5	175.0
300.0	-351.6	-45.7	745.2	0.0	58.5	406.4
310.0	-351.6	-45.7	876.4	0.0	58.5	537.6
320.0	-351.6	-45.7	892.8	0.0	58.5	554.0
330.0	-351.6	-45.7	793.7	0.0	58.5	454.9
340.0	-351.6	-45.7	593.0	0.0	58.5	254.1
350.0	-351.6	-45.7	316.6	0.0	-58.5	-139.2
360.0	-351.6	-45.7	0.0	0.0	-58.5	-455.8

6.3.4 Thruster use

Case 3 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	11.8	3.2	3.5	10.7	15.6	90.0	22.7	48.1
10.0	13.7	358.7	1.6	348.4	22.4	90.0	26.5	55.1
20.0	36.9	0.9	21.8	178.6	25.8	90.0	30.8	60.7
30.0	77.5	2.5	62.7	177.1	26.0	90.0	35.8	65.6
40.0	99.3	0.1	86.1	173.5	26.4	90.0	38.8	69.3
50.0	100.4	0.1	89.1	172.9	27.0	90.0	40.0	72.7
60.0	101.7	0.2	91.6	170.8	27.8	90.0	44.1	75.2
70.0	101.4	5.8	90.8	174.2	27.4	90.0	48.1	77.3
80.0	101.5	7.7	90.9	172.3	27.1	90.0	53.9	78.7
90.0	102.9	9.8	91.9	170.3	26.9	90.0	60.9	79.7
100.0	57.2	17.2	47.0	161.4	26.9	90.0	59.7	80.3
110.0	23.8	49.3	12.5	119.8	26.7	90.0	56.4	80.5
120.0	24.1	52.5	12.2	119.8	21.1	90.0	51.5	80.3
130.0	16.8	82.6	11.9	60.2	17.9	90.0	45.6	79.8
140.0	14.9	81.8	11.1	60.2	14.3	90.0	39.4	78.8
150.0	12.4	77.6	9.4	60.2	12.3	90.0	33.4	77.3
160.0	9.8	67.6	6.9	60.2	11.8	90.0	27.8	75.1
170.0	7.3	40.7	3.3	60.2	14.1	90.0	22.9	71.8
180.0	7.8	5.1	0.7	125.6	15.6	90.0	18.1	66.7
190.0	8.6	341.9	2.8	248.8	17.3	90.0	14.1	59.4
200.0	10.3	326.2	5.8	256.3	18.3	90.0	10.0	44.1
210.0	12.4	310.2	9.4	265.8	15.0	90.0	8.3	331.8
220.0	14.0	303.9	11.5	263.1	13.1	90.0	12.6	307.2
230.0	14.7	299.8	13.1	273.3	9.6	90.0	18.2	296.4
240.0	14.7	299.8	14.2	275.4	4.7	90.0	23.8	291.3
250.0	13.9	299.8	17.3	279.8	-0.9	90.0	28.5	289.1
260.0	12.2	291.8	13.7	287.0	-6.4	90.0	31.8	288.5
270.0	10.1	299.8	12.7	297.6	-11.3	90.0	33.1	289.2
280.0	7.3	299.8	11.6	312.3	-14.8	90.0	32.4	291.2
290.0	4.6	299.8	11.3	334.5	-18.1	90.0	29.7	294.8
300.0	2.8	316.5	11.4	349.3	-18.1	90.0	25.8	300.8
310.0	2.6	359.8	11.3	359.9	-16.3	90.0	21.4	310.4
320.0	4.0	20.5	10.7	7.3	-12.8	90.0	17.6	325.1
330.0	5.6	21.5	9.8	11.8	-8.0	90.0	15.3	345.1
340.0	8.3	21.9	8.0	21.9	0.9	90.0	16.6	24.7
350.0	10.0	9.5	5.5	16.9	8.8	90.0	19.4	38.5
360.0	11.8	3.2	3.5	10.7	15.6	90.0	22.7	48.1

6.3.5 Thruster loss

Case 3 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.84	0.82
10.0	0.86	0.86	0.81
20.0	0.87	0.79	0.81
30.0	0.87	0.80	0.82
40.0	0.88	0.82	0.83
50.0	0.89	0.82	0.85
60.0	0.91	0.83	0.87
70.0	0.91	0.81	0.86
80.0	0.92	0.82	0.85
90.0	0.93	0.82	0.84
100.0	0.93	0.82	0.85
110.0	0.89	0.81	0.85
120.0	0.90	0.81	0.86
130.0	0.88	0.86	0.86
140.0	0.89	0.88	0.86
150.0	0.91	0.89	0.87
160.0	0.93	0.89	0.88
170.0	0.94	0.89	0.89
180.0	0.96	0.84	0.91
190.0	0.92	0.89	0.91
200.0	0.90	0.89	0.91
210.0	0.89	0.88	0.92
220.0	0.88	0.88	0.92
230.0	0.86	0.87	0.93
240.0	0.85	0.86	0.94
250.0	0.84	0.86	0.85
260.0	0.83	0.86	0.85
270.0	0.82	0.86	0.84
280.0	0.81	0.86	0.85
290.0	0.81	0.87	0.86
300.0	0.81	0.89	0.87
310.0	0.89	0.89	0.85
320.0	0.89	0.87	0.83
330.0	0.88	0.85	0.82
340.0	0.87	0.84	0.84
350.0	0.86	0.84	0.82
360.0	0.86	0.84	0.82

Preliminary Design, @IDR5

6.4 Case 4 - Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 4

6.4.1 Environment and thrust utilisation

Case 4 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	30.0	30.0	0.0	35.0	2.5	6.0	8.5	2.00	64.7
10.0	30.0	30.0	10.0	35.0	2.5	6.0	8.5	2.00	82.8
20.0	30.0	30.0	20.0	35.0	2.5	6.0	8.5	2.00	99.2
30.0	30.0	30.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	30.0	30.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	30.0	30.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	30.0	30.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	30.0	30.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	30.0	30.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	30.0	30.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	30.0	30.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	30.0	30.0	110.0	35.0	2.5	6.0	8.5	2.00	88.3
120.0	30.0	30.0	120.0	35.0	2.5	6.0	8.5	2.00	74.2
130.0	30.0	30.0	130.0	35.0	2.5	6.0	8.5	2.00	62.4
140.0	30.0	30.0	140.0	35.0	2.5	6.0	8.5	2.00	53.6
150.0	30.0	30.0	150.0	35.0	2.5	6.0	8.5	2.00	48.7
160.0	30.0	30.0	160.0	35.0	2.5	6.0	8.5	2.00	47.8
170.0	30.0	30.0	170.0	35.0	2.5	6.0	8.5	2.00	56.2
180.0	30.0	30.0	180.0	35.0	2.5	6.0	8.5	2.00	60.0
190.0	30.0	30.0	190.0	35.0	2.5	6.0	8.5	2.00	64.6
200.0	30.0	30.0	200.0	35.0	2.5	6.0	8.5	2.00	67.1
210.0	30.0	30.0	210.0	35.0	2.5	6.0	8.5	2.00	66.1
220.0	30.0	30.0	220.0	35.0	2.5	6.0	8.5	2.00	61.3
230.0	30.0	30.0	230.0	35.0	2.5	6.0	8.5	2.00	39.6
240.0	30.0	30.0	240.0	35.0	2.5	6.0	8.5	2.00	28.6
250.0	30.0	30.0	250.0	35.0	2.5	6.0	8.5	2.00	16.9
260.0	30.0	30.0	260.0	35.0	2.5	6.0	8.5	2.00	13.5
270.0	30.0	30.0	270.0	35.0	2.5	6.0	8.5	2.00	15.0
280.0	30.0	30.0	280.0	35.0	2.5	6.0	8.5	2.00	21.1
290.0	30.0	30.0	290.0	35.0	2.5	6.0	8.5	2.00	25.9
300.0	30.0	30.0	300.0	35.0	2.5	6.0	8.5	2.00	31.4
310.0	30.0	30.0	310.0	35.0	2.5	6.0	8.5	2.00	28.0
320.0	30.0	30.0	320.0	35.0	2.5	6.0	8.5	2.00	8.3
330.0	30.0	30.0	330.0	35.0	2.5	6.0	8.5	2.00	9.6
340.0	30.0	30.0	340.0	35.0	2.5	6.0	8.5	2.00	24.4
350.0	30.0	30.0	350.0	35.0	2.5	6.0	8.5	2.00	46.9
360.0	30.0	30.0	360.0	35.0	2.5	6.0	8.5	2.00	64.7

6.4.2 Relative contributions of force components

Case 4 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	60.8	18.3	5.7	0.0	15.2	100.0
10.0	53.9	16.2	16.6	0.0	13.4	100.0
20.0	47.8	14.3	26.2	0.0	11.8	100.0
30.0	42.3	12.6	34.8	0.0	10.4	100.0
40.0	37.5	11.1	42.3	0.0	9.1	100.0
50.0	33.5	9.9	48.5	0.0	8.1	100.0
60.0	30.4	8.9	53.4	0.0	7.3	100.0
70.0	28.2	8.3	56.8	0.0	6.8	100.0
80.0	26.8	7.9	58.8	0.0	6.5	100.0
90.0	26.4	7.7	59.5	0.0	6.3	100.0
100.0	26.8	7.8	58.9	0.0	6.4	100.0
110.0	28.1	8.2	57.0	0.0	6.7	100.0
120.0	30.3	8.9	53.5	0.0	7.3	100.0
130.0	33.5	9.8	48.6	0.0	8.1	100.0
140.0	37.9	11.1	42.0	0.0	9.1	100.0
150.0	43.3	12.7	33.6	0.0	10.1	100.0
160.0	49.8	14.6	23.5	0.0	12.0	100.0
170.0	57.8	17.0	11.3	0.0	14.0	100.0
180.0	67.6	20.0	-4.1	0.0	16.4	100.0
190.0	81.3	24.1	-25.3	0.0	19.9	100.0
200.0	102.3	30.5	-58.1	0.0	25.2	100.0
210.0	135.9	41.2	-111.2	0.0	34.1	100.0
220.0	167.2	52.1	-163.7	0.0	44.0	100.0
230.0	189.5	63.5	-148.3	0.0	37.2	100.0
240.0	167.5	17.0	148.3	0.0	37.2	100.0
250.0	67.5	-18.0	158.3	0.0	27.2	100.0
260.0	-59.2	-16.1	153.7	0.0	21.6	100.0
270.0	-53.2	-14.5	148.9	0.0	18.8	100.0
280.0	-49.9	-13.6	145.7	0.0	17.9	100.0
290.0	-48.6	-13.1	143.4	0.0	18.3	100.0
300.0	-47.6	-12.6	140.1	0.0	20.1	100.0
310.0	-42.6	-10.6	130.3	0.0	22.9	100.0
320.0	-22.5	-4.0	101.9	0.0	24.7	100.0
330.0	82.8	26.9	-32.4	0.0	22.7	100.0
340.0	87.1	27.2	-37.0	0.0	22.7	100.0
350.0	78.4	24.0	-22.4	0.0	20.0	100.0
360.0	68.9	20.9	-7.1	0.0	17.3	100.0
360.0	60.8	18.3	5.7	0.0	15.2	100.0

6.4.3 Environment forces

Case 4 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-7.1	-2.5	-3.6	0.0	-2.2	-15.4
10.0	-7.1	-2.5	-3.6	0.0	-2.2	-15.4
20.0	-7.1	-2.5	-3.5	0.0	-2.2	-15.3
30.0	-7.1	-2.5	-3.2	0.0	-2.2	-15.0
40.0	-7.1	-2.5	-2.8	0.0	-2.2	-14.6
50.0	-7.1	-2.5	-2.3	0.0	-2.2	-14.1
60.0	-7.1	-2.5	-1.6	0.0	-2.2	-13.5
70.0	-7.1	-2.5	-0.9	0.0	-2.2	-12.7
80.0	-7.1	-2.5	-0.1	0.0	-2.2	-11.9
90.0	-7.1	-2.5	0.7	0.0	-2.2	-11.1
100.0	-7.1	-2.5	1.5	0.0	-2.2	-10.3
110.0	-7.1	-2.5	2.3	0.0	-2.2	-9.6
120.0	-7.1	-2.5	3.0	0.0	-2.2	-8.9
130.0	-7.1	-2.5	3.5	0.0	-2.2	-8.3
140.0	-7.1	-2.5	4.0	0.0	-2.2	-7.9
150.0	-7.1	-2.5	4.3	0.0	-2.2	-7.6
160.0	-7.1	-2.5	4.4	0.0	-2.2	-7.4
170.0	-7.1	-2.5	4.4	0.0	-2.2	-7.4
180.0	-7.1	-2.5	4.3	0.0	-2.2	-7.5
190.0	-7.1	-2.5	4.4	0.0	-2.2	-7.4
200.0	-7.1	-2.5	4.4	0.0	-2.2	-7.4
210.0	-7.1	-2.5	4.3	0.0	-2.2	-7.6
220.0	-7.1	-2.5	4.0	0.0	-2.2	-7.9
230.0	-7.1	-2.5	3.5	0.0	-2.2	-8.3
240.0	-7.1	-2.5	3.0	0.0	-2.2	-8.9
250.0	-7.1	-2.5	2.3	0.0	-2.2	-9.6
260.0	-7.1	-2.5	1.5	0.0	-2.2	-10.3
270.0	-7.1	-2.5	0.7	0.0	-2.2	-11.1
280.0	-7.1	-2.5	-0.1	0.0	-2.2	-11.9
290.0	-7.1	-2.5	-0.9	0.0	-2.2	-12.7
300.0	-7.1	-2.5	-1.6	0.0	-2.2	-13.5
310.0	-7.1	-2.5	-2.3	0.0	-2.2	-14.1
320.0	-7.1	-2.5	-2.8	0.0	-2.2	-14.6
330.0	-7.1	-2.5	-3.2	0.0	-2.2	-15.0
340.0	-7.1	-2.5	-3.5	0.0	-2.2	-15.3
350.0	-7.1	-2.5	-3.6	0.0	-2.2	-15.4
360.0	-7.1	-2.5	-3.6	0.0	-2.2	-15.4

Case 4 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-17.9	-5.2	0.0	0.0	-4.2	-27.3
10.0	-17.9	-5.2	-4.8	0.0	-4.2	-32.1
20.0	-17.9	-5.2	-10.0	0.0	-4.2	-37.2
30.0	-17.9	-5.2	-15.6	0.0	-4.2	-42.9
40.0	-17.9	-5.2	-21.7	0.0	-4.2	-49.0
50.0	-17.9	-5.2	-28.0	0.0	-4.2	-55.2
60.0	-17.9	-5.2	-33.8	0.0	-4.2	-61.1
70.0	-17.9	-5.2	-38.7	0.0	-4.2	-65.9
80.0	-17.9	-5.2	-41.9	0.0	-4.2	-69.1
90.0	-17.9	-5.2	-43.0	0.0	-4.2	-70.3
100.0	-17.9	-5.2	-41.9	0.0	-4.2	-69.1
110.0	-17.9	-5.2	-38.7	0.0	-4.2	-65.9
120.0	-17.9	-5.2	-33.8	0.0	-4.2	-61.1
130.0	-17.9	-5.2	-28.0	0.0	-4.2	-55.2
140.0	-17.9	-5.2	-21.7	0.0	-4.2	-49.0
150.0	-17.9	-5.2	-15.6	0.0	-4.2	-42.9
160.0	-17.9	-5.2	-10.0	0.0	-4.2	-37.2
170.0	-17.9	-5.2	-4.8	0.0	-4.2	-32.1
180.0	-17.9	-5.2	0.0	0.0	-4.2	-27.3
190.0	-17.9	-5.2	4.8	0.0	-4.2	-22.4
200.0	-17.9	-5.2	10.0	0.0	-4.2	-17.3
210.0	-17.9	-5.2	15.6	0.0	-4.2	-11.6
220.0	-17.9	-5.2	21.7	0.0	-4.2	-5.5
230.0	-17.9	-5.2	28.0	0.0	4.2	9.2
240.0	-17.9	-5.2	33.8	0.0	4.2	15.0
250.0	-17.9	-5.2	38.7	0.0	4.2	19.8
260.0	-17.9	-5.2	41.9	0.0	4.2	23.0
270.0	-17.9	-5.2	43.0	0.0	4.2	24.2
280.0	-17.9	-5.2	41.9	0.0	4.2	23.0
290.0	-17.9	-5.2	38.7	0.0	4.2	19.8
300.0	-17.9	-5.2	33.8	0.0	4.2	15.0
310.0	-17.9	-5.2	28.0	0.0	4.2	9.2
320.0	-17.9	-5.2	21.7	0.0	-4.2	-5.5
330.0	-17.9	-5.2	15.6	0.0	-4.2	-11.6
340.0	-17.9	-5.2	10.0	0.0	-4.2	-17.3
350.0	-17.9	-5.2	4.8	0.0	-4.2	-22.4
360.0	-17.9	-5.2	0.0	0.0	-4.2	-27.3

Case 4 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-501.2	-65.8	0.0	0.0	-84.6	-651.6
10.0	-501.2	-65.8	-316.6	0.0	-84.6	-968.2
20.0	-501.2	-65.8	-593.0	0.0	-84.6	-1244.6
30.0	-501.2	-65.8	-793.7	0.0	-84.6	-1445.3
40.0	-501.2	-65.8	-892.8	0.0	-84.6	-1544.4
50.0	-501.2	-65.8	-876.4	0.0	-84.6	-1528.1
60.0	-501.2	-65.8	-745.2	0.0	-84.6	-1396.9
70.0	-501.2	-65.8	-513.8	0.0	-84.6	-1165.5
80.0	-501.2	-65.8	-209.2	0.0	-84.6	-860.9
90.0	-501.2	-65.8	132.4	0.0	-84.6	-519.2
100.0	-501.2	-65.8	470.0	0.0	-84.6	-181.7
110.0	-501.2	-65.8	762.6	0.0	84.6	280.3
120.0	-501.2	-65.8	974.5	0.0	84.6	492.1
130.0	-501.2	-65.8	1079.2	0.0	84.6	589.9
140.0	-501.2	-65.8	1063.0	0.0	84.6	580.6
150.0	-501.2	-65.8	926.1	0.0	84.6	443.7
160.0	-501.2	-65.8	683.5	0.0	84.6	201.2
170.0	-501.2	-65.8	362.6	0.0	-84.6	-289.0
180.0	-501.2	-65.8	0.0	0.0	-84.6	-651.6
190.0	-501.2	-65.8	-362.6	0.0	-84.6	-1014.2
200.0	-501.2	-65.8	-683.5	0.0	-84.6	-1335.2
210.0	-501.2	-65.8	-926.1	0.0	-84.6	-1577.7
220.0	-501.2	-65.8	-1063.0	0.0	-84.6	-1714.6
230.0	-501.2	-65.8	-1079.2	0.0	-84.6	-1730.9
240.0	-501.2	-65.8	-974.5	0.0	-84.6	-1626.2
250.0	-501.2	-65.8	-762.6	0.0	-84.6	-1414.3
260.0	-501.2	-65.8	-470.0	0.0	-84.6	-1121.6
270.0	-501.2	-65.8	-132.4	0.0	-84.6	-784.0
280.0	-501.2	-65.8	209.2	0.0	-84.6	-442.4
290.0	-501.2	-65.8	513.8	0.0	-84.6	-137.8
300.0	-501.2	-65.8	745.2	0.0	84.6	262.8
310.0	-501.2	-65.8	876.4	0.0	84.6	394.0
320.0	-501.2	-65.8	892.8	0.0	84.6	410.4
330.0	-501.2	-65.8	793.7	0.0	84.6	311.3
340.0	-501.2	-65.8	593.0	0.0	84.6	110.6
350.0	-501.2	-65.8	316.6	0.0	-84.6	-335.0
360.0	-501.2	-65.8	0.0	0.0	-84.6	-651.6

6.4.4 Thruster use

Case 4 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	14.1	6.5	2.1	48.0	24.1	90.0	31.3	60.5
10.0	52.4	3.6	37.0	175.2	25.7	90.0	35.6	64.3
20.0	97.7	0.1	83.1	172.4	25.8	90.0	40.1	67.5
30.0	98.4	0.1	86.7	175.0	26.0	90.0	35.7	70.4
40.0	99.3	0.1	89.7	176.1	26.4	90.0	34.0	73.3
50.0	96.5	3.8	87.7	180.0	27.0	90.0	34.5	75.5
60.0	96.4	5.7	87.5	180.0	27.8	90.0	38.4	77.3
70.0	96.6	8.5	87.3	180.0	27.4	90.0	42.5	78.9
80.0	97.8	12.2	87.2	180.0	27.1	90.0	48.5	80.0
90.0	99.9	16.2	87.2	180.0	26.9	90.0	55.4	80.9
100.0	101.2	20.1	85.7	180.0	26.9	90.0	62.4	81.4
110.0	73.2	16.6	63.2	163.5	27.0	90.0	66.6	81.7
120.0	33.8	32.4	25.2	141.3	27.3	90.0	61.8	81.7
130.0	24.6	52.9	13.1	119.8	24.3	90.0	55.9	81.4
140.0	22.7	53.0	11.6	119.8	20.8	90.0	49.6	80.9
150.0	19.8	51.0	9.8	119.8	19.0	90.0	43.6	80.0
160.0	16.2	46.0	7.7	119.8	18.9	90.0	38.0	78.7
170.0	11.3	29.4	4.8	119.8	22.4	90.0	32.9	77.0
180.0	10.0	9.7	2.7	148.4	24.2	90.0	28.2	74.6
190.0	10.5	350.1	3.4	208.8	25.9	90.0	23.6	71.7
200.0	11.8	335.4	5.7	234.7	26.9	90.0	18.8	66.8
210.0	13.2	324.9	8.0	246.0	26.6	90.0	13.9	56.9
220.0	14.4	317.4	9.8	253.7	24.7	90.0	9.6	35.1
230.0	15.5	304.9	12.7	267.4	16.3	90.0	12.4	312.2
240.0	15.4	301.3	12.1	273.8	11.5	90.0	17.4	300.6
250.0	14.5	299.3	10.4	280.0	6.0	90.0	22.0	295.7
260.0	13.0	291.8	12.8	287.6	0.4	90.0	25.2	294.1
270.0	10.9	299.8	11.8	299.1	-4.5	90.0	26.6	294.7
280.0	8.5	300.8	10.8	314.5	-8.0	90.0	26.0	297.4
290.0	6.3	310.3	10.1	329.4	-9.9	90.0	23.6	302.7
300.0	3.9	338.6	10.0	351.3	-12.1	90.0	20.2	311.9
310.0	4.3	7.5	9.8	3.3	-10.3	90.0	16.8	327.0
320.0	7.7	29.5	8.7	24.6	-1.9	90.0	15.6	20.7
330.0	9.2	28.7	8.1	31.6	2.9	90.0	19.0	37.7
340.0	10.7	24.0	7.0	37.0	8.8	90.0	23.1	48.5
350.0	12.4	12.0	4.1	37.5	17.3	90.0	27.2	55.5
360.0	14.1	6.5	2.1	48.0	24.1	90.0	31.3	60.5

6.4.5 Thruster loss

Case 4 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.84	0.82
10.0	0.86	0.82	0.81
20.0	0.87	0.83	0.81
30.0	0.88	0.81	0.82
40.0	0.88	0.81	0.83
50.0	0.89	0.78	0.85
60.0	0.90	0.78	0.87
70.0	0.90	0.78	0.86
80.0	0.91	0.78	0.85
90.0	0.91	0.78	0.84
100.0	0.92	0.76	0.85
110.0	0.94	0.81	0.85
120.0	0.93	0.81	0.86
130.0	0.91	0.81	0.86
140.0	0.93	0.81	0.86
150.0	0.94	0.82	0.87
160.0	0.94	0.83	0.88
170.0	0.94	0.84	0.89
180.0	0.96	0.81	0.91
190.0	0.93	0.84	0.91
200.0	0.91	0.86	0.91
210.0	0.90	0.86	0.92
220.0	0.89	0.86	0.92
230.0	0.87	0.87	0.93
240.0	0.85	0.86	0.94
250.0	0.84	0.86	0.94
260.0	0.83	0.86	0.94
270.0	0.82	0.86	0.84
280.0	0.82	0.86	0.85
290.0	0.82	0.87	0.86
300.0	0.84	0.89	0.87
310.0	0.90	0.89	0.85
320.0	0.90	0.86	0.83
330.0	0.89	0.86	0.86
340.0	0.87	0.85	0.84
350.0	0.86	0.84	0.82
360.0	0.86	0.84	0.82

Preliminary Design, @IDR5

6.5 Case 5 - Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 4

6.5.1 Environment and thrust utilisation

Case 5 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	40.0	40.0	0.0	35.0	2.5	6.0	8.5	2.00	84.7
10.0	40.0	40.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	40.0	40.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	40.0	40.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	40.0	40.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	40.0	40.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	40.0	40.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	40.0	40.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	40.0	40.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	40.0	40.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	40.0	40.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	40.0	40.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	40.0	40.0	120.0	35.0	2.5	6.0	8.5	2.00	93.1
130.0	40.0	40.0	130.0	35.0	2.5	6.0	8.5	2.00	81.2
140.0	40.0	40.0	140.0	35.0	2.5	6.0	8.5	2.00	72.6
150.0	40.0	40.0	150.0	35.0	2.5	6.0	8.5	2.00	68.6
160.0	40.0	40.0	160.0	35.0	2.5	6.0	8.5	2.00	74.4
170.0	40.0	40.0	170.0	35.0	2.5	6.0	8.5	2.00	76.4
180.0	40.0	40.0	180.0	35.0	2.5	6.0	8.5	2.00	80.0
190.0	40.0	40.0	190.0	35.0	2.5	6.0	8.5	2.00	84.6
200.0	40.0	40.0	200.0	35.0	2.5	6.0	8.5	2.00	87.2
210.0	40.0	40.0	210.0	35.0	2.5	6.0	8.5	2.00	86.0
220.0	40.0	40.0	220.0	35.0	2.5	6.0	8.5	2.00	81.0
230.0	40.0	40.0	230.0	35.0	2.5	6.0	8.5	2.00	71.5
240.0	40.0	40.0	240.0	35.0	2.5	6.0	8.5	2.00	42.2
250.0	40.0	40.0	250.0	35.0	2.5	6.0	8.5	2.00	29.4
260.0	40.0	40.0	260.0	35.0	2.5	6.0	8.5	2.00	17.0
270.0	40.0	40.0	270.0	35.0	2.5	6.0	8.5	2.00	11.4
280.0	40.0	40.0	280.0	35.0	2.5	6.0	8.5	2.00	9.5
290.0	40.0	40.0	290.0	35.0	2.5	6.0	8.5	2.00	12.4
300.0	40.0	40.0	300.0	35.0	2.5	6.0	8.5	2.00	18.3
310.0	40.0	40.0	310.0	35.0	2.5	6.0	8.5	2.00	7.7
320.0	40.0	40.0	320.0	35.0	2.5	6.0	8.5	2.00	16.3
330.0	40.0	40.0	330.0	35.0	2.5	6.0	8.5	2.00	27.7
340.0	40.0	40.0	340.0	35.0	2.5	6.0	8.5	2.00	49.5
350.0	40.0	40.0	350.0	35.0	2.5	6.0	8.5	2.00	66.9
360.0	40.0	40.0	360.0	35.0	2.5	6.0	8.5	2.00	84.7

6.5.2 Relative contributions of force components

Case 5 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	62.3	18.9	3.3	0.0	15.5	100.0
10.0	56.2	17.1	12.8	0.0	13.9	100.0
20.0	50.9	15.4	21.1	0.0	12.6	100.0
30.0	46.0	13.9	28.8	0.0	11.3	100.0
40.0	41.6	12.5	35.6	0.0	10.2	100.0
50.0	37.9	11.4	41.5	0.0	9.3	100.0
60.0	34.9	10.4	46.2	0.0	8.5	100.0
70.0	32.7	9.8	49.5	0.0	8.0	100.0
80.0	31.4	9.4	51.6	0.0	7.6	100.0
90.0	31.0	9.2	52.2	0.0	7.5	100.0
100.0	31.4	9.4	51.6	0.0	7.6	100.0
110.0	32.7	9.7	49.6	0.0	7.9	100.0
120.0	34.9	10.4	46.2	0.0	8.5	100.0
130.0	38.1	11.3	41.4	0.0	9.2	100.0
140.0	42.1	12.5	35.2	0.0	10.2	100.0
150.0	46.9	14.0	27.7	0.0	11.1	100.0
160.0	52.4	15.7	19.1	0.0	12.3	100.0
170.0	58.7	17.6	9.4	0.0	14.3	100.0
180.0	66.1	19.8	-2.1	0.0	16.2	100.0
190.0	75.6	22.7	-16.9	0.0	18.5	100.0
200.0	89.0	26.8	-31.7	0.0	21.9	100.0
210.0	109.5	33.1	-69.7	0.0	27.1	100.0
220.0	142.0	33.1	-120.9	0.0	35.6	100.0
230.0	187.3	57.6	-189.3	0.0	47.4	100.0
240.0	-100.5	-25.5	177.9	0.0	48.1	100.0
250.0	-101.0	-27.3	189.8	0.0	38.5	100.0
260.0	-91.4	-25.1	183.7	0.0	32.7	100.0
270.0	-84.8	-23.2	177.5	0.0	30.5	100.0
280.0	-80.4	-21.7	171.4	0.0	30.7	100.0
290.0	-72.5	-18.8	158.9	0.0	32.4	100.0
300.0	-45.2	-9.7	122.7	0.0	32.2	100.0
310.0	116.1	37.4	-84.3	0.0	30.8	100.0
320.0	106.0	33.3	-66.6	0.0	27.4	100.0
330.0	91.0	28.2	-42.3	0.0	23.1	100.0
340.0	78.6	24.2	-22.6	0.0	19.8	100.0
350.0	69.4	21.2	-8.0	0.0	17.4	100.0
360.0	62.3	18.9	3.3	0.0	15.5	100.0

6.5.3 Environment forces

Case 5 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	-2.6	-3.6	0.0	-2.2	-15.1
10.0	-6.7	-2.6	-3.6	0.0	-2.2	-15.1
20.0	-6.7	-2.6	-3.5	0.0	-2.2	-15.0
30.0	-6.7	-2.6	-3.2	0.0	-2.2	-14.7
40.0	-6.7	-2.6	-2.8	0.0	-2.2	-14.3
50.0	-6.7	-2.6	-2.3	0.0	-2.2	-13.8
60.0	-6.7	-2.6	-1.6	0.0	-2.2	-13.2
70.0	-6.7	-2.6	-0.9	0.0	-2.2	-12.4
80.0	-6.7	-2.6	-0.1	0.0	-2.2	-11.6
90.0	-6.7	-2.6	0.7	0.0	-2.2	-10.8
100.0	-6.7	-2.6	1.5	0.0	-2.2	-10.0
110.0	-6.7	-2.6	2.3	0.0	-2.2	-9.3
120.0	-6.7	-2.6	3.0	0.0	-2.2	-8.6
130.0	-6.7	-2.6	3.5	0.0	-2.2	-8.0
140.0	-6.7	-2.6	4.0	0.0	-2.2	-7.6
150.0	-6.7	-2.6	4.3	0.0	-2.2	-7.3
160.0	-6.7	-2.6	4.4	0.0	-2.2	-7.1
170.0	-6.7	-2.6	4.4	0.0	-2.2	-7.1
180.0	-6.7	-2.6	4.3	0.0	-2.2	-7.2
190.0	-6.7	-2.6	4.4	0.0	-2.2	-7.1
200.0	-6.7	-2.6	4.4	0.0	-2.2	-7.1
210.0	-6.7	-2.6	4.3	0.0	-2.2	-7.3
220.0	-6.7	-2.6	4.0	0.0	-2.2	-7.6
230.0	-6.7	-2.6	3.5	0.0	-2.2	-8.0
240.0	-6.7	-2.6	3.0	0.0	-2.2	-8.6
250.0	-6.7	-2.6	2.3	0.0	-2.2	-9.3
260.0	-6.7	-2.6	1.5	0.0	-2.2	-10.0
270.0	-6.7	-2.6	0.7	0.0	-2.2	-10.8
280.0	-6.7	-2.6	-0.1	0.0	-2.2	-11.6
290.0	-6.7	-2.6	-0.9	0.0	-2.2	-12.4
300.0	-6.7	-2.6	-1.6	0.0	-2.2	-13.2
310.0	-6.7	-2.6	-2.3	0.0	-2.2	-13.8
320.0	-6.7	-2.6	-2.8	0.0	-2.2	-14.3
330.0	-6.7	-2.6	-3.2	0.0	-2.2	-14.7
340.0	-6.7	-2.6	-3.5	0.0	-2.2	-15.0
350.0	-6.7	-2.6	-3.6	0.0	-2.2	-15.1
360.0	-6.7	-2.6	-3.6	0.0	-2.2	-15.1

Case 5 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-24.5	-7.2	0.0	0.0	-5.9	-37.7
10.0	-24.5	-7.2	-4.8	0.0	-5.9	-42.5
20.0	-24.5	-7.2	-10.0	0.0	-5.9	-47.7
30.0	-24.5	-7.2	-15.6	0.0	-5.9	-53.3
40.0	-24.5	-7.2	-21.7	0.0	-5.9	-59.4
50.0	-24.5	-7.2	-28.0	0.0	-5.9	-65.7
60.0	-24.5	-7.2	-33.8	0.0	-5.9	-71.5
70.0	-24.5	-7.2	-38.7	0.0	-5.9	-76.3
80.0	-24.5	-7.2	-41.9	0.0	-5.9	-79.5
90.0	-24.5	-7.2	-43.0	0.0	-5.9	-80.7
100.0	-24.5	-7.2	-41.9	0.0	-5.9	-79.5
110.0	-24.5	-7.2	-38.7	0.0	-5.9	-76.3
120.0	-24.5	-7.2	-33.8	0.0	-5.9	-71.5
130.0	-24.5	-7.2	-28.0	0.0	-5.9	-65.7
140.0	-24.5	-7.2	-21.7	0.0	-5.9	-59.4
150.0	-24.5	-7.2	-15.6	0.0	-5.9	-53.3
160.0	-24.5	-7.2	-10.0	0.0	-5.9	-47.7
170.0	-24.5	-7.2	-4.8	0.0	-5.9	-42.5
180.0	-24.5	-7.2	0.0	0.0	-5.9	-37.7
190.0	-24.5	-7.2	4.8	0.0	-5.9	-32.8
200.0	-24.5	-7.2	10.0	0.0	-5.9	-27.7
210.0	-24.5	-7.2	15.6	0.0	-5.9	-22.0
220.0	-24.5	-7.2	21.7	0.0	-5.9	-15.9
230.0	-24.5	-7.2	28.0	0.0	-5.9	-9.7
240.0	-24.5	-7.2	33.8	0.0	5.9	8.0
250.0	-24.5	-7.2	38.7	0.0	5.9	12.8
260.0	-24.5	-7.2	41.9	0.0	5.9	16.0
270.0	-24.5	-7.2	43.0	0.0	5.9	17.1
280.0	-24.5	-7.2	41.9	0.0	5.9	16.0
290.0	-24.5	-7.2	38.7	0.0	5.9	12.8
300.0	-24.5	-7.2	33.8	0.0	5.9	8.0
310.0	-24.5	-7.2	28.0	0.0	-5.9	-9.7
320.0	-24.5	-7.2	21.7	0.0	-5.9	-15.9
330.0	-24.5	-7.2	15.6	0.0	-5.9	-22.0
340.0	-24.5	-7.2	10.0	0.0	-5.9	-27.7
350.0	-24.5	-7.2	4.8	0.0	-5.9	-32.8
360.0	-24.5	-7.2	0.0	0.0	-5.9	-37.7

Case 5 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-601.9	-87.7	0.0	0.0	-102.8	-792.4
10.0	-601.9	-87.7	-316.6	0.0	-102.8	-1109.0
20.0	-601.9	-87.7	-593.0	0.0	-102.8	-1385.4
30.0	-601.9	-87.7	-793.7	0.0	-102.8	-1586.1
40.0	-601.9	-87.7	-892.8	0.0	-102.8	-1685.2
50.0	-601.9	-87.7	-876.4	0.0	-102.8	-1668.8
60.0	-601.9	-87.7	-745.2	0.0	-102.8	-1537.6
70.0	-601.9	-87.7	-513.8	0.0	-102.8	-1306.2
80.0	-601.9	-87.7	-209.2	0.0	-102.8	-1001.6
90.0	-601.9	-87.7	132.4	0.0	-102.8	-660.0
100.0	-601.9	-87.7	470.0	0.0	-102.8	-322.4
110.0	-601.9	-87.7	762.6	0.0	102.8	175.7
120.0	-601.9	-87.7	974.5	0.0	102.8	387.6
130.0	-601.9	-87.7	1079.2	0.0	102.8	482.4
140.0	-601.9	-87.7	1063.0	0.0	102.8	475.1
150.0	-601.9	-87.7	926.1	0.0	102.8	339.2
160.0	-601.9	-87.7	683.5	0.0	-102.8	-108.9
170.0	-601.9	-87.7	362.6	0.0	-102.8	-429.8
180.0	-601.9	-87.7	0.0	0.0	-102.8	-792.4
190.0	-601.9	-87.7	-362.6	0.0	-102.8	-1155.0
200.0	-601.9	-87.7	-683.5	0.0	-102.8	-1475.9
210.0	-601.9	-87.7	-926.1	0.0	-102.8	-1718.5
220.0	-601.9	-87.7	-1063.0	0.0	-102.8	-1855.4
230.0	-601.9	-87.7	-1079.2	0.0	-102.8	-1871.6
240.0	-601.9	-87.7	-974.5	0.0	-102.8	-1766.9
250.0	-601.9	-87.7	-762.6	0.0	-102.8	-1555.0
260.0	-601.9	-87.7	-470.0	0.0	-102.8	-1262.4
270.0	-601.9	-87.7	-132.4	0.0	-102.8	-924.8
280.0	-601.9	-87.7	209.2	0.0	-102.8	-583.2
290.0	-601.9	-87.7	513.8	0.0	-102.8	-278.6
300.0	-601.9	-87.7	745.2	0.0	102.8	158.3
310.0	-601.9	-87.7	876.4	0.0	102.8	289.5
320.0	-601.9	-87.7	892.8	0.0	102.8	305.9
330.0	-601.9	-87.7	793.7	0.0	102.8	206.8
340.0	-601.9	-87.7	593.0	0.0	-102.8	-199.4
350.0	-601.9	-87.7	316.6	0.0	-102.8	-475.8
360.0	-601.9	-87.7	0.0	0.0	-102.8	-792.4

6.5.4 Thruster use

Case 5 thruster use: Thrusters 1 to 3									
Dir	Thruster 1		Thruster 2		Thruster 3		Total		
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	
0.0	58.1	5.9	43.1	172.3	26.0	90.0	40.6	68.1	
10.0	97.3	0.1	84.0	170.5	25.7	90.0	42.3	70.1	
20.0	97.7	0.1	87.1	174.4	25.8	90.0	36.2	72.2	
30.0	98.4	0.1	89.9	176.9	26.0	90.0	32.2	74.5	
40.0	95.0	1.5	87.9	180.0	26.4	90.0	29.8	76.2	
50.0	94.2	1.9	87.7	180.0	27.0	90.0	30.8	77.9	
60.0	94.1	3.9	87.5	180.0	27.8	90.0	34.8	79.4	
70.0	94.3	6.7	87.3	180.0	27.4	90.0	39.0	80.6	
80.0	95.5	10.5	87.2	180.0	27.1	90.0	45.0	81.5	
90.0	97.4	14.6	87.2	180.0	26.9	90.0	51.9	82.2	
100.0	98.4	18.7	85.7	180.0	26.9	90.0	59.0	82.7	
110.0	101.9	24.4	84.3	180.0	27.0	90.0	69.7	83.0	
120.0	85.5	16.3	76.2	164.6	27.3	90.0	72.0	83.2	
130.0	51.6	23.7	43.1	155.8	27.3	90.0	66.1	83.0	
140.0	27.3	39.0	20.2	132.5	27.4	90.0	59.9	82.7	
150.0	21.0	51.0	12.0	119.8	26.6	90.0	53.8	82.2	
160.0	22.9	27.6	16.0	145.5	28.0	90.0	48.2	81.5	
170.0	25.5	17.6	18.3	159.6	28.4	90.0	43.1	80.5	
180.0	33.6	8.4	26.3	171.6	28.9	90.0	38.1	79.1	
190.0	45.6	2.8	38.5	177.5	28.9	90.0	33.6	77.8	
200.0	52.7	359.2	45.6	180.7	29.0	90.0	28.6	75.6	
210.0	50.1	355.5	42.8	184.2	29.1	90.0	23.2	71.7	
220.0	35.8	348.4	28.2	192.7	29.3	90.0	17.6	64.6	
230.0	15.3	319.6	10.2	245.9	29.1	90.0	12.6	50.4	
240.0	15.7	306.0	12.7	267.2	17.4	90.0	11.7	317.2	
250.0	14.7	303.3	12.5	274.9	11.9	90.0	15.8	305.9	
260.0	13.2	302.1	11.7	284.0	6.4	90.0	18.9	302.1	
270.0	11.1	304.7	10.5	295.4	1.5	90.0	20.2	302.4	
280.0	8.3	309.9	9.3	310.1	-2.1	90.0	19.8	306.1	
290.0	6.9	321.6	8.4	327.5	-4.0	90.0	17.8	314.2	
300.0	4.9	352.4	8.3	355.4	-6.6	90.0	15.4	328.9	
310.0	8.3	28.1	7.5	29.8	2.1	90.0	16.9	35.0	
320.0	9.9	32.4	7.9	40.3	5.5	90.0	21.4	48.0	
330.0	11.4	31.3	7.7	48.9	10.4	90.0	26.5	56.2	
340.0	12.9	20.3	5.3	56.9	18.8	90.0	31.5	61.5	
350.0	13.9	17.6	3.8	60.2	25.3	90.0	36.2	65.2	
360.0	58.1	5.9	43.1	172.3	26.0	90.0	40.6	68.1	

6.5.5 Thruster loss

Case 5 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.83	0.82
10.0	0.87	0.84	0.81
20.0	0.87	0.82	0.81
30.0	0.88	0.80	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.90	0.78	0.87
70.0	0.91	0.78	0.86
80.0	0.91	0.78	0.85
90.0	0.92	0.78	0.84
100.0	0.93	0.76	0.85
110.0	0.93	0.75	0.85
120.0	0.94	0.80	0.86
130.0	0.94	0.80	0.86
140.0	0.94	0.81	0.86
150.0	0.94	0.82	0.87
160.0	0.94	0.81	0.88
170.0	0.95	0.79	0.89
180.0	0.96	0.75	0.91
190.0	0.96	0.72	0.91
200.0	0.96	0.72	0.91
210.0	0.95	0.74	0.92
220.0	0.92	0.80	0.92
230.0	0.89	0.85	0.93
240.0	0.86	0.86	0.94
250.0	0.84	0.86	0.94
260.0	0.83	0.86	0.94
270.0	0.82	0.86	0.94
280.0	0.82	0.86	0.85
290.0	0.82	0.87	0.86
300.0	0.88	0.90	0.87
310.0	0.92	0.88	0.92
320.0	0.91	0.88	0.89
330.0	0.89	0.87	0.86
340.0	0.87	0.87	0.84
350.0	0.86	0.86	0.82
360.0	0.86	0.83	0.82

Preliminary Design, @IDR5

6.6 Case 6 - Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 4

6.6.1 Environment and thrust utilisation

Case 6 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	50.0	50.0	0.0	35.0	2.5	6.0	8.5	2.00	97.5
10.0	50.0	50.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	50.0	50.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	50.0	50.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	50.0	50.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	50.0	50.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	50.0	50.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	50.0	50.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	50.0	50.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	50.0	50.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	50.0	50.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	50.0	50.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	50.0	50.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	50.0	50.0	130.0	35.0	2.5	6.0	8.5	2.00	94.8
140.0	50.0	50.0	140.0	35.0	2.5	6.0	8.5	2.00	86.6
150.0	50.0	50.0	150.0	35.0	2.5	6.0	8.5	2.00	81.7
160.0	50.0	50.0	160.0	35.0	2.5	6.0	8.5	2.00	87.8
170.0	50.0	50.0	170.0	35.0	2.5	6.0	8.5	2.00	89.6
180.0	50.0	50.0	180.0	35.0	2.5	6.0	8.5	2.00	93.0
190.0	50.0	50.0	190.0	35.0	2.5	6.0	8.5	2.00	97.6
200.0	50.0	50.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	50.0	50.0	210.0	35.0	2.5	6.0	8.5	2.00	99.2
220.0	50.0	50.0	220.0	35.0	2.5	6.0	8.5	2.00	93.7
230.0	50.0	50.0	230.0	35.0	2.5	6.0	8.5	2.00	84.0
240.0	50.0	50.0	240.0	35.0	2.5	6.0	8.5	2.00	71.6
250.0	50.0	50.0	250.0	35.0	2.5	6.0	8.5	2.00	37.0
260.0	50.0	50.0	260.0	35.0	2.5	6.0	8.5	2.00	24.4
270.0	50.0	50.0	270.0	35.0	2.5	6.0	8.5	2.00	13.4
280.0	50.0	50.0	280.0	35.0	2.5	6.0	8.5	2.00	8.5
290.0	50.0	50.0	290.0	35.0	2.5	6.0	8.5	2.00	6.9
300.0	50.0	50.0	300.0	35.0	2.5	6.0	8.5	2.00	13.8
310.0	50.0	50.0	310.0	35.0	2.5	6.0	8.5	2.00	18.4
320.0	50.0	50.0	320.0	35.0	2.5	6.0	8.5	2.00	27.1
330.0	50.0	50.0	330.0	35.0	2.5	6.0	8.5	2.00	39.7
340.0	50.0	50.0	340.0	35.0	2.5	6.0	8.5	2.00	62.1
350.0	50.0	50.0	350.0	35.0	2.5	6.0	8.5	2.00	79.6
360.0	50.0	50.0	360.0	35.0	2.5	6.0	8.5	2.00	97.5

6.6.2 Relative contributions of force components

Case 6 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	61.9	19.9	2.2	0.0	16.0	100.0
10.0	56.6	18.2	10.7	0.0	14.6	100.0
20.0	51.8	16.6	18.3	0.0	13.3	100.0
30.0	47.4	15.1	25.4	0.0	12.1	100.0
40.0	43.3	13.8	31.8	0.0	11.1	100.0
50.0	39.8	12.7	37.4	0.0	10.2	100.0
60.0	37.0	11.7	41.9	0.0	9.4	100.0
70.0	34.9	11.1	45.1	0.0	8.9	100.0
80.0	33.7	10.7	47.1	0.0	8.5	100.0
90.0	33.3	10.5	47.8	0.0	8.4	100.0
100.0	33.7	10.7	47.1	0.0	8.5	100.0
110.0	35.0	11.1	45.1	0.0	8.9	100.0
120.0	37.1	11.7	41.8	0.0	9.4	100.0
130.0	40.0	12.7	37.2	0.0	10.1	100.0
140.0	43.7	13.8	31.4	0.0	11.1	100.0
150.0	48.1	15.2	24.5	0.0	12.2	100.0
160.0	53.0	16.8	16.9	0.0	13.4	100.0
170.0	58.3	18.5	8.4	0.0	14.8	100.0
180.0	64.4	20.4	-1.2	0.0	16.4	100.0
190.0	72.0	22.9	-13.1	0.0	18.3	100.0
200.0	82.1	26.1	-23.2	0.0	20.9	100.0
210.0	96.9	30.9	-52.5	0.0	24.8	100.0
220.0	119.4	38.1	-88.5	0.0	30.7	100.0
230.0	150.6	49.8	-143.4	0.0	40.0	100.0
240.0	197.1	65.2	-214.6	0.0	52.3	100.0
250.0	-141.3	-38.3	220.6	0.0	58.9	100.0
260.0	-135.1	-38.1	223.1	0.0	50.2	100.0
270.0	-124.0	-35.1	213.2	0.0	45.8	100.0
280.0	-112.4	-31.0	198.6	0.0	44.8	100.0
290.0	-84.9	-21.0	162.8	0.0	43.1	100.0
300.0	144.6	49.1	-133.2	0.0	39.5	100.0
310.0	123.8	41.2	-98.1	0.0	33.1	100.0
320.0	103.3	33.9	-64.4	0.0	27.2	100.0
330.0	87.6	28.6	-39.1	0.0	22.9	100.0
340.0	76.3	24.8	-21.0	0.0	19.9	100.0
350.0	68.2	22.0	-7.9	0.0	17.7	100.0
360.0	61.9	19.9	2.2	0.0	16.0	100.0

6.6.3 Environment forces

Case 6 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.6	-2.7	-3.6	0.0	-2.2	-14.1
10.0	-5.6	-2.7	-3.6	0.0	-2.2	-14.1
20.0	-5.6	-2.7	-3.5	0.0	-2.2	-13.9
30.0	-5.6	-2.7	-3.2	0.0	-2.2	-13.7
40.0	-5.6	-2.7	-2.8	0.0	-2.2	-13.3
50.0	-5.6	-2.7	-2.3	0.0	-2.2	-12.7
60.0	-5.6	-2.7	-1.6	0.0	-2.2	-12.1
70.0	-5.6	-2.7	-0.9	0.0	-2.2	-11.4
80.0	-5.6	-2.7	-0.1	0.0	-2.2	-10.6
90.0	-5.6	-2.7	0.7	0.0	-2.2	-9.7
100.0	-5.6	-2.7	1.5	0.0	-2.2	-8.9
110.0	-5.6	-2.7	2.3	0.0	-2.2	-8.2
120.0	-5.6	-2.7	3.0	0.0	-2.2	-7.5
130.0	-5.6	-2.7	3.5	0.0	-2.2	-6.9
140.0	-5.6	-2.7	4.0	0.0	-2.2	-6.5
150.0	-5.6	-2.7	4.3	0.0	-2.2	-6.2
160.0	-5.6	-2.7	4.4	0.0	-2.2	-6.0
170.0	-5.6	-2.7	4.4	0.0	-2.2	-6.0
180.0	-5.6	-2.7	4.3	0.0	-2.2	-6.2
190.0	-5.6	-2.7	4.4	0.0	-2.2	-6.0
200.0	-5.6	-2.7	4.4	0.0	-2.2	-6.0
210.0	-5.6	-2.7	4.3	0.0	-2.2	-6.2
220.0	-5.6	-2.7	4.0	0.0	-2.2	-6.5
230.0	-5.6	-2.7	3.5	0.0	-2.2	-6.9
240.0	-5.6	-2.7	3.0	0.0	-2.2	-7.5
250.0	-5.6	-2.7	2.3	0.0	-2.2	-8.2
260.0	-5.6	-2.7	1.5	0.0	-2.2	-8.9
270.0	-5.6	-2.7	0.7	0.0	-2.2	-9.7
280.0	-5.6	-2.7	-0.1	0.0	-2.2	-10.6
290.0	-5.6	-2.7	-0.9	0.0	-2.2	-11.4
300.0	-5.6	-2.7	-1.6	0.0	-2.2	-12.1
310.0	-5.6	-2.7	-2.3	0.0	-2.2	-12.7
320.0	-5.6	-2.7	-2.8	0.0	-2.2	-13.3
330.0	-5.6	-2.7	-3.2	0.0	-2.2	-13.7
340.0	-5.6	-2.7	-3.5	0.0	-2.2	-13.9
350.0	-5.6	-2.7	-3.6	0.0	-2.2	-14.1
360.0	-5.6	-2.7	-3.6	0.0	-2.2	-14.1

Case 6 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.3	-9.2	0.0	0.0	-7.3	-45.7
10.0	-29.3	-9.2	-4.8	0.0	-7.3	-50.6
20.0	-29.3	-9.2	-10.0	0.0	-7.3	-55.7
30.0	-29.3	-9.2	-15.6	0.0	-7.3	-61.4
40.0	-29.3	-9.2	-21.7	0.0	-7.3	-67.5
50.0	-29.3	-9.2	-28.0	0.0	-7.3	-73.7
60.0	-29.3	-9.2	-33.8	0.0	-7.3	-79.6
70.0	-29.3	-9.2	-38.7	0.0	-7.3	-84.4
80.0	-29.3	-9.2	-41.9	0.0	-7.3	-87.6
90.0	-29.3	-9.2	-43.0	0.0	-7.3	-88.7
100.0	-29.3	-9.2	-41.9	0.0	-7.3	-87.6
110.0	-29.3	-9.2	-38.7	0.0	-7.3	-84.4
120.0	-29.3	-9.2	-33.8	0.0	-7.3	-79.6
130.0	-29.3	-9.2	-28.0	0.0	-7.3	-73.7
140.0	-29.3	-9.2	-21.7	0.0	-7.3	-67.5
150.0	-29.3	-9.2	-15.6	0.0	-7.3	-61.4
160.0	-29.3	-9.2	-10.0	0.0	-7.3	-55.7
170.0	-29.3	-9.2	-4.8	0.0	-7.3	-50.6
180.0	-29.3	-9.2	0.0	0.0	-7.3	-45.7
190.0	-29.3	-9.2	4.8	0.0	-7.3	-40.9
200.0	-29.3	-9.2	10.0	0.0	-7.3	-35.8
210.0	-29.3	-9.2	15.6	0.0	-7.3	-30.1
220.0	-29.3	-9.2	21.7	0.0	-7.3	-24.0
230.0	-29.3	-9.2	28.0	0.0	-7.3	-17.8
240.0	-29.3	-9.2	33.8	0.0	-7.3	-11.9
250.0	-29.3	-9.2	38.7	0.0	7.3	7.6
260.0	-29.3	-9.2	41.9	0.0	7.3	10.8
270.0	-29.3	-9.2	43.0	0.0	7.3	11.9
280.0	-29.3	-9.2	41.9	0.0	7.3	10.8
290.0	-29.3	-9.2	38.7	0.0	7.3	7.6
300.0	-29.3	-9.2	33.8	0.0	-7.3	-11.9
310.0	-29.3	-9.2	28.0	0.0	-7.3	-17.8
320.0	-29.3	-9.2	21.7	0.0	-7.3	-24.0
330.0	-29.3	-9.2	15.6	0.0	-7.3	-30.1
340.0	-29.3	-9.2	10.0	0.0	-7.3	-35.8
350.0	-29.3	-9.2	4.8	0.0	-7.3	-40.9
360.0	-29.3	-9.2	0.0	0.0	-7.3	-45.7

Case 6 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-615.1	-98.9	0.0	0.0	-107.4	-821.4
10.0	-615.1	-98.9	-316.6	0.0	-107.4	-1138.0
20.0	-615.1	-98.9	-593.0	0.0	-107.4	-1414.3
30.0	-615.1	-98.9	-793.7	0.0	-107.4	-1615.0
40.0	-615.1	-98.9	-892.8	0.0	-107.4	-1714.1
50.0	-615.1	-98.9	-876.4	0.0	-107.4	-1697.8
60.0	-615.1	-98.9	-745.2	0.0	-107.4	-1566.6
70.0	-615.1	-98.9	-513.8	0.0	-107.4	-1335.2
80.0	-615.1	-98.9	-209.2	0.0	-107.4	-1030.6
90.0	-615.1	-98.9	132.4	0.0	-107.4	-689.0
100.0	-615.1	-98.9	470.0	0.0	-107.4	-351.4
110.0	-615.1	-98.9	762.6	0.0	107.4	156.0
120.0	-615.1	-98.9	974.5	0.0	107.4	367.9
130.0	-615.1	-98.9	1079.2	0.0	107.4	472.6
140.0	-615.1	-98.9	1063.0	0.0	107.4	455.3
150.0	-615.1	-98.9	926.1	0.0	107.4	319.4
160.0	-615.1	-98.9	683.5	0.0	-107.4	-137.8
170.0	-615.1	-98.9	362.6	0.0	-107.4	-458.8
180.0	-615.1	-98.9	0.0	0.0	-107.4	-821.4
190.0	-615.1	-98.9	-362.6	0.0	-107.4	-1183.9
200.0	-615.1	-98.9	-683.5	0.0	-107.4	-1504.9
210.0	-615.1	-98.9	-926.1	0.0	-107.4	-1747.4
220.0	-615.1	-98.9	-1063.0	0.0	-107.4	-1884.3
230.0	-615.1	-98.9	-1079.2	0.0	-107.4	-1900.6
240.0	-615.1	-98.9	-974.5	0.0	-107.4	-1795.9
250.0	-615.1	-98.9	-762.6	0.0	-107.4	-1584.0
260.0	-615.1	-98.9	-470.0	0.0	-107.4	-1291.3
270.0	-615.1	-98.9	-132.4	0.0	-107.4	-953.7
280.0	-615.1	-98.9	209.2	0.0	-107.4	-612.1
290.0	-615.1	-98.9	513.8	0.0	-107.4	-307.5
300.0	-615.1	-98.9	745.2	0.0	107.4	138.6
310.0	-615.1	-98.9	876.4	0.0	107.4	269.8
320.0	-615.1	-98.9	892.8	0.0	107.4	286.1
330.0	-615.1	-98.9	793.7	0.0	107.4	187.0
340.0	-615.1	-98.9	593.0	0.0	-107.4	-228.4
350.0	-615.1	-98.9	316.6	0.0	-107.4	-504.7
360.0	-615.1	-98.9	0.0	0.0	-107.4	-821.4

6.6.4 Thruster use

Case 6 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	94.8	6.1	80.8	173.1	26.0	90.0	47.9	72.9
10.0	97.3	0.1	87.2	171.0	25.7	90.0	41.1	74.2
20.0	97.7	0.1	89.4	174.7	25.8	90.0	35.2	75.8
30.0	94.9	2.2	88.1	180.0	26.0	90.0	30.5	77.3
40.0	93.5	1.1	87.9	180.0	26.4	90.0	28.7	78.7
50.0	92.8	1.4	87.7	180.0	27.0	90.0	29.8	80.1
60.0	92.8	3.5	87.5	180.0	27.8	90.0	33.8	81.2
70.0	93.0	6.4	87.3	180.0	27.4	90.0	38.1	82.2
80.0	94.1	10.2	87.2	180.0	27.1	90.0	44.1	83.0
90.0	95.9	14.4	87.2	180.0	26.9	90.0	51.0	83.6
100.0	96.7	18.6	85.7	180.0	26.9	90.0	58.0	84.1
110.0	100.0	24.5	84.3	180.0	27.0	90.0	68.9	84.3
120.0	101.0	27.0	83.0	180.0	27.3	90.0	73.5	84.5
130.0	86.6	17.0	78.8	164.4	27.3	90.0	74.1	84.6
140.0	60.8	21.0	53.5	160.0	27.4	90.0	67.8	84.5
150.0	45.5	23.8	38.7	156.5	27.6	90.0	61.7	84.2
160.0	58.8	15.1	52.2	166.2	28.0	90.0	56.1	83.8
170.0	61.9	11.5	55.5	169.8	28.4	90.0	50.9	83.2
180.0	70.3	7.7	63.9	173.4	28.9	90.0	46.2	82.3
190.0	82.3	4.7	76.1	176.1	28.9	90.0	41.4	81.6
200.0	85.9	3.9	79.7	179.9	29.0	90.0	35.5	80.3
210.0	86.3	0.4	80.1	179.7	29.1	90.0	30.7	78.4
220.0	71.5	357.6	65.0	182.0	29.3	90.0	24.9	74.9
230.0	45.1	351.8	38.5	185.2	29.6	90.0	19.1	68.7
240.0	14.4	321.6	9.1	246.4	29.5	90.0	14.1	57.8
250.0	14.2	306.3	7.5	269.0	15.4	90.0	11.2	317.1
260.0	12.6	307.9	10.5	278.5	9.8	90.0	14.0	309.7
270.0	10.5	308.2	9.2	290.7	4.9	90.0	15.4	309.3
280.0	8.4	314.9	7.7	307.0	1.3	90.0	15.1	314.4
290.0	6.6	328.8	6.7	328.0	-0.6	90.0	13.7	326.2
300.0	7.9	25.2	5.9	33.6	5.3	90.0	17.0	44.6
310.0	9.6	34.7	7.2	47.2	7.1	90.0	21.9	54.4
320.0	11.2	37.4	7.9	57.0	10.5	90.0	27.4	61.1
330.0	12.4	38.6	8.0	60.2	15.4	90.0	33.1	65.6
340.0	13.1	31.5	5.6	60.2	24.1	90.0	38.4	68.7
350.0	44.3	9.6	30.5	166.0	26.2	90.0	43.3	71.0
360.0	94.8	6.1	80.8	173.1	26.0	90.0	47.9	72.9

6.6.5 Thruster loss

Case 6 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.83	0.82
10.0	0.87	0.84	0.81
20.0	0.87	0.82	0.81
30.0	0.87	0.79	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.90	0.78	0.87
70.0	0.91	0.78	0.86
80.0	0.91	0.78	0.85
90.0	0.92	0.78	0.84
100.0	0.93	0.76	0.85
110.0	0.93	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.79	0.86
140.0	0.94	0.79	0.86
150.0	0.94	0.79	0.87
160.0	0.95	0.77	0.88
170.0	0.95	0.76	0.89
180.0	0.96	0.74	0.91
190.0	0.96	0.73	0.91
200.0	0.96	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.95	0.74	0.92
230.0	0.93	0.73	0.93
240.0	0.88	0.85	0.94
250.0	0.84	0.85	0.94
260.0	0.83	0.85	0.94
270.0	0.83	0.85	0.94
280.0	0.82	0.86	0.95
290.0	0.83	0.87	0.86
300.0	0.93	0.90	0.96
310.0	0.93	0.89	0.92
320.0	0.92	0.89	0.89
330.0	0.90	0.89	0.86
340.0	0.88	0.88	0.84
350.0	0.86	0.86	0.82
360.0	0.86	0.83	0.82

Preliminary Design, @IDR5

6.7 Case 7 - Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 4

6.7.1 Environment and thrust utilisation

Case 7 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	60.0	60.0	0.0	35.0	2.5	6.0	8.5	2.00	> 100.0
10.0	60.0	60.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	60.0	60.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	60.0	60.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	60.0	60.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	60.0	60.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	60.0	60.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	60.0	60.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	60.0	60.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	60.0	60.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	60.0	60.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	60.0	60.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	60.0	60.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	60.0	60.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	60.0	60.0	140.0	35.0	2.5	6.0	8.5	2.00	92.0
150.0	60.0	60.0	150.0	35.0	2.5	6.0	8.5	2.00	87.0
160.0	60.0	60.0	160.0	35.0	2.5	6.0	8.5	2.00	85.9
170.0	60.0	60.0	170.0	35.0	2.5	6.0	8.5	2.00	94.3
180.0	60.0	60.0	180.0	35.0	2.5	6.0	8.5	2.00	97.6
190.0	60.0	60.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	60.0	60.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	60.0	60.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	60.0	60.0	220.0	35.0	2.5	6.0	8.5	2.00	98.2
230.0	60.0	60.0	230.0	35.0	2.5	6.0	8.5	2.00	88.6
240.0	60.0	60.0	240.0	35.0	2.5	6.0	8.5	2.00	75.7
250.0	60.0	60.0	250.0	35.0	2.5	6.0	8.5	2.00	62.2
260.0	60.0	60.0	260.0	35.0	2.5	6.0	8.5	2.00	48.0
270.0	60.0	60.0	270.0	35.0	2.5	6.0	8.5	2.00	13.9
280.0	60.0	60.0	280.0	35.0	2.5	6.0	8.5	2.00	27.9
290.0	60.0	60.0	290.0	35.0	2.5	6.0	8.5	2.00	23.5
300.0	60.0	60.0	300.0	35.0	2.5	6.0	8.5	2.00	17.7
310.0	60.0	60.0	310.0	35.0	2.5	6.0	8.5	2.00	22.5
320.0	60.0	60.0	320.0	35.0	2.5	6.0	8.5	2.00	31.6
330.0	60.0	60.0	330.0	35.0	2.5	6.0	8.5	2.00	44.1
340.0	60.0	60.0	340.0	35.0	2.5	6.0	8.5	2.00	66.0
350.0	60.0	60.0	350.0	35.0	2.5	6.0	8.5	2.00	83.7
360.0	60.0	60.0	360.0	35.0	2.5	6.0	8.5	2.00	> 100.0

6.7.2 Relative contributions of force components

Case 7 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	59.8	21.7	1.7	0.0	16.8	100.0
10.0	55.0	19.9	9.7	0.0	15.4	100.0
20.0	50.6	18.3	17.0	0.0	14.1	100.0
30.0	46.5	16.8	23.8	0.0	13.0	100.0
40.0	42.8	15.4	30.0	0.0	11.9	100.0
50.0	39.5	14.2	35.4	0.0	11.0	100.0
60.0	36.8	13.2	39.8	0.0	10.2	100.0
70.0	34.9	12.5	43.0	0.0	9.6	100.0
80.0	33.7	12.0	45.0	0.0	9.3	100.0
90.0	33.3	11.9	45.6	0.0	9.2	100.0
100.0	33.7	12.0	45.0	0.0	9.3	100.0
110.0	34.9	12.4	43.0	0.0	9.6	100.0
120.0	36.9	13.1	39.7	0.0	10.2	100.0
130.0	39.7	14.1	35.2	0.0	10.9	100.0
140.0	43.1	15.4	29.6	0.0	11.9	100.0
150.0	47.1	16.8	23.1	0.0	13.0	100.0
160.0	51.5	18.3	15.9	0.0	14.2	100.0
170.0	56.3	20.1	8.1	0.0	15.5	100.0
180.0	61.7	22.0	-0.8	0.0	17.0	100.0
190.0	68.2	24.4	-11.4	0.0	18.9	100.0
200.0	76.9	27.5	-23.6	0.0	21.3	100.0
210.0	89.1	31.9	-45.3	0.0	24.7	100.0
220.0	107.4	38.1	-76.0	0.0	29.9	100.0
230.0	133.0	48.9	-121.7	0.0	37.9	100.0
240.0	171.9	63.8	-187.1	0.0	49.4	100.0
250.0	216.0	80.8	-259.3	0.0	62.5	100.0
260.0	232.6	89.3	-291.1	0.0	69.2	100.0
270.0	-166.7	-52.5	257.1	0.0	62.1	100.0
280.0	196.8	76.7	-232.9	0.0	59.4	100.0
290.0	173.5	66.5	-191.4	0.0	51.5	100.0
300.0	144.8	54.5	-141.6	0.0	42.2	100.0
310.0	118.2	43.9	-96.2	0.0	34.0	100.0
320.0	97.8	36.0	-61.7	0.0	27.9	100.0
330.0	83.2	30.5	-37.3	0.0	23.6	100.0
340.0	73.0	26.6	-20.2	0.0	20.6	100.0
350.0	65.6	23.8	-7.9	0.0	18.5	100.0
360.0	59.8	21.7	1.7	0.0	16.8	100.0

6.7.3 Environment forces

Case 7 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-4.1	-2.7	-3.6	0.0	-2.1	-12.5
10.0	-4.1	-2.7	-3.6	0.0	-2.1	-12.5
20.0	-4.1	-2.7	-3.5	0.0	-2.1	-12.3
30.0	-4.1	-2.7	-3.2	0.0	-2.1	-12.1
40.0	-4.1	-2.7	-2.8	0.0	-2.1	-11.7
50.0	-4.1	-2.7	-2.3	0.0	-2.1	-11.1
60.0	-4.1	-2.7	-1.6	0.0	-2.1	-10.5
70.0	-4.1	-2.7	-0.9	0.0	-2.1	-9.7
80.0	-4.1	-2.7	-0.1	0.0	-2.1	-9.0
90.0	-4.1	-2.7	0.7	0.0	-2.1	-8.1
100.0	-4.1	-2.7	1.5	0.0	-2.1	-7.3
110.0	-4.1	-2.7	2.3	0.0	-2.1	-6.6
120.0	-4.1	-2.7	3.0	0.0	-2.1	-5.9
130.0	-4.1	-2.7	3.5	0.0	-2.1	-5.3
140.0	-4.1	-2.7	4.0	0.0	-2.1	-4.9
150.0	-4.1	-2.7	4.3	0.0	-2.1	-4.6
160.0	-4.1	-2.7	4.4	0.0	-2.1	-4.4
170.0	-4.1	-2.7	4.4	0.0	-2.1	-4.4
180.0	-4.1	-2.7	4.3	0.0	-2.1	-4.5
190.0	-4.1	-2.7	4.4	0.0	-2.1	-4.4
200.0	-4.1	-2.7	4.4	0.0	-2.1	-4.4
210.0	-4.1	-2.7	4.3	0.0	-2.1	-4.6
220.0	-4.1	-2.7	4.0	0.0	-2.1	-4.9
230.0	-4.1	-2.7	3.5	0.0	-2.1	-5.3
240.0	-4.1	-2.7	3.0	0.0	-2.1	-5.9
250.0	-4.1	-2.7	2.3	0.0	-2.1	-6.6
260.0	-4.1	-2.7	1.5	0.0	-2.1	-7.3
270.0	-4.1	-2.7	0.7	0.0	-2.1	-8.1
280.0	-4.1	-2.7	-0.1	0.0	-2.1	-9.0
290.0	-4.1	-2.7	-0.9	0.0	-2.1	-9.7
300.0	-4.1	-2.7	-1.6	0.0	-2.1	-10.5
310.0	-4.1	-2.7	-2.3	0.0	-2.1	-11.1
320.0	-4.1	-2.7	-2.8	0.0	-2.1	-11.7
330.0	-4.1	-2.7	-3.2	0.0	-2.1	-12.1
340.0	-4.1	-2.7	-3.5	0.0	-2.1	-12.3
350.0	-4.1	-2.7	-3.6	0.0	-2.1	-12.5
360.0	-4.1	-2.7	-3.6	0.0	-2.1	-12.5

Case 7 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-31.0	-10.9	0.0	0.0	-8.5	-50.4
10.0	-31.0	-10.9	-4.8	0.0	-8.5	-55.2
20.0	-31.0	-10.9	-10.0	0.0	-8.5	-60.4
30.0	-31.0	-10.9	-15.6	0.0	-8.5	-66.0
40.0	-31.0	-10.9	-21.7	0.0	-8.5	-72.1
50.0	-31.0	-10.9	-28.0	0.0	-8.5	-78.4
60.0	-31.0	-10.9	-33.8	0.0	-8.5	-84.2
70.0	-31.0	-10.9	-38.7	0.0	-8.5	-89.1
80.0	-31.0	-10.9	-41.9	0.0	-8.5	-92.3
90.0	-31.0	-10.9	-43.0	0.0	-8.5	-93.4
100.0	-31.0	-10.9	-41.9	0.0	-8.5	-92.3
110.0	-31.0	-10.9	-38.7	0.0	-8.5	-89.1
120.0	-31.0	-10.9	-33.8	0.0	-8.5	-84.2
130.0	-31.0	-10.9	-28.0	0.0	-8.5	-78.4
140.0	-31.0	-10.9	-21.7	0.0	-8.5	-72.1
150.0	-31.0	-10.9	-15.6	0.0	-8.5	-66.0
160.0	-31.0	-10.9	-10.0	0.0	-8.5	-60.4
170.0	-31.0	-10.9	-4.8	0.0	-8.5	-55.2
180.0	-31.0	-10.9	0.0	0.0	-8.5	-50.4
190.0	-31.0	-10.9	4.8	0.0	-8.5	-45.6
200.0	-31.0	-10.9	10.0	0.0	-8.5	-40.4
210.0	-31.0	-10.9	15.6	0.0	-8.5	-34.8
220.0	-31.0	-10.9	21.7	0.0	-8.5	-28.7
230.0	-31.0	-10.9	28.0	0.0	-8.5	-22.4
240.0	-31.0	-10.9	33.8	0.0	-8.5	-16.5
250.0	-31.0	-10.9	38.7	0.0	-8.5	-11.7
260.0	-31.0	-10.9	41.9	0.0	-8.5	-8.5
270.0	-31.0	-10.9	43.0	0.0	8.5	9.5
280.0	-31.0	-10.9	41.9	0.0	-8.5	-8.5
290.0	-31.0	-10.9	38.7	0.0	-8.5	-11.7
300.0	-31.0	-10.9	33.8	0.0	-8.5	-16.5
310.0	-31.0	-10.9	28.0	0.0	-8.5	-22.4
320.0	-31.0	-10.9	21.7	0.0	-8.5	-28.7
330.0	-31.0	-10.9	15.6	0.0	-8.5	-34.8
340.0	-31.0	-10.9	10.0	0.0	-8.5	-40.4
350.0	-31.0	-10.9	4.8	0.0	-8.5	-45.6
360.0	-31.0	-10.9	0.0	0.0	-8.5	-50.4

Case 7 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-543.1	-99.5	0.0	0.0	-98.2	-740.8
10.0	-543.1	-99.5	-316.6	0.0	-98.2	-1057.4
20.0	-543.1	-99.5	-593.0	0.0	-98.2	-1333.7
30.0	-543.1	-99.5	-793.7	0.0	-98.2	-1534.4
40.0	-543.1	-99.5	-892.8	0.0	-98.2	-1633.5
50.0	-543.1	-99.5	-876.4	0.0	-98.2	-1617.2
60.0	-543.1	-99.5	-745.2	0.0	-98.2	-1486.0
70.0	-543.1	-99.5	-513.8	0.0	-98.2	-1254.6
80.0	-543.1	-99.5	-209.2	0.0	-98.2	-950.0
90.0	-543.1	-99.5	132.4	0.0	-98.2	-608.4
100.0	-543.1	-99.5	470.0	0.0	-98.2	-270.8
110.0	-543.1	-99.5	762.6	0.0	98.2	218.2
120.0	-543.1	-99.5	974.5	0.0	98.2	430.1
130.0	-543.1	-99.5	1079.2	0.0	98.2	524.8
140.0	-543.1	-99.5	1063.0	0.0	98.2	513.5
150.0	-543.1	-99.5	926.1	0.0	98.2	331.0
160.0	-543.1	-99.5	683.5	0.0	98.2	139.1
170.0	-543.1	-99.5	362.6	0.0	-98.2	-378.2
180.0	-543.1	-99.5	0.0	0.0	-98.2	-740.8
190.0	-543.1	-99.5	-362.6	0.0	-98.2	-1103.3
200.0	-543.1	-99.5	-683.5	0.0	-98.2	-1424.3
210.0	-543.1	-99.5	-926.1	0.0	-98.2	-1666.8
220.0	-543.1	-99.5	-1063.0	0.0	-98.2	-1803.7
230.0	-543.1	-99.5	-1079.2	0.0	-98.2	-1820.0
240.0	-543.1	-99.5	-974.5	0.0	-98.2	-1715.3
250.0	-543.1	-99.5	-762.6	0.0	-98.2	-1503.4
260.0	-543.1	-99.5	-470.0	0.0	-98.2	-1210.7
270.0	-543.1	-99.5	-132.4	0.0	-98.2	-873.1
280.0	-543.1	-99.5	209.2	0.0	-98.2	-531.5
290.0	-543.1	-99.5	513.8	0.0	-98.2	-226.9
300.0	-543.1	-99.5	745.2	0.0	98.2	200.8
310.0	-543.1	-99.5	876.4	0.0	98.2	332.0
320.0	-543.1	-99.5	892.8	0.0	98.2	348.4
330.0	-543.1	-99.5	793.7	0.0	98.2	249.3
340.0	-543.1	-99.5	593.0	0.0	-98.2	-147.8
350.0	-543.1	-99.5	316.6	0.0	-98.2	-424.1
360.0	-543.1	-99.5	0.0	0.0	-98.2	-740.8

6.7.4 Thruster use

Case 7 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	97.2	0.2	87.8	165.5	26.0	90.0	49.9	75.9
10.0	97.3	0.2	89.1	170.0	25.7	90.0	42.6	77.1
20.0	97.7	0.1	90.9	173.6	25.8	90.0	36.8	78.4
30.0	94.1	3.3	88.1	180.0	26.0	90.0	31.9	79.5
40.0	92.8	2.1	87.9	180.0	26.4	90.0	30.1	80.7
50.0	92.3	2.5	87.7	180.0	27.0	90.0	31.3	81.8
60.0	92.2	4.5	87.5	180.0	27.8	90.0	35.3	82.8
70.0	92.5	7.4	87.3	180.0	27.4	90.0	39.6	83.7
80.0	93.5	11.3	87.2	180.0	27.1	90.0	45.6	84.4
90.0	95.3	15.5	87.2	180.0	26.9	90.0	52.5	84.9
100.0	96.1	19.7	85.7	180.0	26.9	90.0	59.4	85.4
110.0	99.1	25.5	84.3	180.0	27.0	90.0	69.9	85.7
120.0	100.0	28.0	83.0	180.0	27.3	90.0	74.5	85.9
130.0	100.0	29.3	81.9	180.0	27.3	90.0	76.5	86.0
140.0	74.2	19.2	68.2	162.7	27.4	90.0	72.3	86.1
150.0	58.7	20.9	53.2	160.9	27.6	90.0	66.2	86.0
160.0	53.5	19.4	48.3	162.3	28.0	90.0	60.5	85.8
170.0	73.8	11.7	68.9	170.1	28.4	90.0	63.4	85.4
180.0	82.1	8.5	77.3	173.0	28.9	90.0	50.1	84.8
190.0	84.8	9.7	79.4	180.0	28.9	90.0	43.5	84.4
200.0	84.1	5.1	79.7	180.0	29.0	90.0	36.7	83.7
210.0	84.5	1.7	80.2	180.0	29.1	90.0	31.9	82.4
220.0	83.0	359.7	78.1	180.2	29.3	90.0	29.1	80.3
230.0	56.4	355.9	51.0	180.6	29.6	90.0	23.0	76.6
240.0	21.1	340.7	15.1	204.7	29.9	90.0	17.6	70.4
250.0	12.1	324.0	7.6	245.3	25.7	90.0	13.4	60.7
260.0	10.5	320.1	6.0	256.4	20.2	90.0	11.2	49.3
270.0	9.3	308.1	7.9	287.7	5.3	90.0	12.5	310.5
280.0	7.5	347.8	2.2	315.7	11.7	90.0	12.4	43.6
290.0	7.3	7.9	2.7	21.2	9.7	90.0	15.2	50.2
300.0	8.3	35.2	5.9	50.8	7.2	90.0	19.6	57.7
310.0	10.1	42.9	7.5	60.2	9.0	90.0	25.0	63.6
320.0	11.6	49.5	8.3	60.2	12.6	90.0	30.9	67.9
330.0	12.7	51.5	8.3	60.2	17.6	90.0	36.8	70.9
340.0	18.3	31.5	6.6	119.8	25.1	90.0	42.2	73.0
350.0	56.1	10.0	43.9	167.3	26.2	90.0	47.2	74.7
360.0	97.2	0.2	87.8	165.5	26.0	90.0	49.9	75.9

6.7.5 Thruster loss

Case 7 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.86	0.82
10.0	0.87	0.85	0.81
20.0	0.87	0.82	0.81
30.0	0.87	0.78	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.90	0.78	0.87
70.0	0.90	0.78	0.86
80.0	0.91	0.78	0.85
90.0	0.92	0.78	0.84
100.0	0.92	0.76	0.85
110.0	0.93	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.79	0.86
150.0	0.94	0.79	0.87
160.0	0.95	0.78	0.88
170.0	0.95	0.76	0.89
180.0	0.96	0.74	0.91
190.0	0.96	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.96	0.72	0.92
230.0	0.94	0.75	0.93
240.0	0.91	0.84	0.94
250.0	0.87	0.85	0.94
260.0	0.86	0.85	0.94
270.0	0.83	0.85	0.94
280.0	0.88	0.86	0.95
290.0	0.93	0.90	0.95
300.0	0.94	0.89	0.96
310.0	0.94	0.89	0.92
320.0	0.93	0.89	0.89
330.0	0.92	0.89	0.86
340.0	0.88	0.90	0.84
350.0	0.86	0.85	0.82
360.0	0.87	0.86	0.82

Preliminary Design, @IDR5

6.8 Case 8 - Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 4

6.8.1 Environment and thrust utilisation

Case 8 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	70.0	70.0	0.0	35.0	2.5	6.0	8.5	2.00	99.5
10.0	70.0	70.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	70.0	70.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	70.0	70.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	70.0	70.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	70.0	70.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	70.0	70.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	70.0	70.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	70.0	70.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	70.0	70.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	70.0	70.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	70.0	70.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	70.0	70.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	70.0	70.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	70.0	70.0	140.0	35.0	2.5	6.0	8.5	2.00	93.0
150.0	70.0	70.0	150.0	35.0	2.5	6.0	8.5	2.00	88.1
160.0	70.0	70.0	160.0	35.0	2.5	6.0	8.5	2.00	87.0
170.0	70.0	70.0	170.0	35.0	2.5	6.0	8.5	2.00	92.9
180.0	70.0	70.0	180.0	35.0	2.5	6.0	8.5	2.00	96.4
190.0	70.0	70.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	70.0	70.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	70.0	70.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	70.0	70.0	220.0	35.0	2.5	6.0	8.5	2.00	97.0
230.0	70.0	70.0	230.0	35.0	2.5	6.0	8.5	2.00	87.5
240.0	70.0	70.0	240.0	35.0	2.5	6.0	8.5	2.00	74.7
250.0	70.0	70.0	250.0	35.0	2.5	6.0	8.5	2.00	60.8
260.0	70.0	70.0	260.0	35.0	2.5	6.0	8.5	2.00	46.8
270.0	70.0	70.0	270.0	35.0	2.5	6.0	8.5	2.00	34.6
280.0	70.0	70.0	280.0	35.0	2.5	6.0	8.5	2.00	26.1
290.0	70.0	70.0	290.0	35.0	2.5	6.0	8.5	2.00	18.0
300.0	70.0	70.0	300.0	35.0	2.5	6.0	8.5	2.00	17.9
310.0	70.0	70.0	310.0	35.0	2.5	6.0	8.5	2.00	22.8
320.0	70.0	70.0	320.0	35.0	2.5	6.0	8.5	2.00	31.7
330.0	70.0	70.0	330.0	35.0	2.5	6.0	8.5	2.00	44.3
340.0	70.0	70.0	340.0	35.0	2.5	6.0	8.5	2.00	59.9
350.0	70.0	70.0	350.0	35.0	2.5	6.0	8.5	2.00	81.5
360.0	70.0	70.0	360.0	35.0	2.5	6.0	8.5	2.00	99.5

6.8.2 Relative contributions of force components

Case 8 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	56.0	24.4	1.2	0.0	18.4	100.0
10.0	51.6	22.5	9.0	0.0	16.9	100.0
20.0	47.6	20.7	16.1	0.0	15.6	100.0
30.0	43.9	19.1	22.7	0.0	14.3	100.0
40.0	40.4	17.6	28.8	0.0	13.2	100.0
50.0	37.4	16.2	34.2	0.0	12.2	100.0
60.0	35.0	15.1	38.5	0.0	11.4	100.0
70.0	33.2	14.4	41.7	0.0	10.8	100.0
80.0	32.1	13.9	43.6	0.0	10.4	100.0
90.0	31.7	13.7	44.2	0.0	10.3	100.0
100.0	32.1	13.9	43.6	0.0	10.4	100.0
110.0	33.2	14.3	41.7	0.0	10.8	100.0
120.0	35.1	15.1	38.5	0.0	11.4	100.0
130.0	37.6	16.2	34.0	0.0	12.2	100.0
140.0	40.7	17.5	28.6	0.0	13.2	100.0
150.0	44.3	19.1	22.3	0.0	14.3	100.0
160.0	48.2	20.8	15.4	0.0	15.5	100.0
170.0	52.4	22.6	8.0	0.0	17.0	100.0
180.0	57.1	24.6	-0.3	0.0	18.5	100.0
190.0	62.8	27.1	-10.2	0.0	20.4	100.0
200.0	70.2	30.3	-23.2	0.0	22.8	100.0
210.0	80.6	34.5	-41.5	0.0	26.2	100.0
220.0	95.0	41.1	-68.5	0.0	31.2	100.0
230.0	113.7	51.5	-108.9	0.0	38.7	100.0
240.0	151.7	66.2	-167.7	0.0	49.7	100.0
250.0	193.5	85.1	-242.6	0.0	63.9	100.0
260.0	228.1	101.5	-305.8	0.0	76.1	100.0
270.0	232.1	104.2	-314.4	0.0	78.1	100.0
280.0	207.3	93.2	-270.4	0.0	69.9	100.0
290.0	171.3	76.6	-205.4	0.0	57.5	100.0
300.0	136.9	60.8	-143.3	0.0	45.6	100.0
310.0	109.8	48.6	-94.9	0.0	36.5	100.0
320.0	90.6	39.9	-60.4	0.0	29.9	100.0
330.0	77.2	33.9	-36.6	0.0	25.5	100.0
340.0	67.9	29.7	-20.0	0.0	22.3	100.0
350.0	61.2	26.8	-8.0	0.0	20.1	100.0
360.0	56.0	24.4	1.2	0.0	18.4	100.0

6.8.3 Environment forces

Case 8 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-2.6	-2.3	-3.6	0.0	-1.6	-10.0
10.0	-2.6	-2.3	-3.6	0.0	-1.6	-10.0
20.0	-2.6	-2.3	-3.5	0.0	-1.6	-9.9
30.0	-2.6	-2.3	-3.2	0.0	-1.6	-9.6
40.0	-2.6	-2.3	-2.8	0.0	-1.6	-9.2
50.0	-2.6	-2.3	-2.3	0.0	-1.6	-8.7
60.0	-2.6	-2.3	-1.6	0.0	-1.6	-8.1
70.0	-2.6	-2.3	-0.9	0.0	-1.6	-7.3
80.0	-2.6	-2.3	-0.1	0.0	-1.6	-6.5
90.0	-2.6	-2.3	0.7	0.0	-1.6	-5.7
100.0	-2.6	-2.3	1.5	0.0	-1.6	-4.9
110.0	-2.6	-2.3	2.3	0.0	-1.6	-4.2
120.0	-2.6	-2.3	3.0	0.0	-1.6	-3.5
130.0	-2.6	-2.3	3.5	0.0	-1.6	-2.9
140.0	-2.6	-2.3	4.0	0.0	-1.6	-2.5
150.0	-2.6	-2.3	4.3	0.0	-1.6	-2.2
160.0	-2.6	-2.3	4.4	0.0	-1.6	-2.0
170.0	-2.6	-2.3	4.4	0.0	-1.6	-2.0
180.0	-2.6	-2.3	4.3	0.0	-1.6	-2.1
190.0	-2.6	-2.3	4.4	0.0	-1.6	-2.0
200.0	-2.6	-2.3	4.4	0.0	-1.6	-2.0
210.0	-2.6	-2.3	4.3	0.0	-1.6	-2.2
220.0	-2.6	-2.3	4.0	0.0	-1.6	-2.5
230.0	-2.6	-2.3	3.5	0.0	-1.6	-2.9
240.0	-2.6	-2.3	3.0	0.0	-1.6	-3.5
250.0	-2.6	-2.3	2.3	0.0	-1.6	-4.2
260.0	-2.6	-2.3	1.5	0.0	-1.6	-4.9
270.0	-2.6	-2.3	0.7	0.0	-1.6	-5.7
280.0	-2.6	-2.3	-0.1	0.0	-1.6	-6.5
290.0	-2.6	-2.3	-0.9	0.0	-1.6	-7.3
300.0	-2.6	-2.3	-1.6	0.0	-1.6	-8.1
310.0	-2.6	-2.3	-2.3	0.0	-1.6	-8.7
320.0	-2.6	-2.3	-2.8	0.0	-1.6	-9.2
330.0	-2.6	-2.3	-3.2	0.0	-1.6	-9.6
340.0	-2.6	-2.3	-3.5	0.0	-1.6	-9.9
350.0	-2.6	-2.3	-3.6	0.0	-1.6	-10.0
360.0	-2.6	-2.3	-3.6	0.0	-1.6	-10.0

Case 8 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.7	-13.2	0.0	0.0	-9.9	-53.7
10.0	-30.7	-13.2	-4.8	0.0	-9.9	-58.6
20.0	-30.7	-13.2	-10.0	0.0	-9.9	-63.7
30.0	-30.7	-13.2	-15.6	0.0	-9.9	-69.4
40.0	-30.7	-13.2	-21.7	0.0	-9.9	-75.5
50.0	-30.7	-13.2	-28.0	0.0	-9.9	-81.7
60.0	-30.7	-13.2	-33.8	0.0	-9.9	-87.6
70.0	-30.7	-13.2	-38.7	0.0	-9.9	-92.4
80.0	-30.7	-13.2	-41.9	0.0	-9.9	-95.6
90.0	-30.7	-13.2	-43.0	0.0	-9.9	-96.7
100.0	-30.7	-13.2	-41.9	0.0	-9.9	-95.6
110.0	-30.7	-13.2	-38.7	0.0	-9.9	-92.4
120.0	-30.7	-13.2	-33.8	0.0	-9.9	-87.6
130.0	-30.7	-13.2	-28.0	0.0	-9.9	-81.7
140.0	-30.7	-13.2	-21.7	0.0	-9.9	-75.5
150.0	-30.7	-13.2	-15.6	0.0	-9.9	-69.4
160.0	-30.7	-13.2	-10.0	0.0	-9.9	-63.7
170.0	-30.7	-13.2	-4.8	0.0	-9.9	-58.6
180.0	-30.7	-13.2	0.0	0.0	-9.9	-53.7
190.0	-30.7	-13.2	4.8	0.0	-9.9	-48.9
200.0	-30.7	-13.2	10.0	0.0	-9.9	-43.7
210.0	-30.7	-13.2	15.6	0.0	-9.9	-38.1
220.0	-30.7	-13.2	21.7	0.0	-9.9	-32.0
230.0	-30.7	-13.2	28.0	0.0	-9.9	-25.7
240.0	-30.7	-13.2	33.8	0.0	-9.9	-19.9
250.0	-30.7	-13.2	38.7	0.0	-9.9	-15.0
260.0	-30.7	-13.2	41.9	0.0	-9.9	-11.9
270.0	-30.7	-13.2	43.0	0.0	-9.9	-10.7
280.0	-30.7	-13.2	41.9	0.0	-9.9	-11.9
290.0	-30.7	-13.2	38.7	0.0	-9.9	-15.0
300.0	-30.7	-13.2	33.8	0.0	-9.9	-19.9
310.0	-30.7	-13.2	28.0	0.0	-9.9	-25.7
320.0	-30.7	-13.2	21.7	0.0	-9.9	-32.0
330.0	-30.7	-13.2	15.6	0.0	-9.9	-38.1
340.0	-30.7	-13.2	10.0	0.0	-9.9	-43.7
350.0	-30.7	-13.2	4.8	0.0	-9.9	-48.9
360.0	-30.7	-13.2	0.0	0.0	-9.9	-53.7

Case 8 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-430.1	-43.1	0.0	0.0	-62.8	-536.0
10.0	-430.1	-43.1	-316.6	0.0	-62.8	-852.6
20.0	-430.1	-43.1	-593.0	0.0	-62.8	-1129.0
30.0	-430.1	-43.1	-793.7	0.0	-62.8	-1329.7
40.0	-430.1	-43.1	-892.8	0.0	-62.8	-1428.8
50.0	-430.1	-43.1	-876.4	0.0	-62.8	-1412.5
60.0	-430.1	-43.1	-745.2	0.0	-62.8	-1281.3
70.0	-430.1	-43.1	-513.8	0.0	-62.8	-1049.9
80.0	-430.1	-43.1	-209.2	0.0	-62.8	-745.3
90.0	-430.1	-43.1	132.4	0.0	-62.8	-403.6
100.0	-430.1	-43.1	470.0	0.0	-62.8	-66.1
110.0	-430.1	-43.1	762.6	0.0	62.8	352.2
120.0	-430.1	-43.1	974.5	0.0	62.8	564.1
130.0	-430.1	-43.1	1079.2	0.0	62.8	668.8
140.0	-430.1	-43.1	1063.0	0.0	62.8	653.5
150.0	-430.1	-43.1	926.1	0.0	62.8	515.0
160.0	-430.1	-43.1	683.5	0.0	62.8	273.1
170.0	-430.1	-43.1	362.6	0.0	-62.8	-173.4
180.0	-430.1	-43.1	0.0	0.0	-62.8	-536.0
190.0	-430.1	-43.1	-362.6	0.0	-62.8	-898.6
200.0	-430.1	-43.1	-683.5	0.0	-62.8	-1219.6
210.0	-430.1	-43.1	-926.1	0.0	-62.8	-1462.1
220.0	-430.1	-43.1	-1063.0	0.0	-62.8	-1599.0
230.0	-430.1	-43.1	-1079.2	0.0	-62.8	-1615.3
240.0	-430.1	-43.1	-974.5	0.0	-62.8	-1510.6
250.0	-430.1	-43.1	-762.6	0.0	-62.8	-1298.7
260.0	-430.1	-43.1	-470.0	0.0	-62.8	-1006.0
270.0	-430.1	-43.1	-132.4	0.0	-62.8	-668.4
280.0	-430.1	-43.1	209.2	0.0	-62.8	-326.8
290.0	-430.1	-43.1	513.8	0.0	62.8	103.4
300.0	-430.1	-43.1	745.2	0.0	62.8	334.8
310.0	-430.1	-43.1	876.4	0.0	62.8	466.0
320.0	-430.1	-43.1	892.8	0.0	62.8	482.3
330.0	-430.1	-43.1	793.7	0.0	62.8	383.2
340.0	-430.1	-43.1	593.0	0.0	62.8	182.5
350.0	-430.1	-43.1	316.6	0.0	-62.8	-219.4
360.0	-430.1	-43.1	0.0	0.0	-62.8	-536.0

6.8.4 Thruster use

Case 8 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	97.2	0.3	91.1	163.0	26.0	90.0	54.0	79.3
10.0	97.3	0.2	91.5	167.4	25.7	90.0	46.7	80.1
20.0	97.7	0.2	92.5	171.0	25.8	90.0	41.0	81.0
30.0	93.6	5.9	88.1	180.0	26.0	90.0	36.0	81.9
40.0	92.4	4.8	87.9	180.0	26.4	90.0	34.3	82.9
50.0	91.9	5.2	87.7	180.0	27.0	90.0	35.5	83.8
60.0	91.9	7.2	87.5	180.0	27.8	90.0	39.5	84.6
70.0	92.3	10.1	87.3	180.0	27.4	90.0	43.8	85.4
80.0	93.4	13.9	87.2	180.0	27.1	90.0	49.7	86.0
90.0	95.3	18.1	87.2	180.0	26.9	90.0	56.6	86.6
100.0	96.2	22.3	85.7	180.0	26.9	90.0	63.6	87.0
110.0	98.6	27.3	84.3	180.0	27.0	90.0	72.4	87.4
120.0	99.4	30.0	83.0	180.0	27.3	90.0	77.0	87.7
130.0	99.2	31.3	81.9	180.0	27.3	90.0	78.9	87.9
140.0	75.5	20.3	71.7	162.2	27.4	90.0	75.5	88.1
150.0	60.1	22.2	56.8	160.4	27.6	90.0	69.4	88.2
160.0	54.8	20.9	51.8	161.8	28.0	90.0	63.7	88.2
170.0	68.7	14.1	66.0	168.3	28.4	90.0	68.6	88.0
180.0	76.8	10.4	74.2	171.5	28.9	90.0	53.1	87.7
190.0	83.4	12.8	79.4	180.0	28.9	90.0	47.4	87.6
200.0	82.4	8.1	79.7	180.0	29.0	90.0	40.6	87.3
210.0	82.6	4.6	80.2	180.0	29.1	90.0	35.8	86.6
220.0	77.4	1.1	74.9	173.1	29.3	90.0	32.1	85.6
230.0	50.6	357.5	47.7	189.0	29.6	90.0	25.9	83.5
240.0	15.1	339.9	11.3	204.3	29.9	90.0	20.2	80.1
250.0	9.8	328.4	0.5	230.2	25.1	90.0	15.6	74.5
260.0	8.3	331.8	4.5	238.3	19.6	90.0	12.8	67.4
270.0	6.8	342.7	2.1	249.0	14.7	90.0	12.2	61.9
280.0	6.0	3.9	0.7	36.6	11.1	90.0	13.5	61.1
290.0	6.5	36.2	4.2	60.2	7.6	90.0	16.7	64.0
300.0	8.2	53.9	6.5	60.2	7.6	90.0	21.5	67.9
310.0	10.3	63.0	8.1	60.2	9.5	90.0	27.2	71.3
320.0	12.1	66.6	8.9	60.2	13.1	90.0	33.3	73.9
330.0	13.4	66.9	8.8	60.2	18.1	90.0	39.3	75.8
340.0	19.4	41.7	9.2	119.8	22.8	90.0	44.9	77.2
350.0	50.9	12.9	41.1	163.9	26.2	90.0	49.9	78.4
360.0	97.2	0.3	91.1	163.0	26.0	90.0	54.0	79.3

6.8.5 Thruster loss

Case 8 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.87	0.82
10.0	0.87	0.85	0.81
20.0	0.87	0.84	0.81
30.0	0.87	0.78	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.89	0.78	0.87
70.0	0.90	0.78	0.86
80.0	0.90	0.78	0.85
90.0	0.91	0.78	0.84
100.0	0.92	0.76	0.85
110.0	0.93	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.79	0.86
150.0	0.94	0.79	0.87
160.0	0.95	0.78	0.88
170.0	0.95	0.76	0.89
180.0	0.96	0.75	0.91
190.0	0.95	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.96	0.73	0.92
230.0	0.95	0.74	0.93
240.0	0.91	0.84	0.94
250.0	0.88	0.85	0.94
260.0	0.87	0.86	0.94
270.0	0.88	0.85	0.94
280.0	0.94	0.90	0.95
290.0	0.94	0.90	0.95
300.0	0.94	0.89	0.96
310.0	0.94	0.89	0.92
320.0	0.94	0.89	0.89
330.0	0.94	0.89	0.86
340.0	0.89	0.90	0.84
350.0	0.86	0.87	0.82
360.0	0.87	0.87	0.82

Preliminary Design, @IDR5

6.9 Case 9 - Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 4

6.9.1 Environment and thrust utilisation

Case 9 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	80.0	80.0	0.0	35.0	2.5	6.0	8.5	2.00	96.8
10.0	80.0	80.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	80.0	80.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	80.0	80.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	80.0	80.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	80.0	80.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	80.0	80.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	80.0	80.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	80.0	80.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	80.0	80.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	80.0	80.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	80.0	80.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	80.0	80.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	80.0	80.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	80.0	80.0	140.0	35.0	2.5	6.0	8.5	2.00	93.0
150.0	80.0	80.0	150.0	35.0	2.5	6.0	8.5	2.00	87.8
160.0	80.0	80.0	160.0	35.0	2.5	6.0	8.5	2.00	86.7
170.0	80.0	80.0	170.0	35.0	2.5	6.0	8.5	2.00	88.6
180.0	80.0	80.0	180.0	35.0	2.5	6.0	8.5	2.00	95.0
190.0	80.0	80.0	190.0	35.0	2.5	6.0	8.5	2.00	99.5
200.0	80.0	80.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	80.0	80.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	80.0	80.0	220.0	35.0	2.5	6.0	8.5	2.00	95.6
230.0	80.0	80.0	230.0	35.0	2.5	6.0	8.5	2.00	86.0
240.0	80.0	80.0	240.0	35.0	2.5	6.0	8.5	2.00	73.4
250.0	80.0	80.0	250.0	35.0	2.5	6.0	8.5	2.00	59.1
260.0	80.0	80.0	260.0	35.0	2.5	6.0	8.5	2.00	45.2
270.0	80.0	80.0	270.0	35.0	2.5	6.0	8.5	2.00	32.9
280.0	80.0	80.0	280.0	35.0	2.5	6.0	8.5	2.00	23.7
290.0	80.0	80.0	290.0	35.0	2.5	6.0	8.5	2.00	16.7
300.0	80.0	80.0	300.0	35.0	2.5	6.0	8.5	2.00	16.7
310.0	80.0	80.0	310.0	35.0	2.5	6.0	8.5	2.00	21.5
320.0	80.0	80.0	320.0	35.0	2.5	6.0	8.5	2.00	30.4
330.0	80.0	80.0	330.0	35.0	2.5	6.0	8.5	2.00	43.1
340.0	80.0	80.0	340.0	35.0	2.5	6.0	8.5	2.00	58.4
350.0	80.0	80.0	350.0	35.0	2.5	6.0	8.5	2.00	78.8
360.0	80.0	80.0	360.0	35.0	2.5	6.0	8.5	2.00	96.8

6.9.2 Relative contributions of force components

Case 9 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	52.7	26.7	0.9	0.0	19.7	100.0
10.0	48.6	24.6	8.6	0.0	18.2	100.0
20.0	44.9	22.7	15.6	0.0	16.8	100.0
30.0	41.5	21.0	22.1	0.0	15.5	100.0
40.0	38.3	19.3	28.1	0.0	14.3	100.0
50.0	35.5	17.9	33.4	0.0	13.2	100.0
60.0	33.2	16.7	37.7	0.0	12.4	100.0
70.0	31.5	15.9	40.9	0.0	11.7	100.0
80.0	30.5	15.4	42.8	0.0	11.3	100.0
90.0	30.2	15.2	43.4	0.0	11.2	100.0
100.0	30.5	15.3	42.8	0.0	11.3	100.0
110.0	31.6	15.9	40.9	0.0	11.7	100.0
120.0	33.2	16.7	37.8	0.0	12.3	100.0
130.0	35.5	17.8	33.5	0.0	13.2	100.0
140.0	38.4	19.2	28.2	0.0	14.3	100.0
150.0	41.6	20.8	22.1	0.0	15.5	100.0
160.0	45.2	22.6	15.4	0.0	16.7	100.0
170.0	49.0	24.5	8.3	0.0	18.3	100.0
180.0	53.2	26.6	0.4	0.0	19.8	100.0
190.0	58.2	29.1	-9.0	0.0	21.7	100.0
200.0	64.7	32.3	-2.1	0.0	24.2	100.0
210.0	73.7	36.5	-38.1	0.0	27.6	100.0
220.0	86.9	43.1	-62.8	0.0	32.5	100.0
230.0	109.1	53.1	-99.4	0.0	39.8	100.0
240.0	135.0	67.4	-152.9	0.0	50.4	100.0
250.0	172.8	87.4	-224.6	0.0	64.5	100.0
260.0	208.3	105.9	-292.3	0.0	78.1	100.0
270.0	219.6	112.3	-314.7	0.0	82.8	100.0
280.0	198.4	101.8	-275.1	0.0	75.0	100.0
290.0	162.2	83.2	-206.6	0.0	61.3	100.0
300.0	128.4	65.7	-142.5	0.0	48.4	100.0
310.0	102.7	52.4	-93.8	0.0	38.6	100.0
320.0	84.7	43.1	-59.7	0.0	31.8	100.0
330.0	72.3	36.8	-36.3	0.0	27.1	100.0
340.0	63.7	32.4	-20.0	0.0	23.9	100.0
350.0	57.5	29.2	-8.2	0.0	21.5	100.0
360.0	52.7	26.7	0.9	0.0	19.7	100.0

6.9.3 Environment forces

Case 9 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-1.2	-1.7	-3.6	0.0	-1.2	-7.7
10.0	-1.2	-1.7	-3.6	0.0	-1.2	-7.7
20.0	-1.2	-1.7	-3.5	0.0	-1.2	-7.6
30.0	-1.2	-1.7	-3.2	0.0	-1.2	-7.3
40.0	-1.2	-1.7	-2.8	0.0	-1.2	-6.9
50.0	-1.2	-1.7	-2.3	0.0	-1.2	-6.4
60.0	-1.2	-1.7	-1.6	0.0	-1.2	-5.7
70.0	-1.2	-1.7	-0.9	0.0	-1.2	-5.0
80.0	-1.2	-1.7	-0.1	0.0	-1.2	-4.2
90.0	-1.2	-1.7	0.7	0.0	-1.2	-3.4
100.0	-1.2	-1.7	1.5	0.0	-1.2	-2.6
110.0	-1.2	-1.7	2.3	0.0	-1.2	-1.8
120.0	-1.2	-1.7	3.0	0.0	1.2	1.2
130.0	-1.2	-1.7	3.5	0.0	1.2	1.8
140.0	-1.2	-1.7	4.0	0.0	1.2	2.2
150.0	-1.2	-1.7	4.3	0.0	1.2	2.5
160.0	-1.2	-1.7	4.4	0.0	1.2	2.7
170.0	-1.2	-1.7	4.4	0.0	1.2	2.7
180.0	-1.2	-1.7	4.3	0.0	1.2	2.6
190.0	-1.2	-1.7	4.4	0.0	1.2	2.7
200.0	-1.2	-1.7	4.4	0.0	1.2	2.7
210.0	-1.2	-1.7	4.3	0.0	1.2	2.5
220.0	-1.2	-1.7	4.0	0.0	1.2	2.2
230.0	-1.2	-1.7	3.5	0.0	1.2	1.8
240.0	-1.2	-1.7	3.0	0.0	1.2	1.2
250.0	-1.2	-1.7	2.3	0.0	-1.2	-1.8
260.0	-1.2	-1.7	1.5	0.0	-1.2	-2.6
270.0	-1.2	-1.7	0.7	0.0	-1.2	-3.4
280.0	-1.2	-1.7	-0.1	0.0	-1.2	-4.2
290.0	-1.2	-1.7	-0.9	0.0	-1.2	-5.0
300.0	-1.2	-1.7	-1.6	0.0	-1.2	-5.7
310.0	-1.2	-1.7	-2.3	0.0	-1.2	-6.4
320.0	-1.2	-1.7	-2.8	0.0	-1.2	-6.9
330.0	-1.2	-1.7	-3.2	0.0	-1.2	-7.3
340.0	-1.2	-1.7	-3.5	0.0	-1.2	-7.6
350.0	-1.2	-1.7	-3.6	0.0	-1.2	-7.7
360.0	-1.2	-1.7	-3.6	0.0	-1.2	-7.7

Case 9 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.8	-15.0	0.0	0.0	-11.0	-55.8
10.0	-29.8	-15.0	-4.8	0.0	-11.0	-60.6
20.0	-29.8	-15.0	-10.0	0.0	-11.0	-65.8
30.0	-29.8	-15.0	-15.6	0.0	-11.0	-71.4
40.0	-29.8	-15.0	-21.7	0.0	-11.0	-77.5
50.0	-29.8	-15.0	-28.0	0.0	-11.0	-83.8
60.0	-29.8	-15.0	-33.8	0.0	-11.0	-89.7
70.0	-29.8	-15.0	-38.7	0.0	-11.0	-94.5
80.0	-29.8	-15.0	-41.9	0.0	-11.0	-97.7
90.0	-29.8	-15.0	-43.0	0.0	-11.0	-98.8
100.0	-29.8	-15.0	-41.9	0.0	-11.0	-97.7
110.0	-29.8	-15.0	-38.7	0.0	-11.0	-94.5
120.0	-29.8	-15.0	-33.8	0.0	-11.0	-89.7
130.0	-29.8	-15.0	-28.0	0.0	-11.0	-83.8
140.0	-29.8	-15.0	-21.7	0.0	-11.0	-77.5
150.0	-29.8	-15.0	-15.6	0.0	-11.0	-71.4
160.0	-29.8	-15.0	-10.0	0.0	-11.0	-65.8
170.0	-29.8	-15.0	-4.8	0.0	-11.0	-60.6
180.0	-29.8	-15.0	0.0	0.0	-11.0	-55.8
190.0	-29.8	-15.0	4.8	0.0	-11.0	-51.0
200.0	-29.8	-15.0	10.0	0.0	-11.0	-45.8
210.0	-29.8	-15.0	15.6	0.0	-11.0	-40.2
220.0	-29.8	-15.0	21.7	0.0	-11.0	-34.1
230.0	-29.8	-15.0	28.0	0.0	-11.0	-27.8
240.0	-29.8	-15.0	33.8	0.0	-11.0	-22.0
250.0	-29.8	-15.0	38.7	0.0	-11.0	-17.1
260.0	-29.8	-15.0	41.9	0.0	-11.0	-13.9
270.0	-29.8	-15.0	43.0	0.0	-11.0	-12.8
280.0	-29.8	-15.0	41.9	0.0	-11.0	-13.9
290.0	-29.8	-15.0	38.7	0.0	-11.0	-17.1
300.0	-29.8	-15.0	33.8	0.0	-11.0	-22.0
310.0	-29.8	-15.0	28.0	0.0	-11.0	-27.8
320.0	-29.8	-15.0	21.7	0.0	-11.0	-34.1
330.0	-29.8	-15.0	15.6	0.0	-11.0	-40.2
340.0	-29.8	-15.0	10.0	0.0	-11.0	-45.8
350.0	-29.8	-15.0	4.8	0.0	-11.0	-51.0
360.0	-29.8	-15.0	0.0	0.0	-11.0	-55.8

Case 9 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-314.1	-11.2	0.0	0.0	-45.3	-370.6
10.0	-314.1	-11.2	-316.6	0.0	-45.3	-687.2
20.0	-314.1	-11.2	-593.0	0.0	-45.3	-963.6
30.0	-314.1	-11.2	-793.7	0.0	-45.3	-1164.3
40.0	-314.1	-11.2	-892.8	0.0	-45.3	-1263.4
50.0	-314.1	-11.2	-876.4	0.0	-45.3	-1247.0
60.0	-314.1	-11.2	-745.2	0.0	-45.3	-1115.8
70.0	-314.1	-11.2	-513.8	0.0	-45.3	-884.4
80.0	-314.1	-11.2	-209.2	0.0	-45.3	-579.8
90.0	-314.1	-11.2	132.4	0.0	-45.3	-238.2
100.0	-314.1	-11.2	470.0	0.0	45.3	190.0
110.0	-314.1	-11.2	762.6	0.0	45.3	482.6
120.0	-314.1	-11.2	974.5	0.0	45.3	694.5
130.0	-314.1	-11.2	1079.2	0.0	45.3	799.2
140.0	-314.1	-11.2	1063.0	0.0	45.3	783.0
150.0	-314.1	-11.2	926.1	0.0	45.3	646.1
160.0	-314.1	-11.2	683.5	0.0	45.3	403.5
170.0	-314.1	-11.2	362.6	0.0	45.3	82.6
180.0	-314.1	-11.2	0.0	0.0	-45.3	-370.6
190.0	-314.1	-11.2	-362.6	0.0	-45.3	-733.2
200.0	-314.1	-11.2	-683.5	0.0	-45.3	-1054.1
210.0	-314.1	-11.2	-926.1	0.0	-45.3	-1296.7
220.0	-314.1	-11.2	-1063.0	0.0	-45.3	-1433.6
230.0	-314.1	-11.2	-1079.2	0.0	-45.3	-1449.8
240.0	-314.1	-11.2	-974.5	0.0	-45.3	-1345.1
250.0	-314.1	-11.2	-762.6	0.0	-45.3	-1133.2
260.0	-314.1	-11.2	-470.0	0.0	-45.3	-840.6
270.0	-314.1	-11.2	-132.4	0.0	-45.3	-503.0
280.0	-314.1	-11.2	209.2	0.0	-45.3	-161.4
290.0	-314.1	-11.2	513.8	0.0	45.3	233.8
300.0	-314.1	-11.2	745.2	0.0	45.3	465.2
310.0	-314.1	-11.2	876.4	0.0	45.3	596.4
320.0	-314.1	-11.2	892.8	0.0	45.3	612.8
330.0	-314.1	-11.2	793.7	0.0	45.3	513.7
340.0	-314.1	-11.2	593.0	0.0	45.3	313.0
350.0	-314.1	-11.2	316.6	0.0	-45.3	-54.0
360.0	-314.1	-11.2	0.0	0.0	-45.3	-370.6

6.9.4 Thruster use

Case 9 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	94.0	9.2	86.4	170.1	26.0	90.0	56.3	82.1
10.0	97.3	0.2	93.9	165.4	25.7	90.0	50.2	82.6
20.0	97.7	0.2	94.3	168.9	25.8	90.0	44.5	83.4
30.0	93.1	8.1	88.1	180.0	26.0	90.0	39.3	84.0
40.0	92.0	6.9	87.9	180.0	26.4	90.0	37.7	84.8
50.0	91.4	7.4	87.7	180.0	27.0	90.0	38.9	85.6
60.0	91.5	9.4	87.5	180.0	27.8	90.0	42.9	86.3
70.0	92.0	12.3	87.3	180.0	27.4	90.0	47.2	86.9
80.0	93.2	16.1	87.2	180.0	27.1	90.0	53.1	87.5
90.0	95.2	20.3	87.2	180.0	26.9	90.0	60.0	88.0
100.0	97.0	25.6	85.7	180.0	26.9	90.0	68.8	88.5
110.0	98.2	29.2	84.3	180.0	27.0	90.0	74.9	88.9
120.0	93.9	29.5	83.0	176.2	27.3	90.0	79.2	90.8
130.0	96.5	33.9	81.9	180.0	27.3	90.0	81.1	91.2
140.0	70.9	22.6	71.4	161.3	27.4	90.0	77.6	91.6
150.0	55.7	25.4	56.5	159.3	27.6	90.0	71.5	92.0
160.0	50.3	24.2	51.5	160.5	28.0	90.0	65.8	92.3
170.0	52.9	19.6	54.5	164.6	28.4	90.0	60.7	92.5
180.0	68.7	12.6	70.6	170.3	28.9	90.0	55.1	92.6
190.0	79.6	15.6	79.4	180.0	28.9	90.0	50.4	93.0
200.0	78.5	10.7	79.7	180.0	29.0	90.0	43.7	93.4
210.0	78.3	7.1	80.2	180.0	29.1	90.0	38.8	93.7
220.0	68.9	2.2	71.1	173.3	29.3	90.0	34.1	93.7
230.0	42.1	358.6	43.0	180.0	29.6	90.0	27.9	93.6
240.0	7.7	328.5	2.7	206.0	29.8	90.0	22.0	93.1
250.0	7.8	332.0	0.1	215.0	24.3	90.0	17.2	83.9
260.0	6.4	337.5	4.0	215.9	18.7	90.0	14.2	79.5
270.0	5.1	334.1	1.8	196.1	13.8	90.0	13.3	75.2
280.0	5.0	24.2	1.7	119.8	10.1	90.0	14.6	73.2
290.0	6.3	65.0	4.7	60.2	7.3	90.0	17.8	73.7
300.0	8.8	75.1	7.0	60.2	7.4	90.0	22.7	75.4
310.0	11.3	79.2	8.6	60.2	9.3	90.0	28.5	77.1
320.0	13.2	80.3	9.4	60.2	12.9	90.0	34.8	78.5
330.0	19.4	50.6	10.0	119.8	16.5	90.0	40.8	79.7
340.0	19.1	47.3	10.8	119.8	22.5	90.0	46.5	80.6
350.0	44.0	16.2	36.7	160.1	26.2	90.0	51.6	81.4
360.0	94.0	9.2	86.4	170.1	26.0	90.0	56.3	82.1

6.9.5 Thruster loss

Case 9 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.85	0.82
10.0	0.87	0.86	0.81
20.0	0.87	0.85	0.81
30.0	0.87	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.88	0.78	0.85
60.0	0.89	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.90	0.78	0.85
90.0	0.91	0.78	0.84
100.0	0.91	0.76	0.85
110.0	0.92	0.75	0.85
120.0	0.94	0.76	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.79	0.86
150.0	0.94	0.79	0.87
160.0	0.94	0.79	0.88
170.0	0.95	0.78	0.89
180.0	0.95	0.76	0.91
190.0	0.95	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.96	0.73	0.92
230.0	0.95	0.74	0.93
240.0	0.89	0.84	0.94
250.0	0.89	0.86	0.94
260.0	0.88	0.86	0.94
270.0	0.92	0.86	0.94
280.0	0.94	0.90	0.95
290.0	0.94	0.90	0.95
300.0	0.94	0.89	0.96
310.0	0.94	0.89	0.92
320.0	0.94	0.89	0.89
330.0	0.92	0.90	0.86
340.0	0.90	0.90	0.84
350.0	0.86	0.88	0.82
360.0	0.86	0.85	0.82

Preliminary Design, @IDR5

6.10 Case 10 - Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 4

6.10.1 Environment and thrust utilisation

Case 10 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	90.0	90.0	0.0	35.0	2.5	6.0	8.5	2.00	95.0
10.0	90.0	90.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	90.0	90.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	90.0	90.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	90.0	90.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	90.0	90.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	90.0	90.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	90.0	90.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	90.0	90.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	90.0	90.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	90.0	90.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	90.0	90.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	90.0	90.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	90.0	90.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	90.0	90.0	140.0	35.0	2.5	6.0	8.5	2.00	92.2
150.0	90.0	90.0	150.0	35.0	2.5	6.0	8.5	2.00	87.5
160.0	90.0	90.0	160.0	35.0	2.5	6.0	8.5	2.00	86.4
170.0	90.0	90.0	170.0	35.0	2.5	6.0	8.5	2.00	88.2
180.0	90.0	90.0	180.0	35.0	2.5	6.0	8.5	2.00	93.7
190.0	90.0	90.0	190.0	35.0	2.5	6.0	8.5	2.00	98.3
200.0	90.0	90.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	90.0	90.0	210.0	35.0	2.5	6.0	8.5	2.00	99.8
220.0	90.0	90.0	220.0	35.0	2.5	6.0	8.5	2.00	94.5
230.0	90.0	90.0	230.0	35.0	2.5	6.0	8.5	2.00	84.9
240.0	90.0	90.0	240.0	35.0	2.5	6.0	8.5	2.00	72.3
250.0	90.0	90.0	250.0	35.0	2.5	6.0	8.5	2.00	58.4
260.0	90.0	90.0	260.0	35.0	2.5	6.0	8.5	2.00	44.5
270.0	90.0	90.0	270.0	35.0	2.5	6.0	8.5	2.00	31.9
280.0	90.0	90.0	280.0	35.0	2.5	6.0	8.5	2.00	22.4
290.0	90.0	90.0	290.0	35.0	2.5	6.0	8.5	2.00	16.1
300.0	90.0	90.0	300.0	35.0	2.5	6.0	8.5	2.00	16.2
310.0	90.0	90.0	310.0	35.0	2.5	6.0	8.5	2.00	21.0
320.0	90.0	90.0	320.0	35.0	2.5	6.0	8.5	2.00	29.9
330.0	90.0	90.0	330.0	35.0	2.5	6.0	8.5	2.00	42.4
340.0	90.0	90.0	340.0	35.0	2.5	6.0	8.5	2.00	57.9
350.0	90.0	90.0	350.0	35.0	2.5	6.0	8.5	2.00	75.5
360.0	90.0	90.0	360.0	35.0	2.5	6.0	8.5	2.00	95.0

6.10.2 Relative contributions of force components

Case 10 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	50.6	28.2	0.6	0.0	20.6	100.0
10.0	46.7	26.0	8.2	0.0	19.0	100.0
20.0	43.2	24.1	15.1	0.0	17.6	100.0
30.0	40.0	22.2	21.5	0.0	16.3	100.0
40.0	36.9	20.5	27.5	0.0	15.0	100.0
50.0	34.3	19.0	32.7	0.0	13.9	100.0
60.0	32.1	17.8	37.0	0.0	13.0	100.0
70.0	30.5	16.9	40.1	0.0	12.4	100.0
80.0	29.6	16.4	42.1	0.0	12.0	100.0
90.0	29.2	16.2	42.7	0.0	11.9	100.0
100.0	29.6	16.4	42.1	0.0	12.0	100.0
110.0	30.5	16.9	40.2	0.0	12.4	100.0
120.0	32.1	17.8	37.1	0.0	13.0	100.0
130.0	34.3	19.0	32.8	0.0	13.9	100.0
140.0	37.0	20.4	27.6	0.0	15.0	100.0
150.0	40.0	22.1	21.6	0.0	16.3	100.0
160.0	43.4	23.9	15.1	0.0	17.6	100.0
170.0	46.9	25.9	8.2	0.0	19.1	100.0
180.0	50.8	28.0	0.5	0.0	20.7	100.0
190.0	55.4	30.5	-8.4	0.0	22.5	100.0
200.0	61.3	33.7	-20.0	0.0	25.0	100.0
210.0	69.4	38.2	-35.3	0.0	28.3	100.0
220.0	81.4	44.1	-58.8	0.0	33.1	100.0
230.0	93.1	53.9	-92.0	0.0	40.0	100.0
240.0	123.2	67.2	-139.2	0.0	49.8	100.0
250.0	153.6	84.5	-200.6	0.0	62.6	100.0
260.0	185.5	102.2	-263.2	0.0	75.5	100.0
270.0	199.6	111.1	-291.9	0.0	81.2	100.0
280.0	183.8	102.6	-261.4	0.0	75.0	100.0
290.0	152.0	85.0	-199.1	0.0	62.1	100.0
300.0	121.1	67.7	-138.3	0.0	49.5	100.0
310.0	97.3	54.4	-91.5	0.0	39.8	100.0
320.0	80.6	45.0	-58.5	0.0	32.9	100.0
330.0	69.1	38.5	-35.8	0.0	28.2	100.0
340.0	61.0	34.0	-19.9	0.0	24.9	100.0
350.0	55.1	30.7	-8.4	0.0	22.5	100.0
360.0	50.6	28.2	0.6	0.0	20.6	100.0

6.10.3 Environment forces

Case 10 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	-1.1	-3.6	0.0	-0.7	-5.4
10.0	0.0	-1.1	-3.6	0.0	-0.7	-5.4
20.0	0.0	-1.1	-3.5	0.0	-0.7	-5.3
30.0	0.0	-1.1	-3.2	0.0	-0.7	-5.0
40.0	0.0	-1.1	-2.8	0.0	-0.7	-4.6
50.0	0.0	-1.1	-2.3	0.0	-0.7	-4.1
60.0	0.0	-1.1	-1.6	0.0	-0.7	-3.5
70.0	0.0	-1.1	-0.9	0.0	-0.7	-2.7
80.0	0.0	-1.1	-0.1	0.0	-0.7	-1.9
90.0	0.0	-1.1	0.7	0.0	-0.7	-1.1
100.0	0.0	-1.1	1.5	0.0	0.7	1.2
110.0	0.0	-1.1	2.3	0.0	0.7	1.9
120.0	0.0	-1.1	3.0	0.0	0.7	2.6
130.0	0.0	-1.1	3.5	0.0	0.7	3.2
140.0	0.0	-1.1	4.0	0.0	0.7	3.6
150.0	0.0	-1.1	4.3	0.0	0.7	3.9
160.0	0.0	-1.1	4.4	0.0	0.7	4.1
170.0	0.0	-1.1	4.4	0.0	0.7	4.1
180.0	0.0	-1.1	4.3	0.0	0.7	3.9
190.0	0.0	-1.1	4.4	0.0	0.7	4.1
200.0	0.0	-1.1	4.4	0.0	0.7	4.1
210.0	0.0	-1.1	4.3	0.0	0.7	3.9
220.0	0.0	-1.1	4.0	0.0	0.7	3.6
230.0	0.0	-1.1	3.5	0.0	0.7	3.2
240.0	0.0	-1.1	3.0	0.0	0.7	2.6
250.0	0.0	-1.1	2.3	0.0	0.7	1.9
260.0	0.0	-1.1	1.5	0.0	0.7	1.2
270.0	0.0	-1.1	0.7	0.0	-0.7	-1.1
280.0	0.0	-1.1	-0.1	0.0	-0.7	-1.9
290.0	0.0	-1.1	-0.9	0.0	-0.7	-2.7
300.0	0.0	-1.1	-1.6	0.0	-0.7	-3.5
310.0	0.0	-1.1	-2.3	0.0	-0.7	-4.1
320.0	0.0	-1.1	-2.8	0.0	-0.7	-4.6
330.0	0.0	-1.1	-3.2	0.0	-0.7	-5.0
340.0	0.0	-1.1	-3.5	0.0	-0.7	-5.3
350.0	0.0	-1.1	-3.6	0.0	-0.7	-5.4
360.0	0.0	-1.1	-3.6	0.0	-0.7	-5.4

Case 10 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.4	-16.3	0.0	0.0	-11.9	-57.7
10.0	-29.4	-16.3	-4.8	0.0	-11.9	-62.5
20.0	-29.4	-16.3	-10.0	0.0	-11.9	-67.6
30.0	-29.4	-16.3	-15.6	0.0	-11.9	-73.3
40.0	-29.4	-16.3	-21.7	0.0	-11.9	-79.4
50.0	-29.4	-16.3	-28.0	0.0	-11.9	-85.6
60.0	-29.4	-16.3	-33.8	0.0	-11.9	-91.5
70.0	-29.4	-16.3	-38.7	0.0	-11.9	-96.3
80.0	-29.4	-16.3	-41.9	0.0	-11.9	-99.5
90.0	-29.4	-16.3	-43.0	0.0	-11.9	-100.6
100.0	-29.4	-16.3	-41.9	0.0	-11.9	-99.5
110.0	-29.4	-16.3	-38.7	0.0	-11.9	-96.3
120.0	-29.4	-16.3	-33.8	0.0	-11.9	-91.5
130.0	-29.4	-16.3	-28.0	0.0	-11.9	-85.6
140.0	-29.4	-16.3	-21.7	0.0	-11.9	-79.4
150.0	-29.4	-16.3	-15.6	0.0	-11.9	-73.3
160.0	-29.4	-16.3	-10.0	0.0	-11.9	-67.6
170.0	-29.4	-16.3	-4.8	0.0	-11.9	-62.5
180.0	-29.4	-16.3	0.0	0.0	-11.9	-57.7
190.0	-29.4	-16.3	4.8	0.0	-11.9	-52.8
200.0	-29.4	-16.3	10.0	0.0	-11.9	-47.7
210.0	-29.4	-16.3	15.6	0.0	-11.9	-42.0
220.0	-29.4	-16.3	21.7	0.0	-11.9	-35.9
230.0	-29.4	-16.3	28.0	0.0	-11.9	-29.7
240.0	-29.4	-16.3	33.8	0.0	-11.9	-23.8
250.0	-29.4	-16.3	38.7	0.0	-11.9	-19.0
260.0	-29.4	-16.3	41.9	0.0	-11.9	-15.8
270.0	-29.4	-16.3	43.0	0.0	-11.9	-14.7
280.0	-29.4	-16.3	41.9	0.0	-11.9	-15.8
290.0	-29.4	-16.3	38.7	0.0	-11.9	-19.0
300.0	-29.4	-16.3	33.8	0.0	-11.9	-23.8
310.0	-29.4	-16.3	28.0	0.0	-11.9	-29.7
320.0	-29.4	-16.3	21.7	0.0	-11.9	-35.9
330.0	-29.4	-16.3	15.6	0.0	-11.9	-42.0
340.0	-29.4	-16.3	10.0	0.0	-11.9	-47.7
350.0	-29.4	-16.3	4.8	0.0	-11.9	-52.8
360.0	-29.4	-16.3	0.0	0.0	-11.9	-57.7

Case 10 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-207.2	-3.8	0.0	0.0	-31.5	-242.5
10.0	-207.2	-3.8	-316.6	0.0	-31.5	-559.1
20.0	-207.2	-3.8	-593.0	0.0	-31.5	-835.5
30.0	-207.2	-3.8	-793.7	0.0	-31.5	-1036.2
40.0	-207.2	-3.8	-892.8	0.0	-31.5	-1135.3
50.0	-207.2	-3.8	-876.4	0.0	-31.5	-1118.9
60.0	-207.2	-3.8	-745.2	0.0	-31.5	-987.7
70.0	-207.2	-3.8	-513.8	0.0	-31.5	-756.3
80.0	-207.2	-3.8	-209.2	0.0	-31.5	-451.7
90.0	-207.2	-3.8	132.4	0.0	-31.5	-110.1
100.0	-207.2	-3.8	470.0	0.0	31.5	290.5
110.0	-207.2	-3.8	762.6	0.0	31.5	583.1
120.0	-207.2	-3.8	974.5	0.0	31.5	795.0
130.0	-207.2	-3.8	1079.2	0.0	31.5	889.8
140.0	-207.2	-3.8	1063.0	0.0	31.5	883.5
150.0	-207.2	-3.8	926.1	0.0	31.5	746.6
160.0	-207.2	-3.8	683.5	0.0	31.5	504.0
170.0	-207.2	-3.8	362.6	0.0	31.5	183.1
180.0	-207.2	-3.8	0.0	0.0	-31.5	-242.5
190.0	-207.2	-3.8	-362.6	0.0	-31.5	-605.1
200.0	-207.2	-3.8	-683.5	0.0	-31.5	-926.0
210.0	-207.2	-3.8	-926.1	0.0	-31.5	-1168.6
220.0	-207.2	-3.8	-1063.0	0.0	-31.5	-1305.5
230.0	-207.2	-3.8	-1079.2	0.0	-31.5	-1321.7
240.0	-207.2	-3.8	-974.5	0.0	-31.5	-1217.0
250.0	-207.2	-3.8	-762.6	0.0	-31.5	-1005.1
260.0	-207.2	-3.8	-470.0	0.0	-31.5	-712.5
270.0	-207.2	-3.8	-132.4	0.0	-31.5	-374.9
280.0	-207.2	-3.8	209.2	0.0	-31.5	-33.3
290.0	-207.2	-3.8	513.8	0.0	31.5	334.3
300.0	-207.2	-3.8	745.2	0.0	31.5	565.7
310.0	-207.2	-3.8	876.4	0.0	31.5	696.9
320.0	-207.2	-3.8	892.8	0.0	31.5	713.3
330.0	-207.2	-3.8	793.7	0.0	31.5	614.2
340.0	-207.2	-3.8	593.0	0.0	31.5	413.5
350.0	-207.2	-3.8	316.6	0.0	31.5	137.1
360.0	-207.2	-3.8	0.0	0.0	-31.5	-242.5

6.10.4 Thruster use

Case 10 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	89.3	10.3	83.9	169.2	26.0	90.0	57.9	84.6
10.0	97.3	0.3	96.4	164.0	25.7	90.0	52.9	85.0
20.0	95.9	12.3	88.2	180.0	25.8	90.0	46.5	83.3
30.0	92.3	9.8	88.1	180.0	26.0	90.0	41.8	86.0
40.0	91.3	8.7	87.9	180.0	26.4	90.0	40.2	86.6
50.0	90.8	9.1	87.7	180.0	27.0	90.0	41.4	87.2
60.0	91.0	11.2	87.5	180.0	27.8	90.0	45.5	87.8
70.0	91.5	14.1	87.3	180.0	27.4	90.0	49.7	88.4
80.0	92.8	17.9	87.2	180.0	27.1	90.0	55.6	88.9
90.0	94.9	22.1	87.2	180.0	26.9	90.0	62.5	89.3
100.0	95.4	27.3	85.7	180.0	26.9	90.0	70.6	90.7
110.0	96.5	31.0	84.3	180.0	27.0	90.0	76.7	91.1
120.0	97.0	33.8	83.0	180.0	27.3	90.0	81.2	91.6
130.0	96.5	35.3	81.9	180.0	27.3	90.0	83.2	92.1
140.0	69.4	24.0	71.1	160.5	27.4	90.0	79.5	92.6
150.0	54.3	27.2	56.2	158.2	27.6	90.0	73.4	93.1
160.0	48.9	26.2	51.2	159.3	28.0	90.0	67.8	93.4
170.0	51.3	21.4	54.1	163.5	28.4	90.0	62.6	93.7
180.0	64.5	14.3	67.7	169.1	28.9	90.0	57.1	93.9
190.0	76.0	10.1	79.6	172.4	28.9	90.0	53.0	94.4
200.0	77.6	12.8	79.7	180.0	29.0	90.0	46.4	94.9
210.0	77.3	9.1	80.2	180.0	29.1	90.0	41.5	95.4
220.0	64.4	3.3	68.0	177.6	29.3	90.0	36.1	95.7
230.0	37.5	0.0	40.7	169.0	29.6	90.0	29.8	96.1
240.0	6.3	333.1	2.6	197.8	29.3	90.0	23.9	96.2
250.0	5.3	332.8	7.0	199.5	23.8	90.0	19.1	95.8
260.0	3.9	341.2	5.0	193.7	18.2	90.0	15.8	94.2
270.0	3.8	340.7	2.7	166.4	13.3	90.0	14.7	85.6
280.0	4.0	43.6	3.2	119.8	9.6	90.0	15.9	83.0
290.0	7.4	87.9	4.9	60.2	7.3	90.0	19.2	81.8
300.0	10.2	90.8	7.2	60.2	7.4	90.0	24.1	81.7
310.0	12.7	91.4	8.9	60.2	9.3	90.0	29.9	82.1
320.0	18.3	58.0	10.2	119.8	11.5	90.0	36.2	82.6
330.0	19.1	56.0	11.4	119.8	16.4	90.0	42.3	83.2
340.0	18.7	52.6	12.1	119.8	22.3	90.0	48.0	83.6
350.0	34.2	22.6	29.4	152.6	26.2	90.0	53.1	84.1
360.0	89.3	10.3	83.9	169.2	26.0	90.0	57.9	84.6

6.10.5 Thruster loss

Case 10 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.85	0.82
10.0	0.87	0.86	0.81
20.0	0.86	0.79	0.81
30.0	0.86	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.88	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.90	0.78	0.85
90.0	0.90	0.78	0.84
100.0	0.91	0.76	0.85
110.0	0.92	0.75	0.85
120.0	0.93	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.79	0.86
150.0	0.94	0.79	0.87
160.0	0.94	0.79	0.88
170.0	0.95	0.78	0.89
180.0	0.95	0.76	0.91
190.0	0.96	0.75	0.91
200.0	0.95	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.96	0.74	0.92
230.0	0.96	0.78	0.93
240.0	0.90	0.83	0.94
250.0	0.89	0.84	0.94
260.0	0.89	0.84	0.94
270.0	0.94	0.85	0.94
280.0	0.94	0.90	0.95
290.0	0.95	0.90	0.95
300.0	0.94	0.89	0.96
310.0	0.94	0.89	0.92
320.0	0.94	0.90	0.89
330.0	0.93	0.90	0.86
340.0	0.91	0.90	0.84
350.0	0.87	0.89	0.82
360.0	0.86	0.85	0.82

Preliminary Design, @IDR5

6.11 Case 11 - Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 4

6.11.1 Environment and thrust utilisation

Case 11 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	100.0	100.0	0.0	35.0	2.5	6.0	8.5	2.00	87.7
10.0	100.0	100.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	100.0	100.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	100.0	100.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	100.0	100.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	100.0	100.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	100.0	100.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	100.0	100.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	100.0	100.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	100.0	100.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	100.0	100.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	100.0	100.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	100.0	100.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	100.0	100.0	130.0	35.0	2.5	6.0	8.5	2.00	94.2
140.0	100.0	100.0	140.0	35.0	2.5	6.0	8.5	2.00	85.2
150.0	100.0	100.0	150.0	35.0	2.5	6.0	8.5	2.00	79.5
160.0	100.0	100.0	160.0	35.0	2.5	6.0	8.5	2.00	79.2
170.0	100.0	100.0	170.0	35.0	2.5	6.0	8.5	2.00	81.1
180.0	100.0	100.0	180.0	35.0	2.5	6.0	8.5	2.00	86.8
190.0	100.0	100.0	190.0	35.0	2.5	6.0	8.5	2.00	91.3
200.0	100.0	100.0	200.0	35.0	2.5	6.0	8.5	2.00	93.9
210.0	100.0	100.0	210.0	35.0	2.5	6.0	8.5	2.00	92.9
220.0	100.0	100.0	220.0	35.0	2.5	6.0	8.5	2.00	87.6
230.0	100.0	100.0	230.0	35.0	2.5	6.0	8.5	2.00	78.1
240.0	100.0	100.0	240.0	35.0	2.5	6.0	8.5	2.00	65.5
250.0	100.0	100.0	250.0	35.0	2.5	6.0	8.5	2.00	51.6
260.0	100.0	100.0	260.0	35.0	2.5	6.0	8.5	2.00	37.8
270.0	100.0	100.0	270.0	35.0	2.5	6.0	8.5	2.00	25.5
280.0	100.0	100.0	280.0	35.0	2.5	6.0	8.5	2.00	14.4
290.0	100.0	100.0	290.0	35.0	2.5	6.0	8.5	2.00	9.7
300.0	100.0	100.0	300.0	35.0	2.5	6.0	8.5	2.00	10.6
310.0	100.0	100.0	310.0	35.0	2.5	6.0	8.5	2.00	15.1
320.0	100.0	100.0	320.0	35.0	2.5	6.0	8.5	2.00	22.9
330.0	100.0	100.0	330.0	35.0	2.5	6.0	8.5	2.00	35.0
340.0	100.0	100.0	340.0	35.0	2.5	6.0	8.5	2.00	50.3
350.0	100.0	100.0	350.0	35.0	2.5	6.0	8.5	2.00	67.6
360.0	100.0	100.0	360.0	35.0	2.5	6.0	8.5	2.00	87.7

6.11.2 Relative contributions of force components

Case 11 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	53.4	26.6	0.3	0.0	19.7	100.0
10.0	49.1	24.5	8.2	0.0	18.1	100.0
20.0	45.3	22.6	15.4	0.0	16.7	100.0
30.0	41.7	20.8	22.1	0.0	15.4	100.0
40.0	38.4	19.2	28.2	0.0	14.2	100.0
50.0	35.6	17.8	33.5	0.0	13.1	100.0
60.0	33.3	16.6	37.8	0.0	12.3	100.0
70.0	31.6	15.8	41.0	0.0	11.6	100.0
80.0	30.6	15.2	42.9	0.0	11.3	100.0
90.0	30.2	15.1	43.6	0.0	11.1	100.0
100.0	30.6	15.2	43.0	0.0	11.3	100.0
110.0	31.6	15.7	41.1	0.0	11.6	100.0
120.0	33.3	16.6	37.9	0.0	12.2	100.0
130.0	35.6	17.7	33.6	0.0	13.1	100.0
140.0	38.4	19.1	28.3	0.0	14.1	100.0
150.0	41.6	20.7	22.3	0.0	15.3	100.0
160.0	45.1	22.5	15.8	0.0	16.5	100.0
170.0	48.9	24.3	8.7	0.0	18.0	100.0
180.0	53.1	26.4	0.9	0.0	19.6	100.0
190.0	58.0	28.9	-8.2	0.0	21.4	100.0
200.0	64.3	32.0	-20.0	0.0	23.7	100.0
210.0	73.1	36.5	-36.4	0.0	26.9	100.0
220.0	85.7	42.1	-59.9	0.0	31.6	100.0
230.0	107.2	51.8	-94.4	0.0	38.4	100.0
240.0	130.7	64.9	-143.8	0.0	48.2	100.0
250.0	165.9	82.3	-209.4	0.0	61.1	100.0
260.0	203.8	101.0	-279.9	0.0	75.1	100.0
270.0	225.7	112.0	-320.9	0.0	83.2	100.0
280.0	213.1	105.9	-297.5	0.0	78.5	100.0
290.0	175.5	87.4	-227.6	0.0	64.6	100.0
300.0	137.0	68.3	-155.8	0.0	50.5	100.0
310.0	107.5	53.7	-101.0	0.0	39.7	100.0
320.0	87.6	43.7	-63.7	0.0	32.4	100.0
330.0	74.2	37.0	-38.7	0.0	27.4	100.0
340.0	65.0	32.5	-21.5	0.0	24.0	100.0
350.0	58.4	29.2	-9.2	0.0	21.6	100.0
360.0	53.4	26.6	0.3	0.0	19.7	100.0

6.11.3 Environment forces

Case 11 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	1.4	0.4	-3.6	0.0	-0.6	-2.3
10.0	1.4	0.4	-3.6	0.0	-0.6	-2.3
20.0	1.4	0.4	-3.5	0.0	-0.6	-2.2
30.0	1.4	0.4	-3.2	0.0	-0.6	-1.9
40.0	1.4	0.4	-2.8	0.0	-0.6	-1.5
50.0	1.4	0.4	-2.3	0.0	-0.6	-1.0
60.0	1.4	0.4	-1.6	0.0	0.6	0.7
70.0	1.4	0.4	-0.9	0.0	0.6	1.5
80.0	1.4	0.4	-0.1	0.0	0.6	2.3
90.0	1.4	0.4	0.7	0.0	0.6	3.1
100.0	1.4	0.4	1.5	0.0	0.6	3.9
110.0	1.4	0.4	2.3	0.0	0.6	4.6
120.0	1.4	0.4	3.0	0.0	0.6	5.3
130.0	1.4	0.4	3.5	0.0	0.6	5.9
140.0	1.4	0.4	4.0	0.0	0.6	6.3
150.0	1.4	0.4	4.3	0.0	0.6	6.6
160.0	1.4	0.4	4.4	0.0	0.6	6.8
170.0	1.4	0.4	4.4	0.0	0.6	6.8
180.0	1.4	0.4	4.3	0.0	0.6	6.7
190.0	1.4	0.4	4.4	0.0	0.6	6.8
200.0	1.4	0.4	4.4	0.0	0.6	6.8
210.0	1.4	0.4	4.3	0.0	0.6	6.6
220.0	1.4	0.4	4.0	0.0	0.6	6.3
230.0	1.4	0.4	3.5	0.0	0.6	5.9
240.0	1.4	0.4	3.0	0.0	0.6	5.3
250.0	1.4	0.4	2.3	0.0	0.6	4.6
260.0	1.4	0.4	1.5	0.0	0.6	3.9
270.0	1.4	0.4	0.7	0.0	0.6	3.1
280.0	1.4	0.4	-0.1	0.0	0.6	2.3
290.0	1.4	0.4	-0.9	0.0	0.6	1.5
300.0	1.4	0.4	-1.6	0.0	0.6	0.7
310.0	1.4	0.4	-2.3	0.0	-0.6	-1.0
320.0	1.4	0.4	-2.8	0.0	-0.6	-1.5
330.0	1.4	0.4	-3.2	0.0	-0.6	-1.9
340.0	1.4	0.4	-3.5	0.0	-0.6	-2.2
350.0	1.4	0.4	-3.6	0.0	-0.6	-2.3
360.0	1.4	0.4	-3.6	0.0	-0.6	-2.3

Case 11 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.8	-14.9	0.0	0.0	-11.0	-55.6
10.0	-29.8	-14.9	-4.8	0.0	-11.0	-60.4
20.0	-29.8	-14.9	-10.0	0.0	-11.0	-65.6
30.0	-29.8	-14.9	-15.6	0.0	-11.0	-71.2
40.0	-29.8	-14.9	-21.7	0.0	-11.0	-77.3
50.0	-29.8	-14.9	-28.0	0.0	-11.0	-83.6
60.0	-29.8	-14.9	-33.8	0.0	-11.0	-89.4
70.0	-29.8	-14.9	-38.7	0.0	-11.0	-94.3
80.0	-29.8	-14.9	-41.9	0.0	-11.0	-97.5
90.0	-29.8	-14.9	-43.0	0.0	-11.0	-98.6
100.0	-29.8	-14.9	-41.9	0.0	-11.0	-97.5
110.0	-29.8	-14.9	-38.7	0.0	-11.0	-94.3
120.0	-29.8	-14.9	-33.8	0.0	-11.0	-89.4
130.0	-29.8	-14.9	-28.0	0.0	-11.0	-83.6
140.0	-29.8	-14.9	-21.7	0.0	-11.0	-77.3
150.0	-29.8	-14.9	-15.6	0.0	-11.0	-71.2
160.0	-29.8	-14.9	-10.0	0.0	-11.0	-65.6
170.0	-29.8	-14.9	-4.8	0.0	-11.0	-60.4
180.0	-29.8	-14.9	0.0	0.0	-11.0	-55.6
190.0	-29.8	-14.9	4.8	0.0	-11.0	-50.7
200.0	-29.8	-14.9	10.0	0.0	-11.0	-45.6
210.0	-29.8	-14.9	15.6	0.0	-11.0	-39.9
220.0	-29.8	-14.9	21.7	0.0	-11.0	-33.8
230.0	-29.8	-14.9	28.0	0.0	-11.0	-27.6
240.0	-29.8	-14.9	33.8	0.0	-11.0	-21.7
250.0	-29.8	-14.9	38.7	0.0	-11.0	-16.9
260.0	-29.8	-14.9	41.9	0.0	-11.0	-13.7
270.0	-29.8	-14.9	43.0	0.0	-11.0	-12.6
280.0	-29.8	-14.9	41.9	0.0	-11.0	-13.7
290.0	-29.8	-14.9	38.7	0.0	-11.0	-16.9
300.0	-29.8	-14.9	33.8	0.0	-11.0	-21.7
310.0	-29.8	-14.9	28.0	0.0	-11.0	-27.6
320.0	-29.8	-14.9	21.7	0.0	-11.0	-33.8
330.0	-29.8	-14.9	15.6	0.0	-11.0	-39.9
340.0	-29.8	-14.9	10.0	0.0	-11.0	-45.6
350.0	-29.8	-14.9	4.8	0.0	-11.0	-50.7
360.0	-29.8	-14.9	0.0	0.0	-11.0	-55.6

Case 11 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-105.5	31.3	0.0	0.0	-32.0	-106.2
10.0	-105.5	31.3	-316.6	0.0	-32.0	-422.8
20.0	-105.5	31.3	-593.0	0.0	-32.0	-699.2
30.0	-105.5	31.3	-793.7	0.0	-32.0	-899.9
40.0	-105.5	31.3	-892.8	0.0	-32.0	-999.0
50.0	-105.5	31.3	-876.4	0.0	-32.0	-982.6
60.0	-105.5	31.3	-745.2	0.0	-32.0	-851.4
70.0	-105.5	31.3	-513.8	0.0	-32.0	-620.0
80.0	-105.5	31.3	-209.2	0.0	-32.0	-315.4
90.0	-105.5	31.3	132.4	0.0	32.0	90.1
100.0	-105.5	31.3	470.0	0.0	32.0	427.7
110.0	-105.5	31.3	762.6	0.0	32.0	720.3
120.0	-105.5	31.3	974.5	0.0	32.0	932.2
130.0	-105.5	31.3	1079.2	0.0	32.0	1027.0
140.0	-105.5	31.3	1063.0	0.0	32.0	1027.7
150.0	-105.5	31.3	926.1	0.0	32.0	833.8
160.0	-105.5	31.3	683.5	0.0	32.0	641.2
170.0	-105.5	31.3	362.6	0.0	32.0	320.3
180.0	-105.5	31.3	0.0	0.0	-32.0	-106.2
190.0	-105.5	31.3	-362.6	0.0	-32.0	-468.8
200.0	-105.5	31.3	-683.5	0.0	-32.0	-789.7
210.0	-105.5	31.3	-926.1	0.0	-32.0	-1032.3
220.0	-105.5	31.3	-1063.0	0.0	-32.0	-1169.2
230.0	-105.5	31.3	-1079.2	0.0	-32.0	-1185.4
240.0	-105.5	31.3	-974.5	0.0	-32.0	-1080.7
250.0	-105.5	31.3	-762.6	0.0	-32.0	-868.8
260.0	-105.5	31.3	-470.0	0.0	-32.0	-576.2
270.0	-105.5	31.3	-132.4	0.0	-32.0	-238.6
280.0	-105.5	31.3	209.2	0.0	32.0	166.9
290.0	-105.5	31.3	513.8	0.0	32.0	471.5
300.0	-105.5	31.3	745.2	0.0	32.0	702.9
310.0	-105.5	31.3	876.4	0.0	32.0	834.1
320.0	-105.5	31.3	892.8	0.0	32.0	850.5
330.0	-105.5	31.3	793.7	0.0	32.0	751.4
340.0	-105.5	31.3	593.0	0.0	32.0	550.7
350.0	-105.5	31.3	316.6	0.0	32.0	274.3
360.0	-105.5	31.3	0.0	0.0	-32.0	-106.2

6.11.4 Thruster use

Case 11 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	66.8	12.8	64.5	166.8	26.0	90.0	55.6	87.6
10.0	95.4	9.0	93.2	171.0	25.7	90.0	55.3	87.8
20.0	92.7	14.2	88.2	180.0	25.8	90.0	48.5	88.0
30.0	91.2	11.7	88.1	180.0	26.0	90.0	44.5	88.4
40.0	90.3	10.5	87.9	180.0	26.4	90.0	42.9	88.8
50.0	89.9	11.0	87.7	180.0	27.0	90.0	44.1	89.3
60.0	89.4	13.1	87.5	180.0	27.8	90.0	48.1	90.5
70.0	90.0	16.1	87.3	180.0	27.4	90.0	52.4	90.9
80.0	91.3	19.9	87.2	180.0	27.1	90.0	58.3	91.4
90.0	93.8	25.0	87.2	180.0	26.9	90.0	66.5	91.8
100.0	94.8	29.3	85.7	180.0	26.9	90.0	73.4	92.3
110.0	95.8	33.1	84.3	180.0	27.0	90.0	79.4	92.8
120.0	96.3	36.0	83.0	180.0	27.3	90.0	84.0	93.5
130.0	73.5	24.5	77.2	160.5	27.3	90.0	83.8	94.0
140.0	48.9	33.5	52.4	154.0	27.4	90.0	77.6	94.7
150.0	34.8	42.5	38.0	148.1	27.6	90.0	71.5	95.3
160.0	29.3	43.7	33.0	148.2	28.0	90.0	65.9	95.9
170.0	30.6	34.5	35.2	155.4	28.4	90.0	66.8	96.4
180.0	42.6	20.2	48.1	165.6	28.9	90.0	56.2	96.8
190.0	53.7	13.1	59.9	170.7	28.9	90.0	51.2	97.6
200.0	60.2	8.9	66.6	173.7	29.0	90.0	46.1	98.5
210.0	57.0	6.2	63.4	175.7	29.1	90.0	40.5	99.4
220.0	41.8	3.5	48.1	177.7	29.3	90.0	34.4	100.6
230.0	15.0	355.7	20.3	189.4	29.6	90.0	28.2	102.0
240.0	4.2	324.7	9.0	194.3	26.4	90.0	22.4	103.7
250.0	3.2	321.2	7.4	195.2	20.9	90.0	17.5	105.3
260.0	1.7	331.2	5.5	188.2	15.3	90.0	14.2	105.8
270.0	1.4	35.0	4.0	165.1	10.4	90.0	13.0	103.7
280.0	4.0	89.5	4.4	121.4	6.0	90.0	13.9	99.4
290.0	8.0	78.7	6.1	119.8	3.8	90.0	17.0	95.0
300.0	11.7	74.1	7.9	119.8	3.5	90.0	21.7	91.9
310.0	15.3	68.1	9.5	119.8	5.2	90.0	27.6	87.9
320.0	17.2	66.1	10.9	119.8	8.6	90.0	33.9	87.4
330.0	17.9	63.7	12.0	119.8	13.5	90.0	40.0	87.2
340.0	17.3	60.3	12.8	119.8	19.5	90.0	45.7	87.2
350.0	15.9	55.9	13.2	119.8	26.1	90.0	50.8	87.4
360.0	66.8	12.8	64.5	166.8	26.0	90.0	55.6	87.6

6.11.5 Thruster loss

Case 11 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.86	0.82
10.0	0.86	0.84	0.81
20.0	0.86	0.79	0.81
30.0	0.86	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.88	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.89	0.78	0.85
90.0	0.90	0.78	0.84
100.0	0.91	0.76	0.85
110.0	0.92	0.75	0.85
120.0	0.93	0.74	0.86
130.0	0.94	0.80	0.86
140.0	0.94	0.80	0.86
150.0	0.94	0.80	0.87
160.0	0.94	0.80	0.88
170.0	0.94	0.80	0.89
180.0	0.95	0.77	0.91
190.0	0.95	0.76	0.91
200.0	0.96	0.75	0.91
210.0	0.96	0.74	0.92
220.0	0.96	0.74	0.92
230.0	0.94	0.75	0.93
240.0	0.89	0.82	0.94
250.0	0.87	0.83	0.94
260.0	0.87	0.82	0.94
270.0	0.94	0.85	0.94
280.0	0.95	0.90	0.95
290.0	0.94	0.90	0.95
300.0	0.94	0.90	0.96
310.0	0.94	0.90	0.92
320.0	0.94	0.90	0.89
330.0	0.93	0.90	0.86
340.0	0.92	0.90	0.84
350.0	0.90	0.90	0.82
360.0	0.86	0.86	0.82

Preliminary Design, @IDR5

6.12 Case 12 - Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 4

6.12.1 Environment and thrust utilisation

Case 12 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	110.0	110.0	0.0	35.0	2.5	6.0	8.5	2.00	77.6
10.0	110.0	110.0	10.0	35.0	2.5	6.0	8.5	2.00	98.5
20.0	110.0	110.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	110.0	110.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	110.0	110.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	110.0	110.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	110.0	110.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	110.0	110.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	110.0	110.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	110.0	110.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	110.0	110.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	110.0	110.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	110.0	110.0	120.0	35.0	2.5	6.0	8.5	2.00	98.0
130.0	110.0	110.0	130.0	35.0	2.5	6.0	8.5	2.00	86.1
140.0	110.0	110.0	140.0	35.0	2.5	6.0	8.5	2.00	75.5
150.0	110.0	110.0	150.0	35.0	2.5	6.0	8.5	2.00	72.4
160.0	110.0	110.0	160.0	35.0	2.5	6.0	8.5	2.00	71.2
170.0	110.0	110.0	170.0	35.0	2.5	6.0	8.5	2.00	73.3
180.0	110.0	110.0	180.0	35.0	2.5	6.0	8.5	2.00	76.9
190.0	110.0	110.0	190.0	35.0	2.5	6.0	8.5	2.00	83.6
200.0	110.0	110.0	200.0	35.0	2.5	6.0	8.5	2.00	86.3
210.0	110.0	110.0	210.0	35.0	2.5	6.0	8.5	2.00	85.3
220.0	110.0	110.0	220.0	35.0	2.5	6.0	8.5	2.00	80.0
230.0	110.0	110.0	230.0	35.0	2.5	6.0	8.5	2.00	70.7
240.0	110.0	110.0	240.0	35.0	2.5	6.0	8.5	2.00	58.1
250.0	110.0	110.0	250.0	35.0	2.5	6.0	8.5	2.00	44.3
260.0	110.0	110.0	260.0	35.0	2.5	6.0	8.5	2.00	30.5
270.0	110.0	110.0	270.0	35.0	2.5	6.0	8.5	2.00	18.3
280.0	110.0	110.0	280.0	35.0	2.5	6.0	8.5	2.00	6.9
290.0	110.0	110.0	290.0	35.0	2.5	6.0	8.5	2.00	7.4
300.0	110.0	110.0	300.0	35.0	2.5	6.0	8.5	2.00	10.4
310.0	110.0	110.0	310.0	35.0	2.5	6.0	8.5	2.00	13.4
320.0	110.0	110.0	320.0	35.0	2.5	6.0	8.5	2.00	15.7
330.0	110.0	110.0	330.0	35.0	2.5	6.0	8.5	2.00	27.1
340.0	110.0	110.0	340.0	35.0	2.5	6.0	8.5	2.00	42.0
350.0	110.0	110.0	350.0	35.0	2.5	6.0	8.5	2.00	59.3
360.0	110.0	110.0	360.0	35.0	2.5	6.0	8.5	2.00	77.6

6.12.2 Relative contributions of force components

Case 12 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	57.9	24.1	-0.3	0.0	18.4	100.0
10.0	53.0	22.1	8.1	0.0	16.8	100.0
20.0	48.7	20.3	15.6	0.0	15.4	100.0
30.0	44.6	18.6	22.6	0.0	14.2	100.0
40.0	41.0	17.1	28.9	0.0	13.0	100.0
50.0	37.8	15.8	34.4	0.0	12.0	100.0
60.0	35.3	14.7	38.8	0.0	11.2	100.0
70.0	33.4	13.9	42.1	0.0	10.6	100.0
80.0	32.3	13.5	44.0	0.0	10.2	100.0
90.0	31.9	13.3	44.7	0.0	10.1	100.0
100.0	32.2	13.5	44.1	0.0	10.2	100.0
110.0	33.3	13.9	42.1	0.0	10.6	100.0
120.0	35.2	14.7	39.0	0.0	11.2	100.0
130.0	37.6	15.7	34.7	0.0	12.0	100.0
140.0	40.7	17.0	29.3	0.0	13.0	100.0
150.0	44.2	18.5	23.2	0.0	14.1	100.0
160.0	48.0	20.1	16.6	0.0	15.3	100.0
170.0	52.1	21.8	9.5	0.0	16.7	100.0
180.0	56.6	23.7	1.6	0.0	18.1	100.0
190.0	61.9	25.9	-7.6	0.0	19.8	100.0
200.0	68.7	28.8	-15.5	0.0	22.0	100.0
210.0	78.1	32.0	-36.0	0.0	25.1	100.0
220.0	91.5	38.1	-59.4	0.0	29.5	100.0
230.0	110.6	46.6	-92.9	0.0	35.8	100.0
240.0	133.6	57.7	-138.7	0.0	44.4	100.0
250.0	168.2	71.2	-194.4	0.0	55.0	100.0
260.0	199.3	84.6	-249.5	0.0	65.6	100.0
270.0	222.3	94.4	-289.9	0.0	73.1	100.0
280.0	224.5	95.0	-292.8	0.0	73.3	100.0
290.0	196.1	82.5	-242.0	0.0	63.4	100.0
300.0	155.5	65.2	-170.5	0.0	49.9	100.0
310.0	121.6	50.9	-111.3	0.0	38.8	100.0
320.0	98.0	40.9	-70.1	0.0	31.2	100.0
330.0	82.1	34.3	-42.4	0.0	26.1	100.0
340.0	71.3	29.7	-23.7	0.0	22.6	100.0
350.0	63.7	26.6	-10.4	0.0	20.2	100.0
360.0	57.9	24.1	-0.3	0.0	18.4	100.0

6.12.3 Environment forces

Case 12 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	3.0	1.6	-3.6	0.0	1.5	2.6
10.0	3.0	1.6	-3.6	0.0	1.5	2.6
20.0	3.0	1.6	-3.5	0.0	1.5	2.7
30.0	3.0	1.6	-3.2	0.0	1.5	3.0
40.0	3.0	1.6	-2.8	0.0	1.5	3.4
50.0	3.0	1.6	-2.3	0.0	1.5	3.9
60.0	3.0	1.6	-1.6	0.0	1.5	4.5
70.0	3.0	1.6	-0.9	0.0	1.5	5.3
80.0	3.0	1.6	-0.1	0.0	1.5	6.1
90.0	3.0	1.6	0.7	0.0	1.5	6.9
100.0	3.0	1.6	1.5	0.0	1.5	7.7
110.0	3.0	1.6	2.3	0.0	1.5	8.4
120.0	3.0	1.6	3.0	0.0	1.5	9.1
130.0	3.0	1.6	3.5	0.0	1.5	9.7
140.0	3.0	1.6	4.0	0.0	1.5	10.1
150.0	3.0	1.6	4.3	0.0	1.5	10.4
160.0	3.0	1.6	4.4	0.0	1.5	10.6
170.0	3.0	1.6	4.4	0.0	1.5	10.6
180.0	3.0	1.6	4.3	0.0	1.5	10.5
190.0	3.0	1.6	4.4	0.0	1.5	10.6
200.0	3.0	1.6	4.4	0.0	1.5	10.6
210.0	3.0	1.6	4.3	0.0	1.5	10.4
220.0	3.0	1.6	4.0	0.0	1.5	10.1
230.0	3.0	1.6	3.5	0.0	1.5	9.7
240.0	3.0	1.6	3.0	0.0	1.5	9.1
250.0	3.0	1.6	2.3	0.0	1.5	8.4
260.0	3.0	1.6	1.5	0.0	1.5	7.7
270.0	3.0	1.6	0.7	0.0	1.5	6.9
280.0	3.0	1.6	-0.1	0.0	1.5	6.1
290.0	3.0	1.6	-0.9	0.0	1.5	5.3
300.0	3.0	1.6	-1.6	0.0	1.5	4.5
310.0	3.0	1.6	-2.3	0.0	1.5	3.9
320.0	3.0	1.6	-2.8	0.0	1.5	3.4
330.0	3.0	1.6	-3.2	0.0	1.5	3.0
340.0	3.0	1.6	-3.5	0.0	1.5	2.7
350.0	3.0	1.6	-3.6	0.0	1.5	2.6
360.0	3.0	1.6	-3.6	0.0	1.5	2.6

Case 12 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.5	-12.7	0.0	0.0	-9.6	-52.8
10.0	-30.5	-12.7	-4.8	0.0	-9.6	-57.7
20.0	-30.5	-12.7	-10.0	0.0	-9.6	-62.8
30.0	-30.5	-12.7	-15.6	0.0	-9.6	-68.5
40.0	-30.5	-12.7	-21.7	0.0	-9.6	-74.6
50.0	-30.5	-12.7	-28.0	0.0	-9.6	-80.8
60.0	-30.5	-12.7	-33.8	0.0	-9.6	-86.7
70.0	-30.5	-12.7	-38.7	0.0	-9.6	-91.5
80.0	-30.5	-12.7	-41.9	0.0	-9.6	-94.7
90.0	-30.5	-12.7	-43.0	0.0	-9.6	-95.8
100.0	-30.5	-12.7	-41.9	0.0	-9.6	-94.7
110.0	-30.5	-12.7	-38.7	0.0	-9.6	-91.5
120.0	-30.5	-12.7	-33.8	0.0	-9.6	-86.7
130.0	-30.5	-12.7	-28.0	0.0	-9.6	-80.8
140.0	-30.5	-12.7	-21.7	0.0	-9.6	-74.6
150.0	-30.5	-12.7	-15.6	0.0	-9.6	-68.5
160.0	-30.5	-12.7	-10.0	0.0	-9.6	-62.8
170.0	-30.5	-12.7	-4.8	0.0	-9.6	-57.7
180.0	-30.5	-12.7	0.0	0.0	-9.6	-52.8
190.0	-30.5	-12.7	4.8	0.0	-9.6	-48.0
200.0	-30.5	-12.7	10.0	0.0	-9.6	-42.8
210.0	-30.5	-12.7	15.6	0.0	-9.6	-37.2
220.0	-30.5	-12.7	21.7	0.0	-9.6	-31.1
230.0	-30.5	-12.7	28.0	0.0	-9.6	-24.8
240.0	-30.5	-12.7	33.8	0.0	-9.6	-19.0
250.0	-30.5	-12.7	38.7	0.0	-9.6	-14.2
260.0	-30.5	-12.7	41.9	0.0	-9.6	-11.0
270.0	-30.5	-12.7	43.0	0.0	-9.6	-9.8
280.0	-30.5	-12.7	41.9	0.0	-9.6	-11.0
290.0	-30.5	-12.7	38.7	0.0	-9.6	-14.2
300.0	-30.5	-12.7	33.8	0.0	-9.6	-19.0
310.0	-30.5	-12.7	28.0	0.0	-9.6	-24.8
320.0	-30.5	-12.7	21.7	0.0	-9.6	-31.1
330.0	-30.5	-12.7	15.6	0.0	-9.6	-37.2
340.0	-30.5	-12.7	10.0	0.0	-9.6	-42.8
350.0	-30.5	-12.7	4.8	0.0	-9.6	-48.0
360.0	-30.5	-12.7	0.0	0.0	-9.6	-52.8

Case 12 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-1.5	61.0	0.0	0.0	34.1	93.6
10.0	-1.5	61.0	-316.6	0.0	-34.1	-291.2
20.0	-1.5	61.0	-593.0	0.0	-34.1	-567.6
30.0	-1.5	61.0	-793.7	0.0	-34.1	-768.3
40.0	-1.5	61.0	-892.8	0.0	-34.1	-867.4
50.0	-1.5	61.0	-876.4	0.0	-34.1	-851.0
60.0	-1.5	61.0	-745.2	0.0	-34.1	-719.8
70.0	-1.5	61.0	-513.8	0.0	-34.1	-488.4
80.0	-1.5	61.0	-209.2	0.0	-34.1	-183.8
90.0	-1.5	61.0	132.4	0.0	34.1	226.0
100.0	-1.5	61.0	470.0	0.0	34.1	563.6
110.0	-1.5	61.0	762.6	0.0	34.1	856.3
120.0	-1.5	61.0	974.5	0.0	34.1	1068.2
130.0	-1.5	61.0	1079.2	0.0	34.1	1172.9
140.0	-1.5	61.0	1063.0	0.0	34.1	1155.6
150.0	-1.5	61.0	926.1	0.0	34.1	1019.7
160.0	-1.5	61.0	683.5	0.0	34.1	777.2
170.0	-1.5	61.0	362.6	0.0	34.1	456.2
180.0	-1.5	61.0	0.0	0.0	34.1	93.6
190.0	-1.5	61.0	-362.6	0.0	-34.1	-337.2
200.0	-1.5	61.0	-683.5	0.0	-34.1	-658.1
210.0	-1.5	61.0	-926.1	0.0	-34.1	-900.7
220.0	-1.5	61.0	-1063.0	0.0	-34.1	-1037.6
230.0	-1.5	61.0	-1079.2	0.0	-34.1	-1053.8
240.0	-1.5	61.0	-974.5	0.0	-34.1	-949.1
250.0	-1.5	61.0	-762.6	0.0	-34.1	-737.2
260.0	-1.5	61.0	-470.0	0.0	-34.1	-444.6
270.0	-1.5	61.0	-132.4	0.0	-34.1	-107.0
280.0	-1.5	61.0	209.2	0.0	34.1	302.9
290.0	-1.5	61.0	513.8	0.0	34.1	607.5
300.0	-1.5	61.0	745.2	0.0	34.1	838.9
310.0	-1.5	61.0	876.4	0.0	34.1	970.1
320.0	-1.5	61.0	892.8	0.0	34.1	986.4
330.0	-1.5	61.0	793.7	0.0	34.1	887.3
340.0	-1.5	61.0	593.0	0.0	34.1	686.6
350.0	-1.5	61.0	316.6	0.0	34.1	410.3
360.0	-1.5	61.0	0.0	0.0	34.1	93.6

6.12.4 Thruster use

Case 12 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	35.4	22.0	37.9	159.0	26.0	90.0	52.9	92.8
10.0	91.7	10.1	94.2	170.3	25.7	90.0	57.7	92.6
20.0	89.6	16.2	88.2	180.0	25.8	90.0	50.9	92.5
30.0	88.5	13.6	88.1	180.0	26.0	90.0	46.9	92.5
40.0	87.9	12.5	87.9	180.0	26.4	90.0	45.4	92.6
50.0	87.6	12.9	87.7	180.0	27.0	90.0	46.7	92.8
60.0	87.8	15.1	87.5	180.0	27.8	90.0	50.7	93.1
70.0	88.5	18.1	87.3	180.0	27.4	90.0	55.0	93.4
80.0	89.8	22.0	87.2	180.0	27.1	90.0	60.9	93.7
90.0	92.3	27.2	87.2	180.0	26.9	90.0	69.2	94.2
100.0	93.3	31.6	85.7	180.0	26.9	90.0	76.1	94.7
110.0	94.2	35.6	84.3	180.0	27.0	90.0	82.2	95.3
120.0	82.2	23.0	89.1	162.1	27.3	90.0	87.2	96.0
130.0	50.1	35.2	56.3	154.0	27.3	90.0	81.4	96.8
140.0	29.2	59.4	33.3	138.6	27.4	90.0	75.3	97.7
150.0	21.7	88.5	22.2	119.8	27.5	90.0	69.3	98.7
160.0	18.6	90.1	20.0	121.9	27.3	90.0	63.7	99.6
170.0	15.5	88.8	17.7	128.2	28.3	90.0	58.6	100.4
180.0	15.2	57.4	21.7	149.3	28.9	90.0	53.7	101.2
190.0	28.7	21.5	38.3	167.1	28.9	90.0	49.2	102.5
200.0	34.8	12.9	44.9	172.2	29.0	90.0	44.1	103.9
210.0	31.4	8.3	41.7	175.1	29.1	90.0	38.6	105.7
220.0	16.2	3.5	26.3	173.3	29.3	90.0	32.7	108.1
230.0	2.0	306.9	11.0	187.6	27.9	90.0	26.7	111.3
240.0	2.1	299.8	10.1	192.4	23.1	90.0	21.1	115.7
250.0	1.6	246.2	8.0	195.8	17.7	90.0	16.5	120.8
260.0	1.4	207.1	6.5	184.8	12.1	90.0	13.4	125.1
270.0	2.4	144.8	5.1	165.3	7.2	90.0	12.0	125.0
280.0	5.1	122.9	5.2	129.4	2.7	90.0	12.5	119.0
290.0	7.9	103.9	6.8	119.8	0.6	90.0	15.1	110.5
300.0	11.1	91.2	8.7	119.8	0.3	90.0	19.5	103.5
310.0	13.8	84.7	10.4	119.8	2.0	90.0	25.2	98.9
320.0	15.5	80.6	11.9	119.8	5.4	90.0	31.3	96.2
330.0	16.0	77.4	13.0	119.8	10.3	90.0	37.3	94.6
340.0	15.2	74.4	13.7	119.8	16.3	90.0	42.9	93.6
350.0	13.5	70.9	14.1	119.8	23.0	90.0	48.1	93.1
360.0	35.4	22.0	37.9	159.0	26.0	90.0	52.9	92.8

6.12.5 Thruster loss

Case 12 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.88	0.82
10.0	0.86	0.84	0.81
20.0	0.86	0.79	0.81
30.0	0.86	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.87	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.88	0.78	0.86
80.0	0.89	0.78	0.85
90.0	0.90	0.78	0.84
100.0	0.90	0.76	0.85
110.0	0.91	0.75	0.85
120.0	0.94	0.80	0.86
130.0	0.94	0.80	0.86
140.0	0.92	0.81	0.86
150.0	0.89	0.82	0.87
160.0	0.90	0.83	0.88
170.0	0.92	0.83	0.89
180.0	0.94	0.81	0.91
190.0	0.95	0.77	0.91
200.0	0.95	0.76	0.91
210.0	0.96	0.74	0.92
220.0	0.96	0.73	0.92
230.0	0.87	0.78	0.93
240.0	0.85	0.81	0.94
250.0	0.81	0.83	0.94
260.0	0.83	0.79	0.94
270.0	0.83	0.85	0.94
280.0	0.94	0.90	0.95
290.0	0.95	0.90	0.95
300.0	0.94	0.90	0.96
310.0	0.94	0.90	0.92
320.0	0.94	0.90	0.89
330.0	0.94	0.90	0.86
340.0	0.93	0.90	0.84
350.0	0.92	0.90	0.82
360.0	0.86	0.88	0.82

Preliminary Design, @IDR5

6.13 Case 13 - Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 4

6.13.1 Environment and thrust utilisation

Case 13 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	120.0	120.0	0.0	35.0	2.5	6.0	8.5	2.00	67.5
10.0	120.0	120.0	10.0	35.0	2.5	6.0	8.5	2.00	89.9
20.0	120.0	120.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	120.0	120.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	120.0	120.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	120.0	120.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	120.0	120.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	120.0	120.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	120.0	120.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	120.0	120.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	120.0	120.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	120.0	120.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	120.0	120.0	120.0	35.0	2.5	6.0	8.5	2.00	85.2
130.0	120.0	120.0	130.0	35.0	2.5	6.0	8.5	2.00	74.1
140.0	120.0	120.0	140.0	35.0	2.5	6.0	8.5	2.00	65.3
150.0	120.0	120.0	150.0	35.0	2.5	6.0	8.5	2.00	61.2
160.0	120.0	120.0	160.0	35.0	2.5	6.0	8.5	2.00	60.0
170.0	120.0	120.0	170.0	35.0	2.5	6.0	8.5	2.00	62.2
180.0	120.0	120.0	180.0	35.0	2.5	6.0	8.5	2.00	66.2
190.0	120.0	120.0	190.0	35.0	2.5	6.0	8.5	2.00	74.2
200.0	120.0	120.0	200.0	35.0	2.5	6.0	8.5	2.00	76.7
210.0	120.0	120.0	210.0	35.0	2.5	6.0	8.5	2.00	75.8
220.0	120.0	120.0	220.0	35.0	2.5	6.0	8.5	2.00	70.6
230.0	120.0	120.0	230.0	35.0	2.5	6.0	8.5	2.00	61.3
240.0	120.0	120.0	240.0	35.0	2.5	6.0	8.5	2.00	49.0
250.0	120.0	120.0	250.0	35.0	2.5	6.0	8.5	2.00	35.1
260.0	120.0	120.0	260.0	35.0	2.5	6.0	8.5	2.00	7.2
270.0	120.0	120.0	270.0	35.0	2.5	6.0	8.5	2.00	21.4
280.0	120.0	120.0	280.0	35.0	2.5	6.0	8.5	2.00	30.7
290.0	120.0	120.0	290.0	35.0	2.5	6.0	8.5	2.00	12.5
300.0	120.0	120.0	300.0	35.0	2.5	6.0	8.5	2.00	13.6
310.0	120.0	120.0	310.0	35.0	2.5	6.0	8.5	2.00	11.9
320.0	120.0	120.0	320.0	35.0	2.5	6.0	8.5	2.00	14.1
330.0	120.0	120.0	330.0	35.0	2.5	6.0	8.5	2.00	17.2
340.0	120.0	120.0	340.0	35.0	2.5	6.0	8.5	2.00	31.2
350.0	120.0	120.0	350.0	35.0	2.5	6.0	8.5	2.00	48.4
360.0	120.0	120.0	360.0	35.0	2.5	6.0	8.5	2.00	67.5

6.13.2 Relative contributions of force components

Case 13 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	63.6	20.7	-0.9	0.0	16.7	100.0
10.0	57.9	18.8	8.2	0.0	15.2	100.0
20.0	52.8	17.1	16.3	0.0	13.8	100.0
30.0	48.1	15.6	23.6	0.0	12.6	100.0
40.0	44.0	14.2	30.3	0.0	11.5	100.0
50.0	40.4	13.1	36.0	0.0	10.6	100.0
60.0	37.5	12.1	40.5	0.0	9.8	100.0
70.0	35.4	11.5	43.8	0.0	9.3	100.0
80.0	34.1	11.1	45.8	0.0	9.0	100.0
90.0	33.7	10.9	46.5	0.0	8.9	100.0
100.0	34.1	11.1	45.9	0.0	9.0	100.0
110.0	35.3	11.5	43.9	0.0	9.3	100.0
120.0	37.3	12.1	40.7	0.0	9.8	100.0
130.0	40.0	13.1	36.3	0.0	10.6	100.0
140.0	43.4	14.2	30.9	0.0	11.5	100.0
150.0	47.2	15.5	24.7	0.0	12.6	100.0
160.0	51.4	16.9	17.9	0.0	13.8	100.0
170.0	56.0	18.5	10.6	0.0	15.0	100.0
180.0	61.0	20.2	2.4	0.0	16.4	100.0
190.0	66.8	22.1	-7.0	0.0	18.1	100.0
200.0	74.2	24.7	-15.1	0.0	20.2	100.0
210.0	84.2	28.2	-35.5	0.0	23.1	100.0
220.0	97.9	33.1	-58.1	0.0	27.1	100.0
230.0	113.8	39.6	-87.9	0.0	32.6	100.0
240.0	131.9	47.0	-120.9	0.0	38.9	100.0
250.0	147.2	52.7	-143.9	0.0	44.0	100.0
260.0	-106.8	-28.3	188.3	0.0	46.8	100.0
270.0	-121.9	-33.7	206.6	0.0	49.0	100.0
280.0	-131.1	-36.0	213.6	0.0	53.5	100.0
290.0	194.8	68.1	-219.4	0.0	56.4	100.0
300.0	173.6	58.9	-180.9	0.0	48.3	100.0
310.0	139.6	46.5	-124.0	0.0	37.9	100.0
320.0	111.9	36.9	-78.8	0.0	30.0	100.0
330.0	92.7	30.4	-47.7	0.0	24.6	100.0
340.0	79.7	26.0	-26.7	0.0	21.1	100.0
350.0	70.5	22.9	-12.0	0.0	18.6	100.0
360.0	63.6	20.7	-0.9	0.0	16.7	100.0

6.13.3 Environment forces

Case 13 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	4.8	2.6	-3.6	0.0	2.4	6.3
10.0	4.8	2.6	-3.6	0.0	2.4	6.3
20.0	4.8	2.6	-3.5	0.0	2.4	6.4
30.0	4.8	2.6	-3.2	0.0	2.4	6.7
40.0	4.8	2.6	-2.8	0.0	2.4	7.1
50.0	4.8	2.6	-2.3	0.0	2.4	7.6
60.0	4.8	2.6	-1.6	0.0	2.4	8.2
70.0	4.8	2.6	-0.9	0.0	2.4	9.0
80.0	4.8	2.6	-0.1	0.0	2.4	9.8
90.0	4.8	2.6	0.7	0.0	2.4	10.6
100.0	4.8	2.6	1.5	0.0	2.4	11.4
110.0	4.8	2.6	2.3	0.0	2.4	12.1
120.0	4.8	2.6	3.0	0.0	2.4	12.8
130.0	4.8	2.6	3.5	0.0	2.4	13.4
140.0	4.8	2.6	4.0	0.0	2.4	13.8
150.0	4.8	2.6	4.3	0.0	2.4	14.1
160.0	4.8	2.6	4.4	0.0	2.4	14.3
170.0	4.8	2.6	4.4	0.0	2.4	14.3
180.0	4.8	2.6	4.3	0.0	2.4	14.2
190.0	4.8	2.6	4.4	0.0	2.4	14.3
200.0	4.8	2.6	4.4	0.0	2.4	14.3
210.0	4.8	2.6	4.3	0.0	2.4	14.1
220.0	4.8	2.6	4.0	0.0	2.4	13.8
230.0	4.8	2.6	3.5	0.0	2.4	13.4
240.0	4.8	2.6	3.0	0.0	2.4	12.8
250.0	4.8	2.6	2.3	0.0	2.4	12.1
260.0	4.8	2.6	1.5	0.0	2.4	11.4
270.0	4.8	2.6	0.7	0.0	2.4	10.6
280.0	4.8	2.6	-0.1	0.0	2.4	9.8
290.0	4.8	2.6	-0.9	0.0	2.4	9.0
300.0	4.8	2.6	-1.6	0.0	2.4	8.2
310.0	4.8	2.6	-2.3	0.0	2.4	7.6
320.0	4.8	2.6	-2.8	0.0	2.4	7.1
330.0	4.8	2.6	-3.2	0.0	2.4	6.7
340.0	4.8	2.6	-3.5	0.0	2.4	6.4
350.0	4.8	2.6	-3.6	0.0	2.4	6.3
360.0	4.8	2.6	-3.6	0.0	2.4	6.3

Case 13 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.7	-9.8	0.0	0.0	-7.9	-48.4
10.0	-30.7	-9.8	-4.8	0.0	-7.9	-53.2
20.0	-30.7	-9.8	-10.0	0.0	-7.9	-58.4
30.0	-30.7	-9.8	-15.6	0.0	-7.9	-64.0
40.0	-30.7	-9.8	-21.7	0.0	-7.9	-70.1
50.0	-30.7	-9.8	-28.0	0.0	-7.9	-76.4
60.0	-30.7	-9.8	-33.8	0.0	-7.9	-82.2
70.0	-30.7	-9.8	-38.7	0.0	-7.9	-87.1
80.0	-30.7	-9.8	-41.9	0.0	-7.9	-90.3
90.0	-30.7	-9.8	-43.0	0.0	-7.9	-91.4
100.0	-30.7	-9.8	-41.9	0.0	-7.9	-90.3
110.0	-30.7	-9.8	-38.7	0.0	-7.9	-87.1
120.0	-30.7	-9.8	-33.8	0.0	-7.9	-82.2
130.0	-30.7	-9.8	-28.0	0.0	-7.9	-76.4
140.0	-30.7	-9.8	-21.7	0.0	-7.9	-70.1
150.0	-30.7	-9.8	-15.6	0.0	-7.9	-64.0
160.0	-30.7	-9.8	-10.0	0.0	-7.9	-58.4
170.0	-30.7	-9.8	-4.8	0.0	-7.9	-53.2
180.0	-30.7	-9.8	0.0	0.0	-7.9	-48.4
190.0	-30.7	-9.8	4.8	0.0	-7.9	-43.6
200.0	-30.7	-9.8	10.0	0.0	-7.9	-38.4
210.0	-30.7	-9.8	15.6	0.0	-7.9	-32.8
220.0	-30.7	-9.8	21.7	0.0	-7.9	-26.7
230.0	-30.7	-9.8	28.0	0.0	-7.9	-20.4
240.0	-30.7	-9.8	33.8	0.0	-7.9	-14.6
250.0	-30.7	-9.8	38.7	0.0	-7.9	-9.7
260.0	-30.7	-9.8	41.9	0.0	7.9	9.3
270.0	-30.7	-9.8	43.0	0.0	7.9	10.4
280.0	-30.7	-9.8	41.9	0.0	7.9	9.3
290.0	-30.7	-9.8	38.7	0.0	-7.9	-9.7
300.0	-30.7	-9.8	33.8	0.0	-7.9	-14.6
310.0	-30.7	-9.8	28.0	0.0	-7.9	-20.4
320.0	-30.7	-9.8	21.7	0.0	-7.9	-26.7
330.0	-30.7	-9.8	15.6	0.0	-7.9	-32.8
340.0	-30.7	-9.8	10.0	0.0	-7.9	-38.4
350.0	-30.7	-9.8	4.8	0.0	-7.9	-43.6
360.0	-30.7	-9.8	0.0	0.0	-7.9	-48.4

Case 13 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	105.7	85.4	0.0	0.0	53.5	244.6
10.0	105.7	85.4	-316.6	0.0	-53.5	-179.0
20.0	105.7	85.4	-593.0	0.0	-53.5	-455.3
30.0	105.7	85.4	-793.7	0.0	-53.5	-656.1
40.0	105.7	85.4	-892.8	0.0	-53.5	-755.2
50.0	105.7	85.4	-876.4	0.0	-53.5	-738.8
60.0	105.7	85.4	-745.2	0.0	-53.5	-607.6
70.0	105.7	85.4	-513.8	0.0	-53.5	-376.2
80.0	105.7	85.4	-209.2	0.0	-53.5	-71.6
90.0	105.7	85.4	132.4	0.0	53.5	377.0
100.0	105.7	85.4	470.0	0.0	53.5	714.6
110.0	105.7	85.4	762.6	0.0	53.5	1007.3
120.0	105.7	85.4	974.5	0.0	53.5	1219.1
130.0	105.7	85.4	1079.2	0.0	53.5	1335.9
140.0	105.7	85.4	1063.0	0.0	53.5	1307.6
150.0	105.7	85.4	926.1	0.0	53.5	1170.1
160.0	105.7	85.4	683.5	0.0	53.5	928.1
170.0	105.7	85.4	362.6	0.0	53.5	607.2
180.0	105.7	85.4	0.0	0.0	53.5	244.6
190.0	105.7	85.4	-362.6	0.0	-53.5	-225.0
200.0	105.7	85.4	-683.5	0.0	-53.5	-545.9
210.0	105.7	85.4	-926.1	0.0	-53.5	-788.5
220.0	105.7	85.4	-1063.0	0.0	-53.5	-925.3
230.0	105.7	85.4	-1079.2	0.0	-53.5	-941.6
240.0	105.7	85.4	-974.5	0.0	-53.5	-836.9
250.0	105.7	85.4	-762.6	0.0	-53.5	-625.0
260.0	105.7	85.4	-470.0	0.0	-53.5	-332.4
270.0	105.7	85.4	-132.4	0.0	53.5	112.2
280.0	105.7	85.4	209.2	0.0	53.5	453.8
290.0	105.7	85.4	513.8	0.0	53.5	758.5
300.0	105.7	85.4	745.2	0.0	53.5	989.8
310.0	105.7	85.4	876.4	0.0	53.5	1121.0
320.0	105.7	85.4	892.8	0.0	53.5	1137.4
330.0	105.7	85.4	793.7	0.0	53.5	1038.3
340.0	105.7	85.4	593.0	0.0	53.5	837.6
350.0	105.7	85.4	316.6	0.0	53.5	561.2
360.0	105.7	85.4	0.0	0.0	53.5	244.6

6.13.4 Thruster use

Case 13 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	12.0	75.2	14.8	129.2	25.3	90.0	48.8	97.4
10.0	61.0	13.1	67.1	168.2	25.7	90.0	53.6	96.7
20.0	86.6	18.2	88.2	180.0	25.8	90.0	53.1	96.4
30.0	86.0	15.4	88.1	180.0	26.0	90.0	49.2	96.0
40.0	85.6	14.2	87.9	180.0	26.4	90.0	47.7	95.9
50.0	85.5	14.7	87.7	180.0	27.0	90.0	48.9	95.8
60.0	85.8	16.9	87.5	180.0	27.8	90.0	53.0	95.8
70.0	86.6	20.0	87.3	180.0	27.4	90.0	57.3	96.0
80.0	87.9	24.0	87.2	180.0	27.1	90.0	63.2	96.3
90.0	90.7	29.7	87.2	180.0	26.9	90.0	72.3	96.7
100.0	91.6	34.4	85.7	180.0	26.9	90.0	79.2	97.3
110.0	92.4	38.5	84.3	180.0	27.0	90.0	85.4	98.0
120.0	50.7	35.4	59.9	154.7	27.3	90.0	83.2	98.9
130.0	26.4	75.7	30.8	130.3	27.3	90.0	77.5	99.9
140.0	24.1	93.9	24.5	119.8	24.8	90.0	71.5	101.2
150.0	21.5	97.7	22.6	119.8	23.1	90.0	65.6	102.5
160.0	18.7	99.5	20.5	123.2	22.8	90.0	60.1	103.8
170.0	15.6	100.0	18.2	129.5	23.8	90.0	55.1	105.0
180.0	12.2	100.0	16.2	138.0	25.5	90.0	50.7	106.3
190.0	8.1	99.1	14.8	151.7	28.5	90.0	45.9	108.2
200.0	6.0	59.7	17.8	166.1	29.0	90.0	41.0	110.4
210.0	2.0	83.9	14.4	173.5	29.1	90.0	35.7	113.3
220.0	1.5	195.7	12.4	181.7	27.4	90.0	30.0	117.4
230.0	2.3	229.4	12.0	189.2	23.9	90.0	24.4	123.3
240.0	3.1	227.4	11.9	192.0	19.1	90.0	19.4	131.4
250.0	3.5	213.8	9.4	191.9	13.6	90.0	15.6	141.3
260.0	6.8	211.7	7.1	215.2	-1.3	90.0	14.7	219.3
270.0	7.1	191.4	3.9	202.1	-7.6	90.0	14.9	224.6
280.0	7.1	173.3	2.3	155.9	-11.2	90.0	13.5	223.6
290.0	9.1	126.4	7.2	119.8	-3.8	90.0	13.2	132.7
300.0	11.5	109.2	9.0	119.8	-4.1	90.0	16.7	119.5
310.0	13.7	99.5	10.7	119.8	-2.4	90.0	21.8	110.4
320.0	15.1	93.8	12.2	119.8	1.0	90.0	27.6	104.8
330.0	15.3	90.2	13.3	119.8	5.9	90.0	33.4	101.5
340.0	14.4	87.9	13.9	119.8	11.9	90.0	38.9	99.5
350.0	12.8	85.0	14.3	121.1	18.5	90.0	44.0	98.2
360.0	12.0	75.2	14.8	129.2	25.3	90.0	48.8	97.4

6.13.5 Thruster loss

Case 13 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.91	0.90	0.82
10.0	0.86	0.85	0.81
20.0	0.85	0.79	0.81
30.0	0.86	0.78	0.82
40.0	0.86	0.78	0.83
50.0	0.87	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.88	0.78	0.86
80.0	0.89	0.78	0.85
90.0	0.89	0.78	0.84
100.0	0.90	0.76	0.85
110.0	0.91	0.75	0.85
120.0	0.93	0.81	0.86
130.0	0.88	0.81	0.86
140.0	0.87	0.81	0.86
150.0	0.88	0.82	0.87
160.0	0.89	0.82	0.88
170.0	0.90	0.83	0.89
180.0	0.92	0.83	0.91
190.0	0.93	0.81	0.91
200.0	0.94	0.78	0.91
210.0	0.94	0.75	0.92
220.0	0.78	0.73	0.92
230.0	0.81	0.73	0.93
240.0	0.81	0.81	0.94
250.0	0.82	0.82	0.94
260.0	0.83	0.86	0.85
270.0	0.82	0.87	0.84
280.0	0.83	0.88	0.85
290.0	0.95	0.90	0.86
300.0	0.95	0.90	0.87
310.0	0.94	0.90	0.85
320.0	0.94	0.90	0.89
330.0	0.94	0.90	0.86
340.0	0.94	0.90	0.84
350.0	0.93	0.90	0.82
360.0	0.91	0.90	0.82

Preliminary Design, @IDR5

6.14 Case 14 - Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 4

6.14.1 Environment and thrust utilisation

Case 14 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	130.0	130.0	0.0	35.0	2.5	6.0	8.5	2.00	55.9
10.0	130.0	130.0	10.0	35.0	2.5	6.0	8.5	2.00	78.8
20.0	130.0	130.0	20.0	35.0	2.5	6.0	8.5	2.00	96.1
30.0	130.0	130.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	130.0	130.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	130.0	130.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	130.0	130.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	130.0	130.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	130.0	130.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	130.0	130.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	130.0	130.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	130.0	130.0	110.0	35.0	2.5	6.0	8.5	2.00	90.3
120.0	130.0	130.0	120.0	35.0	2.5	6.0	8.5	2.00	75.3
130.0	130.0	130.0	130.0	35.0	2.5	6.0	8.5	2.00	62.7
140.0	130.0	130.0	140.0	35.0	2.5	6.0	8.5	2.00	53.8
150.0	130.0	130.0	150.0	35.0	2.5	6.0	8.5	2.00	48.9
160.0	130.0	130.0	160.0	35.0	2.5	6.0	8.5	2.00	48.1
170.0	130.0	130.0	170.0	35.0	2.5	6.0	8.5	2.00	51.2
180.0	130.0	130.0	180.0	35.0	2.5	6.0	8.5	2.00	55.0
190.0	130.0	130.0	190.0	35.0	2.5	6.0	8.5	2.00	63.6
200.0	130.0	130.0	200.0	35.0	2.5	6.0	8.5	2.00	66.2
210.0	130.0	130.0	210.0	35.0	2.5	6.0	8.5	2.00	65.4
220.0	130.0	130.0	220.0	35.0	2.5	6.0	8.5	2.00	60.3
230.0	130.0	130.0	230.0	35.0	2.5	6.0	8.5	2.00	51.1
240.0	130.0	130.0	240.0	35.0	2.5	6.0	8.5	2.00	38.7
250.0	130.0	130.0	250.0	35.0	2.5	6.0	8.5	2.00	9.2
260.0	130.0	130.0	260.0	35.0	2.5	6.0	8.5	2.00	12.3
270.0	130.0	130.0	270.0	35.0	2.5	6.0	8.5	2.00	29.1
280.0	130.0	130.0	280.0	35.0	2.5	6.0	8.5	2.00	38.4
290.0	130.0	130.0	290.0	35.0	2.5	6.0	8.5	2.00	43.1
300.0	130.0	130.0	300.0	35.0	2.5	6.0	8.5	2.00	22.8
310.0	130.0	130.0	310.0	35.0	2.5	6.0	8.5	2.00	18.9
320.0	130.0	130.0	320.0	35.0	2.5	6.0	8.5	2.00	14.0
330.0	130.0	130.0	330.0	35.0	2.5	6.0	8.5	2.00	14.1
340.0	130.0	130.0	340.0	35.0	2.5	6.0	8.5	2.00	20.3
350.0	130.0	130.0	350.0	35.0	2.5	6.0	8.5	2.00	37.0
360.0	130.0	130.0	360.0	35.0	2.5	6.0	8.5	2.00	55.9

6.14.2 Relative contributions of force components

Case 14 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	67.6	18.3	-1.5	0.0	15.6	100.0
10.0	60.9	16.5	8.6	0.0	14.0	100.0
20.0	55.0	14.9	17.4	0.0	12.7	100.0
30.0	49.8	13.4	25.4	0.0	11.4	100.0
40.0	45.1	12.2	32.4	0.0	10.4	100.0
50.0	41.1	11.1	38.3	0.0	9.4	100.0
60.0	38.0	10.2	43.0	0.0	8.7	100.0
70.0	35.8	9.6	46.4	0.0	8.2	100.0
80.0	34.4	9.3	48.4	0.0	7.9	100.0
90.0	33.9	9.2	49.1	0.0	7.8	100.0
100.0	34.4	9.3	48.5	0.0	7.9	100.0
110.0	35.6	9.6	46.5	0.0	8.2	100.0
120.0	37.8	10.2	43.2	0.0	8.7	100.0
130.0	40.7	11.1	38.7	0.0	9.4	100.0
140.0	44.4	12.1	33.1	0.0	10.3	100.0
150.0	48.6	13.3	26.7	0.0	11.1	100.0
160.0	53.3	14.6	19.6	0.0	12.5	100.0
170.0	58.3	16.1	11.9	0.0	13.7	100.0
180.0	63.9	17.7	3.3	0.0	15.1	100.0
190.0	70.3	19.6	-6.6	0.0	16.7	100.0
200.0	78.4	22.0	-13.1	0.0	18.8	100.0
210.0	89.1	25.2	-35.3	0.0	21.6	100.0
220.0	102.7	29.1	-57.4	0.0	25.2	100.0
230.0	118.6	34.2	-80.2	0.0	29.4	100.0
240.0	129.6	36.8	-89.2	0.0	31.8	100.0
250.0	-58.9	-10.5	136.0	0.0	33.3	100.0
260.0	-81.2	-17.4	164.0	0.0	34.5	100.0
270.0	-91.0	-20.3	175.8	0.0	35.4	100.0
280.0	-96.9	-21.5	180.2	0.0	38.1	100.0
290.0	-93.7	-19.2	170.0	0.0	42.9	100.0
300.0	178.2	52.6	-176.1	0.0	45.3	100.0
310.0	157.6	44.7	-140.6	0.0	38.3	100.0
320.0	126.5	35.2	-91.8	0.0	30.1	100.0
330.0	103.0	28.3	-55.5	0.0	24.2	100.0
340.0	87.0	23.7	-31.0	0.0	20.3	100.0
350.0	75.8	20.6	-14.0	0.0	17.6	100.0
360.0	67.6	18.3	-1.5	0.0	15.6	100.0

6.14.3 Environment forces

Case 14 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	6.5	2.7	-3.6	0.0	2.4	8.1
10.0	6.5	2.7	-3.6	0.0	2.4	8.1
20.0	6.5	2.7	-3.5	0.0	2.4	8.2
30.0	6.5	2.7	-3.2	0.0	2.4	8.5
40.0	6.5	2.7	-2.8	0.0	2.4	8.9
50.0	6.5	2.7	-2.3	0.0	2.4	9.4
60.0	6.5	2.7	-1.6	0.0	2.4	10.1
70.0	6.5	2.7	-0.9	0.0	2.4	10.8
80.0	6.5	2.7	-0.1	0.0	2.4	11.6
90.0	6.5	2.7	0.7	0.0	2.4	12.4
100.0	6.5	2.7	1.5	0.0	2.4	13.2
110.0	6.5	2.7	2.3	0.0	2.4	14.0
120.0	6.5	2.7	3.0	0.0	2.4	14.6
130.0	6.5	2.7	3.5	0.0	2.4	15.2
140.0	6.5	2.7	4.0	0.0	2.4	15.7
150.0	6.5	2.7	4.3	0.0	2.4	16.0
160.0	6.5	2.7	4.4	0.0	2.4	16.1
170.0	6.5	2.7	4.4	0.0	2.4	16.1
180.0	6.5	2.7	4.3	0.0	2.4	16.0
190.0	6.5	2.7	4.4	0.0	2.4	16.1
200.0	6.5	2.7	4.4	0.0	2.4	16.1
210.0	6.5	2.7	4.3	0.0	2.4	16.0
220.0	6.5	2.7	4.0	0.0	2.4	15.7
230.0	6.5	2.7	3.5	0.0	2.4	15.2
240.0	6.5	2.7	3.0	0.0	2.4	14.6
250.0	6.5	2.7	2.3	0.0	2.4	14.0
260.0	6.5	2.7	1.5	0.0	2.4	13.2
270.0	6.5	2.7	0.7	0.0	2.4	12.4
280.0	6.5	2.7	-0.1	0.0	2.4	11.6
290.0	6.5	2.7	-0.9	0.0	2.4	10.8
300.0	6.5	2.7	-1.6	0.0	2.4	10.1
310.0	6.5	2.7	-2.3	0.0	2.4	9.4
320.0	6.5	2.7	-2.8	0.0	2.4	8.9
330.0	6.5	2.7	-3.2	0.0	2.4	8.5
340.0	6.5	2.7	-3.5	0.0	2.4	8.2
350.0	6.5	2.7	-3.6	0.0	2.4	8.1
360.0	6.5	2.7	-3.6	0.0	2.4	8.1

Case 14 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-28.8	-7.6	0.0	0.0	-6.5	-43.0
10.0	-28.8	-7.6	-4.8	0.0	-6.5	-47.8
20.0	-28.8	-7.6	-10.0	0.0	-6.5	-53.0
30.0	-28.8	-7.6	-15.6	0.0	-6.5	-58.6
40.0	-28.8	-7.6	-21.7	0.0	-6.5	-64.7
50.0	-28.8	-7.6	-28.0	0.0	-6.5	-71.0
60.0	-28.8	-7.6	-33.8	0.0	-6.5	-76.8
70.0	-28.8	-7.6	-38.7	0.0	-6.5	-81.6
80.0	-28.8	-7.6	-41.9	0.0	-6.5	-84.8
90.0	-28.8	-7.6	-43.0	0.0	-6.5	-86.0
100.0	-28.8	-7.6	-41.9	0.0	-6.5	-84.8
110.0	-28.8	-7.6	-38.7	0.0	-6.5	-81.6
120.0	-28.8	-7.6	-33.8	0.0	-6.5	-76.8
130.0	-28.8	-7.6	-28.0	0.0	-6.5	-71.0
140.0	-28.8	-7.6	-21.7	0.0	-6.5	-64.7
150.0	-28.8	-7.6	-15.6	0.0	-6.5	-58.6
160.0	-28.8	-7.6	-10.0	0.0	-6.5	-53.0
170.0	-28.8	-7.6	-4.8	0.0	-6.5	-47.8
180.0	-28.8	-7.6	0.0	0.0	-6.5	-43.0
190.0	-28.8	-7.6	4.8	0.0	-6.5	-38.1
200.0	-28.8	-7.6	10.0	0.0	-6.5	-33.0
210.0	-28.8	-7.6	15.6	0.0	-6.5	-27.3
220.0	-28.8	-7.6	21.7	0.0	-6.5	-21.2
230.0	-28.8	-7.6	28.0	0.0	-6.5	-15.0
240.0	-28.8	-7.6	33.8	0.0	-6.5	-9.1
250.0	-28.8	-7.6	38.7	0.0	6.5	8.7
260.0	-28.8	-7.6	41.9	0.0	6.5	11.9
270.0	-28.8	-7.6	43.0	0.0	6.5	13.0
280.0	-28.8	-7.6	41.9	0.0	6.5	11.9
290.0	-28.8	-7.6	38.7	0.0	6.5	8.7
300.0	-28.8	-7.6	33.8	0.0	-6.5	-9.1
310.0	-28.8	-7.6	28.0	0.0	-6.5	-15.0
320.0	-28.8	-7.6	21.7	0.0	-6.5	-21.2
330.0	-28.8	-7.6	15.6	0.0	-6.5	-27.3
340.0	-28.8	-7.6	10.0	0.0	-6.5	-33.0
350.0	-28.8	-7.6	4.8	0.0	-6.5	-38.1
360.0	-28.8	-7.6	0.0	0.0	-6.5	-43.0

Case 14 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	200.3	87.3	0.0	0.0	62.5	350.0
10.0	200.3	87.3	-316.6	0.0	-62.5	-91.6
20.0	200.3	87.3	-593.0	0.0	-62.5	-368.0
30.0	200.3	87.3	-793.7	0.0	-62.5	-568.7
40.0	200.3	87.3	-892.8	0.0	-62.5	-667.8
50.0	200.3	87.3	-876.4	0.0	-62.5	-651.4
60.0	200.3	87.3	-745.2	0.0	-62.5	-520.2
70.0	200.3	87.3	-513.8	0.0	-62.5	-288.8
80.0	200.3	87.3	-209.2	0.0	62.5	140.8
90.0	200.3	87.3	132.4	0.0	62.5	482.4
100.0	200.3	87.3	470.0	0.0	62.5	820.0
110.0	200.3	87.3	762.6	0.0	62.5	1112.6
120.0	200.3	87.3	974.5	0.0	62.5	1324.5
130.0	200.3	87.3	1079.2	0.0	62.5	1429.3
140.0	200.3	87.3	1063.0	0.0	62.5	1413.0
150.0	200.3	87.3	926.1	0.0	62.5	1276.1
160.0	200.3	87.3	683.5	0.0	62.5	1033.5
170.0	200.3	87.3	362.6	0.0	62.5	712.6
180.0	200.3	87.3	0.0	0.0	62.5	350.0
190.0	200.3	87.3	-362.6	0.0	-62.5	-137.6
200.0	200.3	87.3	-683.5	0.0	-62.5	-458.5
210.0	200.3	87.3	-926.1	0.0	-62.5	-701.1
220.0	200.3	87.3	-1063.0	0.0	-62.5	-838.0
230.0	200.3	87.3	-1079.2	0.0	-62.5	-854.2
240.0	200.3	87.3	-974.5	0.0	-62.5	-749.5
250.0	200.3	87.3	-762.6	0.0	-62.5	-537.6
260.0	200.3	87.3	-470.0	0.0	-62.5	-245.0
270.0	200.3	87.3	-132.4	0.0	62.5	217.6
280.0	200.3	87.3	209.2	0.0	62.5	559.2
290.0	200.3	87.3	513.8	0.0	62.5	863.8
300.0	200.3	87.3	745.2	0.0	62.5	1095.2
310.0	200.3	87.3	876.4	0.0	62.5	1226.4
320.0	200.3	87.3	892.8	0.0	62.5	1242.8
330.0	200.3	87.3	793.7	0.0	62.5	1143.7
340.0	200.3	87.3	593.0	0.0	62.5	943.0
350.0	200.3	87.3	316.6	0.0	62.5	666.6
360.0	200.3	87.3	0.0	0.0	62.5	350.0

6.14.4 Thruster use

Case 14 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	11.3	85.2	14.1	129.7	20.8	90.0	43.7	100.7
10.0	29.6	21.7	37.3	162.6	25.7	90.0	48.5	99.6
20.0	75.2	10.5	83.2	170.7	25.8	90.0	53.6	98.8
30.0	84.3	16.9	88.1	180.0	26.0	90.0	51.0	98.4
40.0	84.1	15.6	87.9	180.0	26.4	90.0	49.5	97.9
50.0	84.2	16.1	87.7	180.0	27.0	90.0	50.8	97.7
60.0	84.5	18.3	87.5	180.0	27.8	90.0	54.8	97.6
70.0	85.3	21.4	87.3	180.0	27.4	90.0	59.1	97.7
80.0	87.6	27.2	87.2	180.0	27.1	90.0	67.7	97.9
90.0	89.6	31.6	87.2	180.0	26.9	90.0	74.6	98.4
100.0	90.6	36.3	85.7	180.0	26.9	90.0	81.5	99.0
110.0	57.3	30.4	68.4	158.0	27.0	90.0	82.8	99.7
120.0	26.9	73.2	32.7	133.2	27.3	90.0	78.2	100.8
130.0	25.1	95.8	25.5	119.8	23.8	90.0	72.6	102.1
140.0	23.8	98.9	24.1	119.8	20.3	90.0	66.6	103.6
150.0	21.3	103.3	22.2	119.8	18.6	90.0	60.7	105.2
160.0	18.6	105.9	20.0	123.4	18.3	90.0	55.3	106.9
170.0	15.5	107.7	17.8	129.8	19.3	90.0	50.4	108.6
180.0	12.2	109.7	15.9	138.5	21.0	90.0	45.1	110.4
190.0	8.0	113.9	14.4	153.1	24.3	90.0	41.4	112.9
200.0	5.1	126.0	13.6	164.7	25.5	90.0	36.7	116.0
210.0	3.4	158.4	12.9	175.2	25.0	90.0	31.7	120.3
220.0	3.2	197.3	12.6	181.2	23.1	90.0	26.4	126.4
230.0	4.0	215.6	12.2	181.8	19.6	90.0	21.4	135.4
240.0	4.8	216.2	11.7	194.8	14.8	90.0	17.3	148.1
250.0	7.9	219.5	9.5	213.8	1.6	90.0	16.5	211.9
260.0	8.2	207.4	7.3	213.9	-4.0	90.0	17.8	222.0
270.0	3.6	188.4	4.1	199.1	-10.4	90.0	18.0	226.4
280.0	9.3	173.7	2.6	155.2	-14.0	90.0	16.6	225.7
290.0	10.0	154.9	3.5	119.8	-16.0	90.0	13.9	218.9
300.0	11.9	119.5	8.4	119.8	-8.6	90.0	13.6	137.8
310.0	13.8	108.5	10.2	119.8	-6.9	90.0	17.7	122.2
320.0	14.9	102.0	11.6	119.8	-3.5	90.0	23.0	112.7
330.0	15.0	98.3	12.7	119.8	1.4	90.0	28.6	107.2
340.0	14.0	96.4	13.4	119.8	7.4	90.0	34.0	104.0
350.0	12.3	94.9	13.7	120.9	14.1	90.0	39.0	102.0
360.0	11.3	85.2	14.1	129.7	20.8	90.0	43.7	100.7

6.14.5 Thruster loss

Case 14 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.93	0.90	0.82
10.0	0.85	0.87	0.81
20.0	0.86	0.84	0.81
30.0	0.86	0.78	0.82
40.0	0.86	0.78	0.83
50.0	0.87	0.78	0.85
60.0	0.87	0.78	0.87
70.0	0.88	0.78	0.86
80.0	0.88	0.78	0.85
90.0	0.89	0.78	0.84
100.0	0.90	0.76	0.85
110.0	0.92	0.81	0.85
120.0	0.87	0.81	0.86
130.0	0.86	0.81	0.86
140.0	0.87	0.81	0.86
150.0	0.87	0.82	0.87
160.0	0.88	0.82	0.88
170.0	0.89	0.83	0.89
180.0	0.90	0.83	0.91
190.0	0.91	0.81	0.91
200.0	0.91	0.79	0.91
210.0	0.85	0.74	0.92
220.0	0.79	0.75	0.92
230.0	0.81	0.80	0.93
240.0	0.81	0.82	0.94
250.0	0.82	0.86	0.94
260.0	0.83	0.86	0.85
270.0	0.81	0.87	0.84
280.0	0.83	0.88	0.85
290.0	0.92	0.90	0.86
300.0	0.95	0.90	0.87
310.0	0.95	0.90	0.85
320.0	0.94	0.90	0.83
330.0	0.94	0.90	0.86
340.0	0.94	0.90	0.84
350.0	0.94	0.90	0.82
360.0	0.93	0.90	0.82

Preliminary Design, @IDR5

6.15 Case 15 - Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 4

6.15.1 Environment and thrust utilisation

Case 15 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	140.0	140.0	0.0	35.0	2.5	6.0	8.5	2.00	41.3
10.0	140.0	140.0	10.0	35.0	2.5	6.0	8.5	2.00	60.2
20.0	140.0	140.0	20.0	35.0	2.5	6.0	8.5	2.00	82.1
30.0	140.0	140.0	30.0	35.0	2.5	6.0	8.5	2.00	97.2
40.0	140.0	140.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	140.0	140.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	140.0	140.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	140.0	140.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	140.0	140.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	140.0	140.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	140.0	140.0	100.0	35.0	2.5	6.0	8.5	2.00	90.0
110.0	140.0	140.0	110.0	35.0	2.5	6.0	8.5	2.00	75.5
120.0	140.0	140.0	120.0	35.0	2.5	6.0	8.5	2.00	60.6
130.0	140.0	140.0	130.0	35.0	2.5	6.0	8.5	2.00	48.8
140.0	140.0	140.0	140.0	35.0	2.5	6.0	8.5	2.00	40.0
150.0	140.0	140.0	150.0	35.0	2.5	6.0	8.5	2.00	35.1
160.0	140.0	140.0	160.0	35.0	2.5	6.0	8.5	2.00	34.1
170.0	140.0	140.0	170.0	35.0	2.5	6.0	8.5	2.00	36.6
180.0	140.0	140.0	180.0	35.0	2.5	6.0	8.5	2.00	41.3
190.0	140.0	140.0	190.0	35.0	2.5	6.0	8.5	2.00	50.3
200.0	140.0	140.0	200.0	35.0	2.5	6.0	8.5	2.00	52.9
210.0	140.0	140.0	210.0	35.0	2.5	6.0	8.5	2.00	52.1
220.0	140.0	140.0	220.0	35.0	2.5	6.0	8.5	2.00	47.0
230.0	140.0	140.0	230.0	35.0	2.5	6.0	8.5	2.00	38.1
240.0	140.0	140.0	240.0	35.0	2.5	6.0	8.5	2.00	11.4
250.0	140.0	140.0	250.0	35.0	2.5	6.0	8.5	2.00	10.2
260.0	140.0	140.0	260.0	35.0	2.5	6.0	8.5	2.00	22.0
270.0	140.0	140.0	270.0	35.0	2.5	6.0	8.5	2.00	39.0
280.0	140.0	140.0	280.0	35.0	2.5	6.0	8.5	2.00	48.2
290.0	140.0	140.0	290.0	35.0	2.5	6.0	8.5	2.00	52.8
300.0	140.0	140.0	300.0	35.0	2.5	6.0	8.5	2.00	52.6
310.0	140.0	140.0	310.0	35.0	2.5	6.0	8.5	2.00	32.8
320.0	140.0	140.0	320.0	35.0	2.5	6.0	8.5	2.00	24.3
330.0	140.0	140.0	330.0	35.0	2.5	6.0	8.5	2.00	15.3
340.0	140.0	140.0	340.0	35.0	2.5	6.0	8.5	2.00	12.1
350.0	140.0	140.0	350.0	35.0	2.5	6.0	8.5	2.00	23.0
360.0	140.0	140.0	360.0	35.0	2.5	6.0	8.5	2.00	41.5

6.15.2 Relative contributions of force components

Case 15 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	70.5	17.0	-2.6	0.0	15.1	100.0
10.0	62.3	15.0	9.5	0.0	13.3	100.0
20.0	55.3	13.2	19.7	0.0	11.7	100.0
30.0	49.2	11.7	28.7	0.0	10.4	100.0
40.0	43.9	10.4	36.4	0.0	9.3	100.0
50.0	39.5	9.4	42.7	0.0	8.3	100.0
60.0	36.2	8.6	47.6	0.0	7.6	100.0
70.0	33.8	8.0	51.1	0.0	7.1	100.0
80.0	32.4	7.7	53.1	0.0	6.8	100.0
90.0	31.9	7.6	53.8	0.0	6.7	100.0
100.0	32.4	7.7	53.1	0.0	6.8	100.0
110.0	33.7	8.1	51.1	0.0	7.1	100.0
120.0	36.0	8.6	47.7	0.0	7.6	100.0
130.0	39.1	9.4	43.1	0.0	8.4	100.0
140.0	43.1	10.4	37.2	0.0	9.2	100.0
150.0	47.7	11.6	30.4	0.0	10.3	100.0
160.0	52.8	13.0	22.7	0.0	11.5	100.0
170.0	58.4	14.5	14.4	0.0	12.8	100.0
180.0	64.7	16.1	5.0	0.0	14.2	100.0
190.0	71.6	18.1	-5.6	0.0	15.9	100.0
200.0	80.0	20.5	-18.4	0.0	18.0	100.0
210.0	89.7	23.4	-33.7	0.0	20.5	100.0
220.0	97.8	26.1	-46.7	0.0	23.0	100.0
230.0	97.1	26.5	-40.5	0.0	22.9	100.0
240.0	-27.6	-1.3	104.2	0.0	24.7	100.0
250.0	-50.3	-7.8	133.4	0.0	24.7	100.0
260.0	-59.2	-10.6	146.0	0.0	23.8	100.0
270.0	-63.7	-11.9	151.9	0.0	23.7	100.0
280.0	-67.7	-12.6	155.1	0.0	25.3	100.0
290.0	-70.5	-12.4	154.1	0.0	28.8	100.0
300.0	-60.6	-8.2	134.8	0.0	34.1	100.0
310.0	152.3	42.2	-131.1	0.0	36.7	100.0
320.0	143.6	37.1	-113.2	0.0	32.5	100.0
330.0	116.6	29.1	-71.4	0.0	25.7	100.0
340.0	95.6	23.5	-39.8	0.0	20.7	100.0
350.0	81.0	19.7	-18.1	0.0	17.4	100.0
360.0	70.5	17.0	-2.6	0.0	15.1	100.0

6.15.3 Environment forces

Case 15 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	7.8	2.9	-3.6	0.0	2.4	9.5
10.0	7.8	2.9	-3.6	0.0	2.4	9.5
20.0	7.8	2.9	-3.5	0.0	2.4	9.6
30.0	7.8	2.9	-3.2	0.0	2.4	9.9
40.0	7.8	2.9	-2.8	0.0	2.4	10.3
50.0	7.8	2.9	-2.3	0.0	2.4	10.8
60.0	7.8	2.9	-1.6	0.0	2.4	11.5
70.0	7.8	2.9	-0.9	0.0	2.4	12.2
80.0	7.8	2.9	-0.1	0.0	2.4	13.0
90.0	7.8	2.9	0.7	0.0	2.4	13.8
100.0	7.8	2.9	1.5	0.0	2.4	14.6
110.0	7.8	2.9	2.3	0.0	2.4	15.4
120.0	7.8	2.9	3.0	0.0	2.4	16.0
130.0	7.8	2.9	3.5	0.0	2.4	16.6
140.0	7.8	2.9	4.0	0.0	2.4	17.1
150.0	7.8	2.9	4.3	0.0	2.4	17.4
160.0	7.8	2.9	4.4	0.0	2.4	17.5
170.0	7.8	2.9	4.4	0.0	2.4	17.5
180.0	7.8	2.9	4.3	0.0	2.4	17.4
190.0	7.8	2.9	4.4	0.0	2.4	17.5
200.0	7.8	2.9	4.4	0.0	2.4	17.5
210.0	7.8	2.9	4.3	0.0	2.4	17.4
220.0	7.8	2.9	4.0	0.0	2.4	17.1
230.0	7.8	2.9	3.5	0.0	2.4	16.6
240.0	7.8	2.9	3.0	0.0	2.4	16.0
250.0	7.8	2.9	2.3	0.0	2.4	15.4
260.0	7.8	2.9	1.5	0.0	2.4	14.6
270.0	7.8	2.9	0.7	0.0	2.4	13.8
280.0	7.8	2.9	-0.1	0.0	2.4	13.0
290.0	7.8	2.9	-0.9	0.0	2.4	12.2
300.0	7.8	2.9	-1.6	0.0	2.4	11.5
310.0	7.8	2.9	-2.3	0.0	2.4	10.8
320.0	7.8	2.9	-2.8	0.0	2.4	10.3
330.0	7.8	2.9	-3.2	0.0	2.4	9.9
340.0	7.8	2.9	-3.5	0.0	2.4	9.6
350.0	7.8	2.9	-3.6	0.0	2.4	9.5
360.0	7.8	2.9	-3.6	0.0	2.4	9.5

Case 15 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-24.2	-5.6	0.0	0.0	-5.0	-34.7
10.0	-24.2	-5.6	-4.8	0.0	-5.0	-39.6
20.0	-24.2	-5.6	-10.0	0.0	-5.0	-44.7
30.0	-24.2	-5.6	-15.6	0.0	-5.0	-50.4
40.0	-24.2	-5.6	-21.7	0.0	-5.0	-56.5
50.0	-24.2	-5.6	-28.0	0.0	-5.0	-62.7
60.0	-24.2	-5.6	-33.8	0.0	-5.0	-68.6
70.0	-24.2	-5.6	-38.7	0.0	-5.0	-73.4
80.0	-24.2	-5.6	-41.9	0.0	-5.0	-76.6
90.0	-24.2	-5.6	-43.0	0.0	-5.0	-77.7
100.0	-24.2	-5.6	-41.9	0.0	-5.0	-76.6
110.0	-24.2	-5.6	-38.7	0.0	-5.0	-73.4
120.0	-24.2	-5.6	-33.8	0.0	-5.0	-68.6
130.0	-24.2	-5.6	-28.0	0.0	-5.0	-62.7
140.0	-24.2	-5.6	-21.7	0.0	-5.0	-56.5
150.0	-24.2	-5.6	-15.6	0.0	-5.0	-50.4
160.0	-24.2	-5.6	-10.0	0.0	-5.0	-44.7
170.0	-24.2	-5.6	-4.8	0.0	-5.0	-39.6
180.0	-24.2	-5.6	0.0	0.0	-5.0	-34.7
190.0	-24.2	-5.6	4.8	0.0	-5.0	-29.9
200.0	-24.2	-5.6	10.0	0.0	-5.0	-24.8
210.0	-24.2	-5.6	15.6	0.0	-5.0	-19.1
220.0	-24.2	-5.6	21.7	0.0	-5.0	-13.0
230.0	-24.2	-5.6	28.0	0.0	-5.0	-6.7
240.0	-24.2	-5.6	33.8	0.0	5.0	9.0
250.0	-24.2	-5.6	38.7	0.0	5.0	13.9
260.0	-24.2	-5.6	41.9	0.0	5.0	17.1
270.0	-24.2	-5.6	43.0	0.0	5.0	18.2
280.0	-24.2	-5.6	41.9	0.0	5.0	17.1
290.0	-24.2	-5.6	38.7	0.0	5.0	13.9
300.0	-24.2	-5.6	33.8	0.0	5.0	9.0
310.0	-24.2	-5.6	28.0	0.0	-5.0	-6.7
320.0	-24.2	-5.6	21.7	0.0	-5.0	-13.0
330.0	-24.2	-5.6	15.6	0.0	-5.0	-19.1
340.0	-24.2	-5.6	10.0	0.0	-5.0	-24.8
350.0	-24.2	-5.6	4.8	0.0	-5.0	-29.9
360.0	-24.2	-5.6	0.0	0.0	-5.0	-34.7

Case 15 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	252.6	85.4	0.0	0.0	67.7	405.8
10.0	252.6	85.4	-316.6	0.0	67.7	89.2
20.0	252.6	85.4	-593.0	0.0	-67.7	-322.6
30.0	252.6	85.4	-793.7	0.0	-67.7	-523.3
40.0	252.6	85.4	-892.8	0.0	-67.7	-622.4
50.0	252.6	85.4	-876.4	0.0	-67.7	-606.1
60.0	252.6	85.4	-745.2	0.0	-67.7	-474.9
70.0	252.6	85.4	-513.8	0.0	-67.7	-243.5
80.0	252.6	85.4	-209.2	0.0	67.7	196.5
90.0	252.6	85.4	132.4	0.0	67.7	538.2
100.0	252.6	85.4	470.0	0.0	67.7	875.7
110.0	252.6	85.4	762.6	0.0	67.7	1168.4
120.0	252.6	85.4	974.5	0.0	67.7	1380.3
130.0	252.6	85.4	1079.2	0.0	67.7	1495.0
140.0	252.6	85.4	1063.0	0.0	67.7	1463.7
150.0	252.6	85.4	926.1	0.0	67.7	1331.8
160.0	252.6	85.4	683.5	0.0	67.7	1089.3
170.0	252.6	85.4	362.6	0.0	67.7	768.4
180.0	252.6	85.4	0.0	0.0	67.7	405.8
190.0	252.6	85.4	-362.6	0.0	-67.7	-92.3
200.0	252.6	85.4	-683.5	0.0	-67.7	-413.2
210.0	252.6	85.4	-926.1	0.0	-67.7	-655.7
220.0	252.6	85.4	-1063.0	0.0	-67.7	-792.6
230.0	252.6	85.4	-1079.2	0.0	-67.7	-808.9
240.0	252.6	85.4	-974.5	0.0	-67.7	-704.2
250.0	252.6	85.4	-762.6	0.0	-67.7	-492.3
260.0	252.6	85.4	-470.0	0.0	-67.7	-199.6
270.0	252.6	85.4	-132.4	0.0	67.7	273.4
280.0	252.6	85.4	209.2	0.0	67.7	615.0
290.0	252.6	85.4	513.8	0.0	67.7	919.6
300.0	252.6	85.4	745.2	0.0	67.7	1151.0
310.0	252.6	85.4	876.4	0.0	67.7	1282.2
320.0	252.6	85.4	892.8	0.0	67.7	1298.5
330.0	252.6	85.4	793.7	0.0	67.7	1199.4
340.0	252.6	85.4	593.0	0.0	67.7	998.7
350.0	252.6	85.4	316.6	0.0	67.7	722.4
360.0	252.6	85.4	0.0	0.0	67.7	405.8

6.15.4 Thruster use

Case 15 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	10.0	97.0	12.6	131.0	15.3	90.0	36.0	105.3
10.0	8.9	84.8	13.4	139.9	22.1	90.0	40.7	103.5
20.0	35.4	15.6	44.8	167.8	25.8	90.0	45.7	102.1
30.0	75.7	9.4	85.4	172.0	26.0	90.0	51.3	101.1
40.0	82.0	16.5	87.9	180.0	26.4	90.0	50.6	100.5
50.0	82.3	17.0	87.7	180.0	27.0	90.0	51.8	100.0
60.0	82.8	19.3	87.5	180.0	27.8	90.0	55.9	99.6
70.0	83.6	22.4	87.3	180.0	27.4	90.0	60.2	99.6
80.0	85.9	28.4	87.2	180.0	27.1	90.0	69.0	99.7
90.0	87.9	33.0	87.2	180.0	26.9	90.0	75.9	100.2
100.0	56.6	27.4	69.0	160.0	26.9	90.0	78.0	100.8
110.0	25.4	70.1	32.9	136.9	27.0	90.0	75.0	101.8
120.0	24.0	98.6	25.1	119.8	23.1	90.0	70.4	103.2
130.0	23.9	101.1	24.2	119.8	18.2	90.0	64.9	104.8
140.0	22.7	104.7	22.7	119.8	14.8	90.0	59.0	106.8
150.0	20.5	110.0	20.9	119.8	13.0	90.0	53.3	109.0
160.0	17.9	113.2	18.7	124.0	12.7	90.0	48.0	111.4
170.0	14.9	116.6	16.6	131.0	13.7	90.0	43.3	113.9
180.0	11.7	121.2	14.7	140.7	15.4	90.0	38.7	116.6
190.0	7.8	131.8	13.4	156.9	18.8	90.0	34.7	120.4
200.0	5.6	152.5	12.8	169.6	19.9	90.0	30.3	125.3
210.0	4.8	182.8	12.6	181.1	19.6	90.0	25.8	132.3
220.0	5.1	207.0	12.7	190.5	17.6	90.0	21.4	142.7
230.0	6.1	216.9	12.3	197.5	14.1	90.0	17.9	157.9
240.0	9.0	222.7	11.1	214.2	3.5	90.0	18.4	209.4
250.0	9.5	217.3	8.9	217.9	-2.0	90.0	20.7	222.1
260.0	9.9	207.1	7.6	219.5	-7.6	90.0	22.5	229.4
270.0	10.3	191.0	4.2	209.5	-14.1	90.0	22.8	232.8
280.0	10.5	178.2	2.4	171.3	-17.8	90.0	21.4	232.7
290.0	11.3	162.8	2.9	119.8	-19.7	90.0	18.5	228.7
300.0	11.5	142.9	4.6	119.8	-20.0	90.0	14.6	218.3
310.0	13.4	119.2	8.6	119.8	-12.4	90.0	12.8	148.1
320.0	14.2	111.8	10.1	119.8	-9.0	90.0	16.6	128.4
330.0	14.2	107.8	11.2	119.8	-4.1	90.0	21.5	117.4
340.0	13.1	106.5	11.9	119.8	1.9	90.0	26.6	111.2
350.0	11.4	106.4	12.2	121.0	8.5	90.0	31.4	107.6
360.0	10.0	97.0	12.6	131.0	15.3	90.0	36.0	105.3

6.15.5 Thruster loss

Case 15 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.94	0.90	0.82
10.0	0.91	0.89	0.81
20.0	0.86	0.85	0.81
30.0	0.86	0.83	0.82
40.0	0.86	0.78	0.83
50.0	0.87	0.78	0.85
60.0	0.87	0.78	0.87
70.0	0.88	0.78	0.86
80.0	0.88	0.78	0.85
90.0	0.89	0.78	0.84
100.0	0.91	0.82	0.85
110.0	0.87	0.82	0.85
120.0	0.86	0.81	0.86
130.0	0.86	0.81	0.86
140.0	0.86	0.81	0.86
150.0	0.87	0.82	0.87
160.0	0.87	0.82	0.88
170.0	0.88	0.83	0.89
180.0	0.89	0.82	0.91
190.0	0.89	0.80	0.91
200.0	0.86	0.77	0.91
210.0	0.73	0.72	0.92
220.0	0.80	0.79	0.92
230.0	0.81	0.83	0.93
240.0	0.81	0.85	0.94
250.0	0.82	0.86	0.85
260.0	0.83	0.86	0.85
270.0	0.82	0.88	0.84
280.0	0.79	0.83	0.85
290.0	0.89	0.90	0.86
300.0	0.94	0.90	0.87
310.0	0.95	0.90	0.85
320.0	0.94	0.90	0.83
330.0	0.94	0.90	0.82
340.0	0.94	0.90	0.84
350.0	0.94	0.90	0.82
360.0	0.94	0.90	0.82

Preliminary Design, @IDR5

6.16 Case 16 - Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 4

6.16.1 Environment and thrust utilisation

Case 16 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	150.0	150.0	0.0	35.0	2.5	6.0	8.5	2.00	26.5
10.0	150.0	150.0	10.0	35.0	2.5	6.0	8.5	2.00	45.3
20.0	150.0	150.0	20.0	35.0	2.5	6.0	8.5	2.00	67.0
30.0	150.0	150.0	30.0	35.0	2.5	6.0	8.5	2.00	82.2
40.0	150.0	150.0	40.0	35.0	2.5	6.0	8.5	2.00	94.2
50.0	150.0	150.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	150.0	150.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	150.0	150.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	150.0	150.0	80.0	35.0	2.5	6.0	8.5	2.00	66.6
90.0	150.0	150.0	90.0	35.0	2.5	6.0	8.5	2.00	87.8
100.0	150.0	150.0	100.0	35.0	2.5	6.0	8.5	2.00	75.4
110.0	150.0	150.0	110.0	35.0	2.5	6.0	8.5	2.00	60.7
120.0	150.0	150.0	120.0	35.0	2.5	6.0	8.5	2.00	46.1
130.0	150.0	150.0	130.0	35.0	2.5	6.0	8.5	2.00	34.5
140.0	150.0	150.0	140.0	35.0	2.5	6.0	8.5	2.00	26.4
150.0	150.0	150.0	150.0	35.0	2.5	6.0	8.5	2.00	22.4
160.0	150.0	150.0	160.0	35.0	2.5	6.0	8.5	2.00	20.4
170.0	150.0	150.0	170.0	35.0	2.5	6.0	8.5	2.00	22.4
180.0	150.0	150.0	180.0	35.0	2.5	6.0	8.5	2.00	27.1
190.0	150.0	150.0	190.0	35.0	2.5	6.0	8.5	2.00	35.9
200.0	150.0	150.0	200.0	35.0	2.5	6.0	8.5	2.00	38.6
210.0	150.0	150.0	210.0	35.0	2.5	6.0	8.5	2.00	37.8
220.0	150.0	150.0	220.0	35.0	2.5	6.0	8.5	2.00	23.3
230.0	150.0	150.0	230.0	35.0	2.5	6.0	8.5	2.00	13.7
240.0	150.0	150.0	240.0	35.0	2.5	6.0	8.5	2.00	11.7
250.0	150.0	150.0	250.0	35.0	2.5	6.0	8.5	2.00	17.6
260.0	150.0	150.0	260.0	35.0	2.5	6.0	8.5	2.00	32.2
270.0	150.0	150.0	270.0	35.0	2.5	6.0	8.5	2.00	49.2
280.0	150.0	150.0	280.0	35.0	2.5	6.0	8.5	2.00	58.3
290.0	150.0	150.0	290.0	35.0	2.5	6.0	8.5	2.00	62.8
300.0	150.0	150.0	300.0	35.0	2.5	6.0	8.5	2.00	62.4
310.0	150.0	150.0	310.0	35.0	2.5	6.0	8.5	2.00	59.0
320.0	150.0	150.0	320.0	35.0	2.5	6.0	8.5	2.00	50.2
330.0	150.0	150.0	330.0	35.0	2.5	6.0	8.5	2.00	26.7
340.0	150.0	150.0	340.0	35.0	2.5	6.0	8.5	2.00	13.6
350.0	150.0	150.0	350.0	35.0	2.5	6.0	8.5	2.00	10.2
360.0	150.0	150.0	360.0	35.0	2.5	6.0	8.5	2.00	26.9

6.16.2 Relative contributions of force components

Case 16 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	73.0	16.9	-5.1	0.0	15.3	100.0
10.0	62.1	14.1	10.9	0.0	12.9	100.0
20.0	53.4	12.0	23.7	0.0	11.0	100.0
30.0	46.1	10.2	34.3	0.0	9.4	100.0
40.0	40.1	8.9	42.9	0.0	8.1	100.0
50.0	35.3	7.8	49.8	0.0	7.2	100.0
60.0	31.8	7.0	54.8	0.0	6.4	100.0
70.0	29.4	6.4	58.3	0.0	5.9	100.0
80.0	28.0	6.1	60.3	0.0	5.7	100.0
90.0	27.5	6.0	60.9	0.0	5.6	100.0
100.0	28.0	6.2	60.2	0.0	5.7	100.0
110.0	29.3	6.5	58.2	0.0	6.0	100.0
120.0	31.7	7.1	54.7	0.0	6.5	100.0
130.0	35.0	7.9	49.9	0.0	7.2	100.0
140.0	39.2	9.0	43.7	0.0	8.2	100.0
150.0	44.2	10.3	36.2	0.0	9.3	100.0
160.0	49.8	11.8	27.8	0.0	10.5	100.0
170.0	55.9	13.5	18.5	0.0	12.1	100.0
180.0	62.6	15.4	8.3	0.0	13.7	100.0
190.0	69.1	17.5	-2.1	0.0	15.4	100.0
200.0	75.0	19.9	-12.1	0.0	17.3	100.0
210.0	76.0	21.0	-15.9	0.0	18.4	100.0
220.0	74.0	22.1	-46.6	0.0	17.1	100.0
230.0	69.7	4.1	85.5	0.0	19.1	100.0
240.0	-21.8	-1.2	110.2	0.0	17.8	100.0
250.0	-34.0	-3.8	121.8	0.0	16.0	100.0
260.0	-36.7	-4.9	126.9	0.0	14.7	100.0
270.0	-38.5	-5.5	129.6	0.0	14.4	100.0
280.0	-40.8	-5.9	131.5	0.0	15.1	100.0
290.0	-43.6	-6.0	132.4	0.0	17.1	100.0
300.0	-45.1	-5.1	129.2	0.0	20.9	100.0
310.0	-35.3	-0.5	109.2	0.0	26.7	100.0
320.0	17.1	14.6	38.9	0.0	29.4	100.0
330.0	127.6	33.5	-90.3	0.0	29.2	100.0
340.0	106.9	26.2	-56.4	0.0	23.3	100.0
350.0	87.3	20.6	-26.6	0.0	18.6	100.0
360.0	73.0	16.9	-5.1	0.0	15.3	100.0

6.16.3 Environment forces

Case 16 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.3	3.1	-3.6	0.0	2.4	10.2
10.0	8.3	3.1	-3.6	0.0	2.4	10.2
20.0	8.3	3.1	-3.5	0.0	2.4	10.3
30.0	8.3	3.1	-3.2	0.0	2.4	10.6
40.0	8.3	3.1	-2.8	0.0	2.4	11.0
50.0	8.3	3.1	-2.3	0.0	2.4	11.5
60.0	8.3	3.1	-1.6	0.0	2.4	12.2
70.0	8.3	3.1	-0.9	0.0	2.4	12.9
80.0	8.3	3.1	-0.1	0.0	2.4	13.7
90.0	8.3	3.1	0.7	0.0	2.4	14.5
100.0	8.3	3.1	1.5	0.0	2.4	15.3
110.0	8.3	3.1	2.3	0.0	2.4	16.1
120.0	8.3	3.1	3.0	0.0	2.4	16.7
130.0	8.3	3.1	3.5	0.0	2.4	17.3
140.0	8.3	3.1	4.0	0.0	2.4	17.8
150.0	8.3	3.1	4.3	0.0	2.4	18.1
160.0	8.3	3.1	4.4	0.0	2.4	18.2
170.0	8.3	3.1	4.4	0.0	2.4	18.2
180.0	8.3	3.1	4.3	0.0	2.4	18.1
190.0	8.3	3.1	4.4	0.0	2.4	18.2
200.0	8.3	3.1	4.4	0.0	2.4	18.2
210.0	8.3	3.1	4.3	0.0	2.4	18.1
220.0	8.3	3.1	4.0	0.0	2.4	17.8
230.0	8.3	3.1	3.5	0.0	2.4	17.3
240.0	8.3	3.1	3.0	0.0	2.4	16.7
250.0	8.3	3.1	2.3	0.0	2.4	16.1
260.0	8.3	3.1	1.5	0.0	2.4	15.3
270.0	8.3	3.1	0.7	0.0	2.4	14.5
280.0	8.3	3.1	-0.1	0.0	2.4	13.7
290.0	8.3	3.1	-0.9	0.0	2.4	12.9
300.0	8.3	3.1	-1.6	0.0	2.4	12.2
310.0	8.3	3.1	-2.3	0.0	2.4	11.5
320.0	8.3	3.1	-2.8	0.0	2.4	11.0
330.0	8.3	3.1	-3.2	0.0	2.4	10.6
340.0	8.3	3.1	-3.5	0.0	2.4	10.3
350.0	8.3	3.1	-3.6	0.0	2.4	10.2
360.0	8.3	3.1	-3.6	0.0	2.4	10.2

Case 16 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-17.7	-3.6	0.0	0.0	-3.4	-24.7
10.0	-17.7	-3.6	-4.8	0.0	-3.4	-29.6
20.0	-17.7	-3.6	-10.0	0.0	-3.4	-34.7
30.0	-17.7	-3.6	-15.6	0.0	-3.4	-40.4
40.0	-17.7	-3.6	-21.7	0.0	-3.4	-46.5
50.0	-17.7	-3.6	-28.0	0.0	-3.4	-52.7
60.0	-17.7	-3.6	-33.8	0.0	-3.4	-58.6
70.0	-17.7	-3.6	-38.7	0.0	-3.4	-63.4
80.0	-17.7	-3.6	-41.9	0.0	-3.4	-66.6
90.0	-17.7	-3.6	-43.0	0.0	-3.4	-67.7
100.0	-17.7	-3.6	-41.9	0.0	-3.4	-66.6
110.0	-17.7	-3.6	-38.7	0.0	-3.4	-63.4
120.0	-17.7	-3.6	-33.8	0.0	-3.4	-58.6
130.0	-17.7	-3.6	-28.0	0.0	-3.4	-52.7
140.0	-17.7	-3.6	-21.7	0.0	-3.4	-46.5
150.0	-17.7	-3.6	-15.6	0.0	-3.4	-40.4
160.0	-17.7	-3.6	-10.0	0.0	-3.4	-34.7
170.0	-17.7	-3.6	-4.8	0.0	-3.4	-29.6
180.0	-17.7	-3.6	0.0	0.0	-3.4	-24.7
190.0	-17.7	-3.6	4.8	0.0	-3.4	-19.9
200.0	-17.7	-3.6	10.0	0.0	-3.4	-14.8
210.0	-17.7	-3.6	15.6	0.0	-3.4	-9.1
220.0	-17.7	-3.6	21.7	0.0	3.4	3.8
230.0	-17.7	-3.6	28.0	0.0	3.4	10.1
240.0	-17.7	-3.6	33.8	0.0	3.4	15.9
250.0	-17.7	-3.6	38.7	0.0	3.4	20.8
260.0	-17.7	-3.6	41.9	0.0	3.4	24.0
270.0	-17.7	-3.6	43.0	0.0	3.4	25.1
280.0	-17.7	-3.6	41.9	0.0	3.4	24.0
290.0	-17.7	-3.6	38.7	0.0	3.4	20.8
300.0	-17.7	-3.6	33.8	0.0	3.4	15.9
310.0	-17.7	-3.6	28.0	0.0	3.4	10.1
320.0	-17.7	-3.6	21.7	0.0	3.4	3.8
330.0	-17.7	-3.6	15.6	0.0	-3.4	-9.1
340.0	-17.7	-3.6	10.0	0.0	-3.4	-14.8
350.0	-17.7	-3.6	4.8	0.0	-3.4	-19.9
360.0	-17.7	-3.6	0.0	0.0	-3.4	-24.7

Case 16 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	246.7	79.9	0.0	0.0	65.4	392.0
10.0	246.7	79.9	-316.6	0.0	65.4	75.4
20.0	246.7	79.9	-593.0	0.0	-65.4	-331.8
30.0	246.7	79.9	-793.7	0.0	-65.4	-532.5
40.0	246.7	79.9	-892.8	0.0	-65.4	-631.6
50.0	246.7	79.9	-876.4	0.0	-65.4	-615.3
60.0	246.7	79.9	-745.2	0.0	-65.4	-484.1
70.0	246.7	79.9	-513.8	0.0	-65.4	-252.7
80.0	246.7	79.9	-209.2	0.0	65.4	182.8
90.0	246.7	79.9	132.4	0.0	65.4	524.4
100.0	246.7	79.9	470.0	0.0	65.4	862.0
110.0	246.7	79.9	762.6	0.0	65.4	1154.7
120.0	246.7	79.9	974.5	0.0	65.4	1366.6
130.0	246.7	79.9	1079.2	0.0	65.4	1471.3
140.0	246.7	79.9	1063.0	0.0	65.4	1455.0
150.0	246.7	79.9	926.1	0.0	65.4	1318.1
160.0	246.7	79.9	683.5	0.0	65.4	1075.6
170.0	246.7	79.9	362.6	0.0	65.4	754.6
180.0	246.7	79.9	0.0	0.0	65.4	392.0
190.0	246.7	79.9	-362.6	0.0	-65.4	-101.4
200.0	246.7	79.9	-683.5	0.0	-65.4	-422.4
210.0	246.7	79.9	-926.1	0.0	-65.4	-664.9
220.0	246.7	79.9	-1063.0	0.0	-65.4	-801.8
230.0	246.7	79.9	-1079.2	0.0	-65.4	-818.1
240.0	246.7	79.9	-974.5	0.0	-65.4	-713.4
250.0	246.7	79.9	-762.6	0.0	-65.4	-501.5
260.0	246.7	79.9	-470.0	0.0	-65.4	-208.8
270.0	246.7	79.9	-132.4	0.0	65.4	259.7
280.0	246.7	79.9	209.2	0.0	65.4	601.3
290.0	246.7	79.9	513.8	0.0	65.4	905.9
300.0	246.7	79.9	745.2	0.0	65.4	1137.3
310.0	246.7	79.9	876.4	0.0	65.4	1268.5
320.0	246.7	79.9	892.8	0.0	65.4	1284.8
330.0	246.7	79.9	793.7	0.0	65.4	1185.7
340.0	246.7	79.9	593.0	0.0	65.4	985.0
350.0	246.7	79.9	316.6	0.0	65.4	708.7
360.0	246.7	79.9	0.0	0.0	65.4	392.1

6.16.4 Thruster use

Case 16 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	8.3	111.4	10.3	134.1	9.6	90.0	26.8	112.4
10.0	6.8	98.6	11.2	144.9	16.4	90.0	31.3	109.0
20.0	5.3	77.1	12.6	156.1	24.5	90.0	36.2	106.6
30.0	33.6	12.5	43.9	170.7	26.0	90.0	41.7	104.7
40.0	65.6	9.0	76.4	172.6	26.4	90.0	47.8	103.3
50.0	80.0	17.2	87.7	180.0	27.0	90.0	51.8	102.5
60.0	80.6	19.5	87.5	180.0	27.8	90.0	55.8	101.9
70.0	81.4	22.7	87.3	180.0	27.4	90.0	60.1	101.7
80.0	72.8	16.3	85.8	167.2	27.1	90.0	68.0	101.6
90.0	49.6	25.3	62.5	161.7	26.9	90.0	69.3	102.1
100.0	22.1	66.8	30.9	141.0	26.9	90.0	68.4	102.9
110.0	21.1	101.0	23.2	121.4	22.9	90.0	65.4	104.2
120.0	22.0	104.2	22.8	119.8	17.4	90.0	60.9	106.0
130.0	22.1	106.9	21.9	119.8	12.6	90.0	55.5	108.2
140.0	21.0	111.2	20.5	119.8	9.1	90.0	49.8	110.9
150.0	19.0	117.1	18.7	120.3	7.3	90.0	44.2	114.1
160.0	16.6	121.3	16.6	125.4	7.0	90.0	39.2	117.7
170.0	13.8	126.6	14.5	133.7	8.0	90.0	34.7	121.6
180.0	10.9	134.4	12.8	145.3	9.7	90.0	30.5	126.2
190.0	7.6	152.3	11.9	164.0	13.1	90.0	27.0	132.5
200.0	6.4	176.9	11.8	178.3	14.1	90.0	23.4	141.0
210.0	6.3	201.4	12.4	190.7	13.7	90.0	20.2	153.2
220.0	8.7	221.0	12.6	207.8	7.8	90.0	18.2	192.2
230.0	9.9	225.1	12.7	215.4	4.3	90.0	20.0	210.2
240.0	10.8	224.2	12.0	221.3	-0.5	90.0	23.1	223.6
250.0	11.4	219.4	10.5	226.2	-6.0	90.0	26.3	232.3
260.0	11.7	211.5	8.3	229.9	-11.5	90.0	28.4	237.4
270.0	11.9	196.9	4.7	229.5	-18.0	90.0	29.0	240.0
280.0	11.0	185.3	2.2	213.6	-21.7	90.0	27.6	240.3
290.0	12.2	173.2	1.6	119.8	-23.6	90.0	24.5	238.2
300.0	11.8	153.9	3.1	119.8	-23.8	90.0	20.1	232.6
310.0	15.7	153.9	5.1	60.2	-21.4	90.0	15.3	221.2
320.0	12.5	129.8	6.0	119.8	-18.7	90.0	11.6	199.2
330.0	12.8	119.0	8.8	119.8	-9.8	90.0	14.0	139.3
340.0	11.8	118.6	9.5	119.8	-3.8	90.0	18.0	125.0
350.0	10.1	119.9	9.8	121.9	2.9	90.0	22.4	117.1
360.0	8.3	111.4	10.3	134.1	9.6	90.0	26.8	112.4

6.16.5 Thruster loss

Case 16 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.94	0.90	0.82
10.0	0.93	0.89	0.81
20.0	0.89	0.88	0.81
30.0	0.86	0.84	0.82
40.0	0.87	0.82	0.83
50.0	0.87	0.78	0.85
60.0	0.87	0.78	0.87
70.0	0.88	0.78	0.86
80.0	0.90	0.84	0.85
90.0	0.90	0.83	0.84
100.0	0.86	0.82	0.85
110.0	0.85	0.81	0.85
120.0	0.85	0.81	0.86
130.0	0.86	0.81	0.86
140.0	0.86	0.81	0.86
150.0	0.86	0.82	0.87
160.0	0.87	0.82	0.88
170.0	0.87	0.82	0.89
180.0	0.87	0.82	0.91
190.0	0.85	0.78	0.91
200.0	0.73	0.72	0.91
210.0	0.79	0.79	0.92
220.0	0.81	0.83	0.92
230.0	0.81	0.84	0.93
240.0	0.81	0.85	0.86
250.0	0.82	0.85	0.85
260.0	0.83	0.86	0.85
270.0	0.83	0.87	0.84
280.0	0.81	0.89	0.85
290.0	0.83	0.90	0.86
300.0	0.92	0.90	0.87
310.0	0.92	0.89	0.85
320.0	0.95	0.90	0.83
330.0	0.94	0.90	0.82
340.0	0.94	0.90	0.81
350.0	0.94	0.90	0.82
360.0	0.94	0.90	0.82

Preliminary Design, @IDR5

6.17 Case 17 - Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 4

6.17.1 Environment and thrust utilisation

Case 17 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	160.0	160.0	0.0	35.0	2.5	6.0	8.5	2.00	15.1
10.0	160.0	160.0	10.0	35.0	2.5	6.0	8.5	2.00	37.1
20.0	160.0	160.0	20.0	35.0	2.5	6.0	8.5	2.00	54.4
30.0	160.0	160.0	30.0	35.0	2.5	6.0	8.5	2.00	69.6
40.0	160.0	160.0	40.0	35.0	2.5	6.0	8.5	2.00	81.7
50.0	160.0	160.0	50.0	35.0	2.5	6.0	8.5	2.00	89.5
60.0	160.0	160.0	60.0	35.0	2.5	6.0	8.5	2.00	92.4
70.0	160.0	160.0	70.0	35.0	2.5	6.0	8.5	2.00	93.7
80.0	160.0	160.0	80.0	35.0	2.5	6.0	8.5	2.00	95.5
90.0	160.0	160.0	90.0	35.0	2.5	6.0	8.5	2.00	76.5
100.0	160.0	160.0	100.0	35.0	2.5	6.0	8.5	2.00	64.0
110.0	160.0	160.0	110.0	35.0	2.5	6.0	8.5	2.00	49.3
120.0	160.0	160.0	120.0	35.0	2.5	6.0	8.5	2.00	35.2
130.0	160.0	160.0	130.0	35.0	2.5	6.0	8.5	2.00	24.2
140.0	160.0	160.0	140.0	35.0	2.5	6.0	8.5	2.00	19.6
150.0	160.0	160.0	150.0	35.0	2.5	6.0	8.5	2.00	17.5
160.0	160.0	160.0	160.0	35.0	2.5	6.0	8.5	2.00	15.3
170.0	160.0	160.0	170.0	35.0	2.5	6.0	8.5	2.00	12.9
180.0	160.0	160.0	180.0	35.0	2.5	6.0	8.5	2.00	16.2
190.0	160.0	160.0	190.0	35.0	2.5	6.0	8.5	2.00	23.9
200.0	160.0	160.0	200.0	35.0	2.5	6.0	8.5	2.00	26.6
210.0	160.0	160.0	210.0	35.0	2.5	6.0	8.5	2.00	19.2
220.0	160.0	160.0	220.0	35.0	2.5	6.0	8.5	2.00	14.4
230.0	160.0	160.0	230.0	35.0	2.5	6.0	8.5	2.00	13.3
240.0	160.0	160.0	240.0	35.0	2.5	6.0	8.5	2.00	13.4
250.0	160.0	160.0	250.0	35.0	2.5	6.0	8.5	2.00	26.1
260.0	160.0	160.0	260.0	35.0	2.5	6.0	8.5	2.00	40.7
270.0	160.0	160.0	270.0	35.0	2.5	6.0	8.5	2.00	56.6
280.0	160.0	160.0	280.0	35.0	2.5	6.0	8.5	2.00	65.6
290.0	160.0	160.0	290.0	35.0	2.5	6.0	8.5	2.00	70.1
300.0	160.0	160.0	300.0	35.0	2.5	6.0	8.5	2.00	69.7
310.0	160.0	160.0	310.0	35.0	2.5	6.0	8.5	2.00	66.3
320.0	160.0	160.0	320.0	35.0	2.5	6.0	8.5	2.00	58.2
330.0	160.0	160.0	330.0	35.0	2.5	6.0	8.5	2.00	46.0
340.0	160.0	160.0	340.0	35.0	2.5	6.0	8.5	2.00	23.2
350.0	160.0	160.0	350.0	35.0	2.5	6.0	8.5	2.00	7.9
360.0	160.0	160.0	360.0	35.0	2.5	6.0	8.5	2.00	15.1

6.17.2 Relative contributions of force components

Case 17 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	74.5	19.3	-10.8	0.0	17.0	100.0
10.0	60.1	14.9	11.7	0.0	13.3	100.0
20.0	48.9	11.7	28.8	0.0	10.6	100.0
30.0	40.2	9.4	41.8	0.0	8.6	100.0
40.0	33.6	7.7	51.7	0.0	7.1	100.0
50.0	28.6	6.5	58.9	0.0	6.0	100.0
60.0	25.2	5.6	63.9	0.0	5.3	100.0
70.0	22.9	5.1	67.2	0.0	4.8	100.0
80.0	21.6	4.8	69.1	0.0	4.5	100.0
90.0	21.2	4.8	69.6	0.0	4.4	100.0
100.0	21.7	4.9	68.8	0.0	4.6	100.0
110.0	23.0	5.3	66.8	0.0	4.9	100.0
120.0	25.3	5.9	63.4	0.0	5.4	100.0
130.0	28.6	6.8	58.3	0.0	6.2	100.0
140.0	33.0	8.1	51.7	0.0	7.3	100.0
150.0	38.2	9.7	43.5	0.0	8.5	100.0
160.0	44.2	11.6	34.1	0.0	10.2	100.0
170.0	50.4	13.7	24.0	0.0	11.9	100.0
180.0	56.4	16.1	13.8	0.0	13.7	100.0
190.0	59.8	18.2	6.8	0.0	15.2	100.0
200.0	57.7	19.2	1.5	0.0	15.6	100.0
210.0	28.4	13.5	42.2	0.0	15.6	100.0
220.0	6.9	8.1	69.6	0.0	15.5	100.0
230.0	1.3	3.4	90.5	0.0	13.4	100.0
240.0	-11.1	0.7	102.1	0.0	11.3	100.0
250.0	-16.8	-0.7	107.9	0.0	9.7	100.0
260.0	-18.0	-1.4	110.7	0.0	8.8	100.0
270.0	-18.9	-1.7	112.2	0.0	8.5	100.0
280.0	-20.0	-1.9	113.1	0.0	8.8	100.0
290.0	-21.3	-1.9	113.4	0.0	9.8	100.0
300.0	-22.5	-1.4	112.1	0.0	11.8	100.0
310.0	-21.6	0.3	105.9	0.0	15.4	100.0
320.0	-10.9	5.5	84.3	0.0	21.2	100.0
330.0	28.4	18.2	26.7	0.0	26.7	100.0
340.0	105.4	32.6	-64.9	0.0	27.0	100.0
350.0	92.7	25.6	-40.4	0.0	22.1	100.0
360.0	74.5	19.3	-10.8	0.0	17.0	100.0

6.17.3 Environment forces

Case 17 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.2	3.2	-3.6	0.0	2.5	10.3
10.0	8.2	3.2	-3.6	0.0	2.5	10.3
20.0	8.2	3.2	-3.5	0.0	2.5	10.5
30.0	8.2	3.2	-3.2	0.0	2.5	10.7
40.0	8.2	3.2	-2.8	0.0	2.5	11.1
50.0	8.2	3.2	-2.3	0.0	2.5	11.7
60.0	8.2	3.2	-1.6	0.0	2.5	12.3
70.0	8.2	3.2	-0.9	0.0	2.5	13.1
80.0	8.2	3.2	-0.1	0.0	2.5	13.8
90.0	8.2	3.2	0.7	0.0	2.5	14.7
100.0	8.2	3.2	1.5	0.0	2.5	15.5
110.0	8.2	3.2	2.3	0.0	2.5	16.2
120.0	8.2	3.2	3.0	0.0	2.5	16.9
130.0	8.2	3.2	3.5	0.0	2.5	17.5
140.0	8.2	3.2	4.0	0.0	2.5	17.9
150.0	8.2	3.2	4.3	0.0	2.5	18.2
160.0	8.2	3.2	4.4	0.0	2.5	18.4
170.0	8.2	3.2	4.4	0.0	2.5	18.4
180.0	8.2	3.2	4.3	0.0	2.5	18.3
190.0	8.2	3.2	4.4	0.0	2.5	18.4
200.0	8.2	3.2	4.4	0.0	2.5	18.4
210.0	8.2	3.2	4.3	0.0	2.5	18.2
220.0	8.2	3.2	4.0	0.0	2.5	17.9
230.0	8.2	3.2	3.5	0.0	2.5	17.5
240.0	8.2	3.2	3.0	0.0	2.5	16.9
250.0	8.2	3.2	2.3	0.0	2.5	16.2
260.0	8.2	3.2	1.5	0.0	2.5	15.5
270.0	8.2	3.2	0.7	0.0	2.5	14.7
280.0	8.2	3.2	-0.1	0.0	2.5	13.8
290.0	8.2	3.2	-0.9	0.0	2.5	13.1
300.0	8.2	3.2	-1.6	0.0	2.5	12.3
310.0	8.2	3.2	-2.3	0.0	2.5	11.7
320.0	8.2	3.2	-2.8	0.0	2.5	11.1
330.0	8.2	3.2	-3.2	0.0	2.5	10.7
340.0	8.2	3.2	-3.5	0.0	2.5	10.5
350.0	8.2	3.2	-3.6	0.0	2.5	10.3
360.0	8.2	3.2	-3.6	0.0	2.5	10.3

Case 17 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-11.1	-2.1	0.0	0.0	-2.1	-15.4
10.0	-11.1	-2.1	-4.8	0.0	-2.1	-20.2
20.0	-11.1	-2.1	-10.0	0.0	-2.1	-25.4
30.0	-11.1	-2.1	-15.6	0.0	-2.1	-31.0
40.0	-11.1	-2.1	-21.7	0.0	-2.1	-37.1
50.0	-11.1	-2.1	-28.0	0.0	-2.1	-43.4
60.0	-11.1	-2.1	-33.8	0.0	-2.1	-49.2
70.0	-11.1	-2.1	-38.7	0.0	-2.1	-54.1
80.0	-11.1	-2.1	-41.9	0.0	-2.1	-57.2
90.0	-11.1	-2.1	-43.0	0.0	-2.1	-58.4
100.0	-11.1	-2.1	-41.9	0.0	-2.1	-57.2
110.0	-11.1	-2.1	-38.7	0.0	-2.1	-54.1
120.0	-11.1	-2.1	-33.8	0.0	-2.1	-49.2
130.0	-11.1	-2.1	-28.0	0.0	-2.1	-43.4
140.0	-11.1	-2.1	-21.7	0.0	-2.1	-37.1
150.0	-11.1	-2.1	-15.6	0.0	-2.1	-31.0
160.0	-11.1	-2.1	-10.0	0.0	-2.1	-25.4
170.0	-11.1	-2.1	-4.8	0.0	-2.1	-20.2
180.0	-11.1	-2.1	0.0	0.0	-2.1	-15.4
190.0	-11.1	-2.1	4.8	0.0	-2.1	-10.5
200.0	-11.1	-2.1	10.0	0.0	-2.1	-5.4
210.0	-11.1	-2.1	15.6	0.0	2.1	4.5
220.0	-11.1	-2.1	21.7	0.0	2.1	10.6
230.0	-11.1	-2.1	28.0	0.0	2.1	16.9
240.0	-11.1	-2.1	33.8	0.0	2.1	22.7
250.0	-11.1	-2.1	38.7	0.0	2.1	27.6
260.0	-11.1	-2.1	41.9	0.0	2.1	30.8
270.0	-11.1	-2.1	43.0	0.0	2.1	31.9
280.0	-11.1	-2.1	41.9	0.0	2.1	30.8
290.0	-11.1	-2.1	38.7	0.0	2.1	27.6
300.0	-11.1	-2.1	33.8	0.0	2.1	22.7
310.0	-11.1	-2.1	28.0	0.0	2.1	16.9
320.0	-11.1	-2.1	21.7	0.0	2.1	10.6
330.0	-11.1	-2.1	15.6	0.0	2.1	4.5
340.0	-11.1	-2.1	10.0	0.0	-2.1	-5.4
350.0	-11.1	-2.1	4.8	0.0	-2.1	-10.5
360.0	-11.1	-2.1	0.0	0.0	-2.1	-15.4

Case 17 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	193.5	60.9	0.0	0.0	49.5	303.9
10.0	193.5	60.9	-316.6	0.0	-49.5	-111.7
20.0	193.5	60.9	-593.0	0.0	-49.5	-388.1
30.0	193.5	60.9	-793.7	0.0	-49.5	-588.8
40.0	193.5	60.9	-892.8	0.0	-49.5	-687.9
50.0	193.5	60.9	-876.4	0.0	-49.5	-671.6
60.0	193.5	60.9	-745.2	0.0	-49.5	-540.4
70.0	193.5	60.9	-513.8	0.0	-49.5	-309.0
80.0	193.5	60.9	-209.2	0.0	49.5	94.7
90.0	193.5	60.9	132.4	0.0	49.5	436.3
100.0	193.5	60.9	470.0	0.0	49.5	773.9
110.0	193.5	60.9	762.6	0.0	49.5	1066.5
120.0	193.5	60.9	974.5	0.0	49.5	1278.4
130.0	193.5	60.9	1079.2	0.0	49.5	1398.1
140.0	193.5	60.9	1063.0	0.0	49.5	1365.8
150.0	193.5	60.9	926.1	0.0	49.5	1230.0
160.0	193.5	60.9	683.5	0.0	49.5	987.4
170.0	193.5	60.9	362.6	0.0	49.5	666.5
180.0	193.5	60.9	0.0	0.0	49.5	303.9
190.0	193.5	60.9	-362.6	0.0	-49.5	-157.7
200.0	193.5	60.9	-683.5	0.0	-49.5	-478.7
210.0	193.5	60.9	-926.1	0.0	-49.5	-721.2
220.0	193.5	60.9	-1063.0	0.0	-49.5	-858.1
230.0	193.5	60.9	-1079.2	0.0	-49.5	-874.4
240.0	193.5	60.9	-974.5	0.0	-49.5	-769.7
250.0	193.5	60.9	-762.6	0.0	-49.5	-557.8
260.0	193.5	60.9	-470.0	0.0	-49.5	-265.1
270.0	193.5	60.9	-132.4	0.0	49.5	171.5
280.0	193.5	60.9	209.2	0.0	49.5	513.1
290.0	193.5	60.9	513.8	0.0	49.5	817.7
300.0	193.5	60.9	745.2	0.0	49.5	1049.1
310.0	193.5	60.9	876.4	0.0	49.5	1180.3
320.0	193.5	60.9	892.8	0.0	49.5	1196.7
330.0	193.5	60.9	793.7	0.0	49.5	1097.6
340.0	193.5	60.9	593.0	0.0	49.5	896.8
350.0	193.5	60.9	316.6	0.0	49.5	620.5
360.0	193.5	60.9	0.0	0.0	49.5	303.9

6.17.4 Thruster use

Case 17 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	6.7	128.8	7.9	141.3	5.2	90.0	18.5	123.9
10.0	4.0	117.1	9.1	158.4	13.2	90.0	22.7	117.1
20.0	2.9	93.4	10.7	165.1	19.7	90.0	27.4	112.4
30.0	3.0	67.3	12.2	167.2	25.6	90.0	32.8	109.1
40.0	30.6	10.4	41.5	172.8	26.4	90.0	38.8	106.7
50.0	51.3	9.5	62.8	172.8	27.0	90.0	44.9	105.1
60.0	58.7	10.9	70.8	171.6	27.8	90.0	50.7	104.1
70.0	60.9	13.1	73.5	169.9	27.4	90.0	55.6	103.6
80.0	41.1	22.1	54.0	164.2	27.1	90.0	58.9	103.6
90.0	20.6	50.9	31.7	150.8	26.9	90.0	60.2	104.1
100.0	17.2	100.3	20.5	127.2	24.0	90.0	59.3	105.1
110.0	18.9	105.4	20.7	122.9	18.5	90.0	56.4	106.7
120.0	19.7	110.1	20.4	119.9	13.0	90.0	52.0	108.9
130.0	19.9	113.1	19.5	119.8	8.2	90.0	46.7	111.9
140.0	18.9	118.2	18.0	119.8	4.8	90.0	41.2	115.8
150.0	17.3	123.8	16.2	122.1	2.9	90.0	36.0	120.4
160.0	15.1	129.5	14.2	128.4	2.6	90.0	31.3	125.9
170.0	12.5	137.1	12.3	138.7	3.6	90.0	27.3	132.3
180.0	10.0	148.7	10.9	153.3	5.3	90.0	23.1	139.9
190.0	7.8	171.4	10.7	174.0	8.2	90.0	21.2	150.2
200.0	7.3	195.0	11.5	189.6	9.2	90.0	19.1	163.6
210.0	8.9	216.8	12.4	206.5	6.1	90.0	18.8	193.9
220.0	10.3	225.6	13.2	215.8	4.5	90.0	20.8	210.7
230.0	11.6	228.6	13.4	225.0	1.0	90.0	24.3	224.0
240.0	12.6	227.4	12.3	229.1	-3.8	90.0	28.3	233.4
250.0	13.1	223.1	7.5	234.6	-9.3	90.0	32.0	239.5
260.0	13.3	217.1	9.4	239.8	-14.8	90.0	34.4	243.3
270.0	13.3	204.1	6.1	245.6	-20.9	90.0	35.1	245.3
280.0	13.1	193.6	3.3	251.6	-24.5	90.0	33.7	245.8
290.0	12.6	182.3	0.7	231.3	-26.5	90.0	30.5	244.7
300.0	13.4	171.5	2.0	60.2	-26.4	90.0	25.9	241.5
310.0	14.2	162.3	3.8	60.2	-24.5	90.0	20.5	235.3
320.0	14.8	155.5	4.7	60.2	-20.9	90.0	15.4	223.6
330.0	11.2	137.0	5.1	119.8	-16.6	90.0	11.7	202.8
340.0	10.4	133.0	6.8	119.8	-8.1	90.0	11.8	152.7
350.0	8.7	134.9	7.2	125.4	-1.5	90.0	14.8	134.4
360.0	6.7	128.8	7.9	141.3	5.2	90.0	18.5	123.9

6.17.5 Thruster loss

Case 17 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.94	0.89	0.82
10.0	0.94	0.88	0.81
20.0	0.91	0.86	0.81
30.0	0.87	0.85	0.82
40.0	0.87	0.82	0.83
50.0	0.88	0.82	0.85
60.0	0.88	0.83	0.87
70.0	0.89	0.84	0.86
80.0	0.89	0.84	0.85
90.0	0.87	0.84	0.84
100.0	0.85	0.82	0.85
110.0	0.85	0.81	0.85
120.0	0.85	0.81	0.86
130.0	0.85	0.81	0.86
140.0	0.86	0.81	0.86
150.0	0.86	0.82	0.87
160.0	0.86	0.82	0.88
170.0	0.86	0.82	0.89
180.0	0.85	0.80	0.91
190.0	0.77	0.74	0.91
200.0	0.77	0.78	0.91
210.0	0.81	0.83	0.92
220.0	0.81	0.84	0.92
230.0	0.81	0.85	0.93
240.0	0.81	0.85	0.86
250.0	0.82	0.85	0.85
260.0	0.83	0.85	0.85
270.0	0.84	0.86	0.84
280.0	0.84	0.86	0.85
290.0	0.79	0.89	0.86
300.0	0.85	0.89	0.87
310.0	0.90	0.89	0.85
320.0	0.92	0.89	0.83
330.0	0.94	0.90	0.82
340.0	0.94	0.90	0.81
350.0	0.94	0.90	0.81
360.0	0.94	0.89	0.82

Preliminary Design, @IDR5

6.18 Case 18 - Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 4

6.18.1 Environment and thrust utilisation

Case 18 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	170.0	170.0	0.0	35.0	2.5	6.0	8.5	2.00	7.1
10.0	170.0	170.0	10.0	35.0	2.5	6.0	8.5	2.00	27.4
20.0	170.0	170.0	20.0	35.0	2.5	6.0	8.5	2.00	44.7
30.0	170.0	170.0	30.0	35.0	2.5	6.0	8.5	2.00	60.0
40.0	170.0	170.0	40.0	35.0	2.5	6.0	8.5	2.00	72.2
50.0	170.0	170.0	50.0	35.0	2.5	6.0	8.5	2.00	80.1
60.0	170.0	170.0	60.0	35.0	2.5	6.0	8.5	2.00	83.1
70.0	170.0	170.0	70.0	35.0	2.5	6.0	8.5	2.00	83.7
80.0	170.0	170.0	80.0	35.0	2.5	6.0	8.5	2.00	81.4
90.0	170.0	170.0	90.0	35.0	2.5	6.0	8.5	2.00	68.5
100.0	170.0	170.0	100.0	35.0	2.5	6.0	8.5	2.00	56.2
110.0	170.0	170.0	110.0	35.0	2.5	6.0	8.5	2.00	41.3
120.0	170.0	170.0	120.0	35.0	2.5	6.0	8.5	2.00	27.3
130.0	170.0	170.0	130.0	35.0	2.5	6.0	8.5	2.00	18.4
140.0	170.0	170.0	140.0	35.0	2.5	6.0	8.5	2.00	17.2
150.0	170.0	170.0	150.0	35.0	2.5	6.0	8.5	2.00	15.6
160.0	170.0	170.0	160.0	35.0	2.5	6.0	8.5	2.00	13.5
170.0	170.0	170.0	170.0	35.0	2.5	6.0	8.5	2.00	11.5
180.0	170.0	170.0	180.0	35.0	2.5	6.0	8.5	2.00	10.4
190.0	170.0	170.0	190.0	35.0	2.5	6.0	8.5	2.00	14.6
200.0	170.0	170.0	200.0	35.0	2.5	6.0	8.5	2.00	13.9
210.0	170.0	170.0	210.0	35.0	2.5	6.0	8.5	2.00	13.3
220.0	170.0	170.0	220.0	35.0	2.5	6.0	8.5	2.00	13.7
230.0	170.0	170.0	230.0	35.0	2.5	6.0	8.5	2.00	14.5
240.0	170.0	170.0	240.0	35.0	2.5	6.0	8.5	2.00	18.2
250.0	170.0	170.0	250.0	35.0	2.5	6.0	8.5	2.00	32.1
260.0	170.0	170.0	260.0	35.0	2.5	6.0	8.5	2.00	46.7
270.0	170.0	170.0	270.0	35.0	2.5	6.0	8.5	2.00	61.2
280.0	170.0	170.0	280.0	35.0	2.5	6.0	8.5	2.00	70.2
290.0	170.0	170.0	290.0	35.0	2.5	6.0	8.5	2.00	74.7
300.0	170.0	170.0	300.0	35.0	2.5	6.0	8.5	2.00	74.1
310.0	170.0	170.0	310.0	35.0	2.5	6.0	8.5	2.00	70.9
320.0	170.0	170.0	320.0	35.0	2.5	6.0	8.5	2.00	62.8
330.0	170.0	170.0	330.0	35.0	2.5	6.0	8.5	2.00	50.5
340.0	170.0	170.0	340.0	35.0	2.5	6.0	8.5	2.00	35.3
350.0	170.0	170.0	350.0	35.0	2.5	6.0	8.5	2.00	14.4
360.0	170.0	170.0	360.0	35.0	2.5	6.0	8.5	2.00	7.0

6.18.2 Relative contributions of force components

Case 18 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	76.7	25.9	-23.5	0.0	20.9	100.0
10.0	58.3	18.1	8.5	0.0	15.1	100.0
20.0	43.1	12.5	33.6	0.0	10.7	100.0
30.0	32.4	8.9	50.9	0.0	7.8	100.0
40.0	25.1	6.6	62.3	0.0	5.9	100.0
50.0	20.3	5.2	69.9	0.0	4.7	100.0
60.0	17.1	4.3	74.7	0.0	3.9	100.0
70.0	15.2	3.8	77.6	0.0	3.4	100.0
80.0	14.2	3.5	79.1	0.0	3.2	100.0
90.0	13.9	3.5	79.4	0.0	3.2	100.0
100.0	14.4	3.7	78.6	0.0	3.3	100.0
110.0	15.7	4.1	76.6	0.0	3.6	100.0
120.0	17.8	4.8	73.2	0.0	4.2	100.0
130.0	21.1	5.9	67.9	0.0	5.1	100.0
140.0	25.6	7.4	60.6	0.0	6.4	100.0
150.0	31.3	9.6	51.1	0.0	8.0	100.0
160.0	37.7	12.1	40.1	0.0	10.0	100.0
170.0	43.9	14.9	29.1	0.0	12.1	100.0
180.0	48.2	17.5	20.5	0.0	13.8	100.0
190.0	46.9	18.4	20.5	0.0	14.2	100.0
200.0	34.2	15.6	30.1	0.0	14.2	100.0
210.0	20.8	11.4	55.0	0.0	12.8	100.0
220.0	9.6	7.1	72.8	0.0	10.3	100.0
230.0	2.5	4.4	85.1	0.0	8.1	100.0
240.0	-1.4	2.6	92.4	0.0	6.4	100.0
250.0	-3.3	1.6	96.4	0.0	5.3	100.0
260.0	-4.3	1.0	98.6	0.0	4.8	100.0
270.0	-4.9	0.8	99.7	0.0	4.5	100.0
280.0	-5.3	0.7	100.0	0.0	4.6	100.0
290.0	-5.5	0.9	99.6	0.0	5.1	100.0
300.0	-5.3	1.4	97.9	0.0	6.1	100.0
310.0	-4.0	2.6	93.5	0.0	7.9	100.0
320.0	0.6	5.3	83.0	0.0	11.2	100.0
330.0	13.9	11.4	58.0	0.0	16.7	100.0
340.0	44.7	22.7	9.0	0.0	23.5	100.0
350.0	85.8	32.5	-43.6	0.0	25.3	100.0
360.0	76.7	25.9	-23.5	0.0	20.9	100.0

6.18.3 Environment forces

Case 18 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.1	3.3	-3.6	0.0	2.5	10.3
10.0	8.1	3.3	-3.6	0.0	2.5	10.3
20.0	8.1	3.3	-3.5	0.0	2.5	10.4
30.0	8.1	3.3	-3.2	0.0	2.5	10.7
40.0	8.1	3.3	-2.8	0.0	2.5	11.1
50.0	8.1	3.3	-2.3	0.0	2.5	11.6
60.0	8.1	3.3	-1.6	0.0	2.5	12.2
70.0	8.1	3.3	-0.9	0.0	2.5	13.0
80.0	8.1	3.3	-0.1	0.0	2.5	13.8
90.0	8.1	3.3	0.7	0.0	2.5	14.6
100.0	8.1	3.3	1.5	0.0	2.5	15.4
110.0	8.1	3.3	2.3	0.0	2.5	16.1
120.0	8.1	3.3	3.0	0.0	2.5	16.8
130.0	8.1	3.3	3.5	0.0	2.5	17.4
140.0	8.1	3.3	4.0	0.0	2.5	17.8
150.0	8.1	3.3	4.3	0.0	2.5	18.1
160.0	8.1	3.3	4.4	0.0	2.5	18.3
170.0	8.1	3.3	4.4	0.0	2.5	18.3
180.0	8.1	3.3	4.3	0.0	2.5	18.2
190.0	8.1	3.3	4.4	0.0	2.5	18.3
200.0	8.1	3.3	4.4	0.0	2.5	18.3
210.0	8.1	3.3	4.3	0.0	2.5	18.1
220.0	8.1	3.3	4.0	0.0	2.5	17.8
230.0	8.1	3.3	3.5	0.0	2.5	17.4
240.0	8.1	3.3	3.0	0.0	2.5	16.8
250.0	8.1	3.3	2.3	0.0	2.5	16.1
260.0	8.1	3.3	1.5	0.0	2.5	15.4
270.0	8.1	3.3	0.7	0.0	2.5	14.6
280.0	8.1	3.3	-0.1	0.0	2.5	13.8
290.0	8.1	3.3	-0.9	0.0	2.5	13.0
300.0	8.1	3.3	-1.6	0.0	2.5	12.2
310.0	8.1	3.3	-2.3	0.0	2.5	11.6
320.0	8.1	3.3	-2.8	0.0	2.5	11.1
330.0	8.1	3.3	-3.2	0.0	2.5	10.7
340.0	8.1	3.3	-3.5	0.0	2.5	10.4
350.0	8.1	3.3	-3.6	0.0	2.5	10.3
360.0	8.1	3.3	-3.6	0.0	2.5	10.3

Case 18 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.2	-0.9	0.0	0.0	-1.0	-7.2
10.0	-5.2	-0.9	-4.8	0.0	-1.0	-12.0
20.0	-5.2	-0.9	-10.0	0.0	-1.0	-17.2
30.0	-5.2	-0.9	-15.6	0.0	-1.0	-22.8
40.0	-5.2	-0.9	-21.7	0.0	-1.0	-28.9
50.0	-5.2	-0.9	-28.0	0.0	-1.0	-35.2
60.0	-5.2	-0.9	-33.8	0.0	-1.0	-41.0
70.0	-5.2	-0.9	-38.7	0.0	-1.0	-45.9
80.0	-5.2	-0.9	-41.9	0.0	-1.0	-49.1
90.0	-5.2	-0.9	-43.0	0.0	-1.0	-50.2
100.0	-5.2	-0.9	-41.9	0.0	-1.0	-49.1
110.0	-5.2	-0.9	-38.7	0.0	-1.0	-45.9
120.0	-5.2	-0.9	-33.8	0.0	-1.0	-41.0
130.0	-5.2	-0.9	-28.0	0.0	-1.0	-35.2
140.0	-5.2	-0.9	-21.7	0.0	-1.0	-28.9
150.0	-5.2	-0.9	-15.6	0.0	-1.0	-22.8
160.0	-5.2	-0.9	-10.0	0.0	-1.0	-17.2
170.0	-5.2	-0.9	-4.8	0.0	-1.0	-12.0
180.0	-5.2	-0.9	0.0	0.0	-1.0	-7.2
190.0	-5.2	-0.9	4.8	0.0	-1.0	-2.4
200.0	-5.2	-0.9	10.0	0.0	1.0	4.8
210.0	-5.2	-0.9	15.6	0.0	1.0	10.4
220.0	-5.2	-0.9	21.7	0.0	1.0	16.5
230.0	-5.2	-0.9	28.0	0.0	1.0	22.8
240.0	-5.2	-0.9	33.8	0.0	1.0	28.7
250.0	-5.2	-0.9	38.7	0.0	1.0	33.5
260.0	-5.2	-0.9	41.9	0.0	1.0	36.7
270.0	-5.2	-0.9	43.0	0.0	1.0	37.8
280.0	-5.2	-0.9	41.9	0.0	1.0	36.7
290.0	-5.2	-0.9	38.7	0.0	1.0	33.5
300.0	-5.2	-0.9	33.8	0.0	1.0	28.7
310.0	-5.2	-0.9	28.0	0.0	1.0	22.8
320.0	-5.2	-0.9	21.7	0.0	1.0	16.5
330.0	-5.2	-0.9	15.6	0.0	1.0	10.4
340.0	-5.2	-0.9	10.0	0.0	1.0	4.8
350.0	-5.2	-0.9	4.8	0.0	-1.0	-2.4
360.0	-5.2	-0.9	0.0	0.0	-1.0	-7.2

Case 18 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	109.9	34.3	0.0	0.0	27.7	171.8
10.0	109.9	34.3	-316.6	0.0	-27.7	-200.2
20.0	109.9	34.3	-593.0	0.0	-27.7	-476.5
30.0	109.9	34.3	-793.7	0.0	-27.7	-677.2
40.0	109.9	34.3	-892.8	0.0	-27.7	-776.3
50.0	109.9	34.3	-876.4	0.0	-27.7	-760.0
60.0	109.9	34.3	-745.2	0.0	-27.7	-628.8
70.0	109.9	34.3	-513.8	0.0	-27.7	-397.4
80.0	109.9	34.3	-209.2	0.0	-27.7	-92.8
90.0	109.9	34.3	132.4	0.0	27.7	304.2
100.0	109.9	34.3	470.0	0.0	27.7	641.8
110.0	109.9	34.3	762.6	0.0	27.7	934.5
120.0	109.9	34.3	974.5	0.0	27.7	1146.4
130.0	109.9	34.3	1079.2	0.0	27.7	1251.1
140.0	109.9	34.3	1063.0	0.0	27.7	1231.8
150.0	109.9	34.3	926.1	0.0	27.7	1077.9
160.0	109.9	34.3	683.5	0.0	27.7	855.4
170.0	109.9	34.3	362.6	0.0	27.7	534.4
180.0	109.9	34.3	0.0	0.0	27.7	171.8
190.0	109.9	34.3	-362.6	0.0	-27.7	-246.2
200.0	109.9	34.3	-683.5	0.0	-27.7	-567.1
210.0	109.9	34.3	-926.1	0.0	-27.7	-809.6
220.0	109.9	34.3	-1063.0	0.0	-27.7	-946.5
230.0	109.9	34.3	-1079.2	0.0	-27.7	-962.8
240.0	109.9	34.3	-974.5	0.0	-27.7	-858.1
250.0	109.9	34.3	-762.6	0.0	-27.7	-646.2
260.0	109.9	34.3	-470.0	0.0	-27.7	-353.5
270.0	109.9	34.3	-132.4	0.0	27.7	39.5
280.0	109.9	34.3	209.2	0.0	27.7	381.1
290.0	109.9	34.3	513.8	0.0	27.7	685.7
300.0	109.9	34.3	745.2	0.0	27.7	917.1
310.0	109.9	34.3	876.4	0.0	27.7	1048.3
320.0	109.9	34.3	892.8	0.0	27.7	1064.6
330.0	109.9	34.3	793.7	0.0	27.7	965.5
340.0	109.9	34.3	593.0	0.0	27.7	764.8
350.0	109.9	34.3	316.6	0.0	27.7	488.5
360.0	109.9	34.3	0.0	0.0	27.7	171.8

6.18.4 Thruster use

Case 18 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	5.5	151.7	6.0	155.3	2.1	90.0	12.5	145.0
10.0	3.1	155.6	7.5	171.1	9.6	90.0	15.8	130.5
20.0	1.4	155.3	9.1	176.7	16.1	90.0	20.1	121.2
30.0	0.5	85.4	10.7	177.7	21.9	90.0	25.2	115.0
40.0	3.6	21.1	14.5	175.1	26.4	90.0	31.0	110.9
50.0	24.3	10.0	35.8	173.7	27.0	90.0	37.0	108.2
60.0	31.8	12.4	43.7	171.6	27.8	90.0	42.8	106.6
70.0	34.0	16.2	46.5	168.9	27.4	90.0	47.7	105.8
80.0	23.3	28.7	35.8	162.5	27.1	90.0	51.0	105.7
90.0	12.5	98.2	17.6	136.6	25.7	90.0	52.3	106.2
100.0	14.8	104.2	18.1	130.3	20.9	90.0	51.4	107.4
110.0	16.6	109.6	18.3	125.3	15.3	90.0	48.6	109.4
120.0	17.6	114.6	17.9	122.0	9.9	90.0	44.3	112.3
130.0	17.7	119.5	17.0	120.5	5.1	90.0	39.2	116.3
140.0	17.0	124.8	15.6	121.4	1.6	90.0	34.0	121.6
150.0	15.6	130.7	13.8	125.3	-0.3	90.0	29.1	128.5
160.0	13.6	138.1	11.9	133.3	-0.6	90.0	25.1	136.8
170.0	11.3	148.5	10.3	146.7	0.4	90.0	21.9	146.7
180.0	9.3	163.9	9.5	164.8	2.1	90.0	19.7	158.4
190.0	8.2	187.4	10.2	186.0	4.5	90.0	18.4	172.6
200.0	8.9	210.0	11.5	203.5	4.3	90.0	18.9	194.7
210.0	10.3	223.4	12.9	214.6	4.0	90.0	20.9	209.9
220.0	11.9	230.2	14.0	222.9	2.1	90.0	24.3	222.9
230.0	13.2	232.3	14.4	229.6	-1.4	90.0	28.7	232.7
240.0	14.1	230.9	14.0	235.5	-6.2	90.0	33.2	239.6
250.0	14.6	226.9	12.7	241.2	-11.7	90.0	37.2	244.3
260.0	14.7	220.7	10.8	246.9	-17.2	90.0	39.8	247.3
270.0	14.5	211.0	7.9	254.2	-22.7	90.0	40.5	248.9
280.0	14.1	201.5	5.2	263.3	-26.3	90.0	39.2	249.4
290.0	19.5	188.7	7.0	333.8	-27.4	90.0	35.9	248.8
300.0	16.9	181.4	4.7	354.3	-27.8	90.0	31.2	246.9
310.0	12.8	171.8	2.2	60.2	-26.5	90.0	25.6	243.0
320.0	13.1	164.3	3.2	60.2	-22.9	90.0	19.9	236.2
330.0	10.4	150.5	3.2	119.8	-18.4	90.0	14.9	224.4
340.0	9.4	153.5	3.9	119.8	-12.4	90.0	11.4	204.8
350.0	7.7	152.2	4.9	135.0	-4.7	90.0	10.5	167.0
360.0	5.5	151.7	6.0	155.3	2.1	90.0	12.5	145.0

6.18.5 Thruster loss

Case 18 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.93	0.88	0.82
10.0	0.92	0.84	0.81
20.0	0.92	0.80	0.81
30.0	0.88	0.80	0.82
40.0	0.86	0.81	0.83
50.0	0.88	0.82	0.85
60.0	0.88	0.83	0.87
70.0	0.89	0.84	0.86
80.0	0.88	0.85	0.85
90.0	0.85	0.83	0.84
100.0	0.85	0.82	0.85
110.0	0.85	0.81	0.85
120.0	0.85	0.81	0.86
130.0	0.85	0.81	0.86
140.0	0.85	0.81	0.86
150.0	0.85	0.82	0.92
160.0	0.85	0.82	0.91
170.0	0.84	0.81	0.89
180.0	0.81	0.78	0.91
190.0	0.75	0.75	0.91
200.0	0.80	0.83	0.91
210.0	0.81	0.84	0.92
220.0	0.81	0.85	0.92
230.0	0.81	0.85	0.86
240.0	0.81	0.85	0.86
250.0	0.81	0.85	0.85
260.0	0.82	0.85	0.85
270.0	0.84	0.85	0.84
280.0	0.85	0.85	0.85
290.0	0.83	0.87	0.86
300.0	0.79	0.90	0.87
310.0	0.85	0.89	0.85
320.0	0.89	0.89	0.83
330.0	0.93	0.90	0.82
340.0	0.93	0.90	0.81
350.0	0.93	0.90	0.81
360.0	0.93	0.88	0.82

Preliminary Design, @IDR5

6.19 Case 19 - Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 4

6.19.1 Environment and thrust utilisation

Case 19 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	180.0	180.0	0.0	35.0	2.5	6.0	8.5	2.00	5.7
10.0	180.0	180.0	10.0	35.0	2.5	6.0	8.5	2.00	20.1
20.0	180.0	180.0	20.0	35.0	2.5	6.0	8.5	2.00	37.5
30.0	180.0	180.0	30.0	35.0	2.5	6.0	8.5	2.00	52.8
40.0	180.0	180.0	40.0	35.0	2.5	6.0	8.5	2.00	65.1
50.0	180.0	180.0	50.0	35.0	2.5	6.0	8.5	2.00	73.0
60.0	180.0	180.0	60.0	35.0	2.5	6.0	8.5	2.00	76.2
70.0	180.0	180.0	70.0	35.0	2.5	6.0	8.5	2.00	76.8
80.0	180.0	180.0	80.0	35.0	2.5	6.0	8.5	2.00	72.3
90.0	180.0	180.0	90.0	35.0	2.5	6.0	8.5	2.00	63.3
100.0	180.0	180.0	100.0	35.0	2.5	6.0	8.5	2.00	50.8
110.0	180.0	180.0	110.0	35.0	2.5	6.0	8.5	2.00	35.9
120.0	180.0	180.0	120.0	35.0	2.5	6.0	8.5	2.00	22.1
130.0	180.0	180.0	130.0	35.0	2.5	6.0	8.5	2.00	15.8
140.0	180.0	180.0	140.0	35.0	2.5	6.0	8.5	2.00	15.2
150.0	180.0	180.0	150.0	35.0	2.5	6.0	8.5	2.00	13.5
160.0	180.0	180.0	160.0	35.0	2.5	6.0	8.5	2.00	11.9
170.0	180.0	180.0	170.0	35.0	2.5	6.0	8.5	2.00	10.8
180.0	180.0	180.0	180.0	35.0	2.5	6.0	8.5	2.00	11.2
190.0	180.0	180.0	190.0	35.0	2.5	6.0	8.5	2.00	10.8
200.0	180.0	180.0	200.0	35.0	2.5	6.0	8.5	2.00	11.9
210.0	180.0	180.0	210.0	35.0	2.5	6.0	8.5	2.00	13.5
220.0	180.0	180.0	220.0	35.0	2.5	6.0	8.5	2.00	15.2
230.0	180.0	180.0	230.0	35.0	2.5	6.0	8.5	2.00	15.8
240.0	180.0	180.0	240.0	35.0	2.5	6.0	8.5	2.00	22.1
250.0	180.0	180.0	250.0	35.0	2.5	6.0	8.5	2.00	36.2
260.0	180.0	180.0	260.0	35.0	2.5	6.0	8.5	2.00	50.8
270.0	180.0	180.0	270.0	35.0	2.5	6.0	8.5	2.00	63.3
280.0	180.0	180.0	280.0	35.0	2.5	6.0	8.5	2.00	72.3
290.0	180.0	180.0	290.0	35.0	2.5	6.0	8.5	2.00	76.8
300.0	180.0	180.0	300.0	35.0	2.5	6.0	8.5	2.00	76.2
310.0	180.0	180.0	310.0	35.0	2.5	6.0	8.5	2.00	73.0
320.0	180.0	180.0	320.0	35.0	2.5	6.0	8.5	2.00	65.1
330.0	180.0	180.0	330.0	35.0	2.5	6.0	8.5	2.00	52.8
340.0	180.0	180.0	340.0	35.0	2.5	6.0	8.5	2.00	37.5
350.0	180.0	180.0	350.0	35.0	2.5	6.0	8.5	2.00	20.1
360.0	180.0	180.0	360.0	35.0	2.5	6.0	8.5	2.00	5.7

6.19.2 Relative contributions of force components

Case 19 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	78.1	32.5	-35.3	0.0	24.6	100.0
10.0	63.8	26.6	-10.5	0.0	20.1	100.0
20.0	39.9	16.6	31.0	0.0	12.6	100.0
30.0	23.7	9.9	59.0	0.0	7.5	100.0
40.0	14.8	6.1	74.4	0.0	4.7	100.0
50.0	10.0	4.2	82.6	0.0	3.2	100.0
60.0	7.5	3.1	87.0	0.0	2.4	100.0
70.0	6.2	2.6	89.3	0.0	2.0	100.0
80.0	5.6	2.3	90.3	0.0	1.8	100.0
90.0	5.6	2.3	90.3	0.0	1.8	100.0
100.0	6.1	2.6	89.4	0.0	1.9	100.0
110.0	7.3	3.0	87.4	0.0	2.3	100.0
120.0	9.4	3.9	83.8	0.0	3.0	100.0
130.0	12.7	5.3	77.9	0.0	4.0	100.0
140.0	17.9	7.5	68.9	0.0	5.7	100.0
150.0	25.2	10.5	56.3	0.0	8.0	100.0
160.0	33.6	14.0	41.8	0.0	10.6	100.0
170.0	40.8	17.0	29.3	0.0	12.9	100.0
180.0	44.0	18.3	23.8	0.0	13.9	100.0
190.0	40.8	17.0	29.3	0.0	12.9	100.0
200.0	33.6	14.0	41.8	0.0	10.6	100.0
210.0	25.2	10.5	56.3	0.0	8.0	100.0
220.0	17.9	7.5	68.9	0.0	5.7	100.0
230.0	12.7	5.3	77.9	0.0	4.0	100.0
240.0	9.4	3.9	83.8	0.0	3.0	100.0
250.0	7.3	3.0	87.4	0.0	2.3	100.0
260.0	6.1	2.6	89.4	0.0	1.9	100.0
270.0	5.6	2.3	90.3	0.0	1.8	100.0
280.0	5.6	2.3	90.3	0.0	1.8	100.0
290.0	6.2	2.6	89.3	0.0	2.0	100.0
300.0	7.5	3.1	87.0	0.0	2.4	100.0
310.0	10.0	4.2	82.6	0.0	3.2	100.0
320.0	14.8	6.1	74.4	0.0	4.7	100.0
330.0	23.7	9.9	59.0	0.0	7.5	100.0
340.0	39.9	16.6	31.0	0.0	12.6	100.0
350.0	63.8	26.6	-10.5	0.0	20.1	100.0
360.0	78.1	32.5	-35.3	0.0	24.6	100.0

6.19.3 Environment forces

Case 19 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.0	3.3	-3.6	0.0	2.5	10.2
10.0	8.0	3.3	-3.6	0.0	2.5	10.2
20.0	8.0	3.3	-3.5	0.0	2.5	10.3
30.0	8.0	3.3	-3.2	0.0	2.5	10.6
40.0	8.0	3.3	-2.8	0.0	2.5	11.0
50.0	8.0	3.3	-2.3	0.0	2.5	11.5
60.0	8.0	3.3	-1.6	0.0	2.5	12.2
70.0	8.0	3.3	-0.9	0.0	2.5	12.9
80.0	8.0	3.3	-0.1	0.0	2.5	13.7
90.0	8.0	3.3	0.7	0.0	2.5	14.5
100.0	8.0	3.3	1.5	0.0	2.5	15.3
110.0	8.0	3.3	2.3	0.0	2.5	16.1
120.0	8.0	3.3	3.0	0.0	2.5	16.8
130.0	8.0	3.3	3.5	0.0	2.5	17.3
140.0	8.0	3.3	4.0	0.0	2.5	17.8
150.0	8.0	3.3	4.3	0.0	2.5	18.1
160.0	8.0	3.3	4.4	0.0	2.5	18.2
170.0	8.0	3.3	4.4	0.0	2.5	18.2
180.0	8.0	3.3	4.3	0.0	2.5	18.1
190.0	8.0	3.3	4.4	0.0	2.5	18.2
200.0	8.0	3.3	4.4	0.0	2.5	18.2
210.0	8.0	3.3	4.3	0.0	2.5	18.1
220.0	8.0	3.3	4.0	0.0	2.5	17.8
230.0	8.0	3.3	3.5	0.0	2.5	17.3
240.0	8.0	3.3	3.0	0.0	2.5	16.8
250.0	8.0	3.3	2.3	0.0	2.5	16.1
260.0	8.0	3.3	1.5	0.0	2.5	15.3
270.0	8.0	3.3	0.7	0.0	2.5	14.5
280.0	8.0	3.3	-0.1	0.0	2.5	13.7
290.0	8.0	3.3	-0.9	0.0	2.5	12.9
300.0	8.0	3.3	-1.6	0.0	2.5	12.2
310.0	8.0	3.3	-2.3	0.0	2.5	11.5
320.0	8.0	3.3	-2.8	0.0	2.5	11.0
330.0	8.0	3.3	-3.2	0.0	2.5	10.6
340.0	8.0	3.3	-3.5	0.0	2.5	10.3
350.0	8.0	3.3	-3.6	0.0	2.5	10.2
360.0	8.0	3.3	-3.6	0.0	2.5	10.2

Case 19 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-4.8	0.0	0.0	-4.8
20.0	0.0	0.0	-10.0	0.0	0.0	-10.0
30.0	0.0	0.0	-15.6	0.0	0.0	-15.6
40.0	0.0	0.0	-21.7	0.0	0.0	-21.7
50.0	0.0	0.0	-28.0	0.0	0.0	-28.0
60.0	0.0	0.0	-33.8	0.0	0.0	-33.8
70.0	0.0	0.0	-38.7	0.0	0.0	-38.7
80.0	0.0	0.0	-41.9	0.0	0.0	-41.9
90.0	0.0	0.0	-43.0	0.0	0.0	-43.0
100.0	0.0	0.0	-41.9	0.0	0.0	-41.9
110.0	0.0	0.0	-38.7	0.0	0.0	-38.7
120.0	0.0	0.0	-33.8	0.0	0.0	-33.8
130.0	0.0	0.0	-28.0	0.0	0.0	-28.0
140.0	0.0	0.0	-21.7	0.0	0.0	-21.7
150.0	0.0	0.0	-15.6	0.0	0.0	-15.6
160.0	0.0	0.0	-10.0	0.0	0.0	-10.0
170.0	0.0	0.0	-4.8	0.0	0.0	-4.8
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	4.8	0.0	0.0	4.8
200.0	0.0	0.0	10.0	0.0	0.0	10.0
210.0	0.0	0.0	15.6	0.0	0.0	15.6
220.0	0.0	0.0	21.7	0.0	0.0	21.7
230.0	0.0	0.0	28.0	0.0	0.0	28.0
240.0	0.0	0.0	33.8	0.0	0.0	33.8
250.0	0.0	0.0	38.7	0.0	0.0	38.7
260.0	0.0	0.0	41.9	0.0	0.0	41.9
270.0	0.0	0.0	43.0	0.0	0.0	43.0
280.0	0.0	0.0	41.9	0.0	0.0	41.9
290.0	0.0	0.0	38.7	0.0	0.0	38.7
300.0	0.0	0.0	33.8	0.0	0.0	33.8
310.0	0.0	0.0	28.0	0.0	0.0	28.0
320.0	0.0	0.0	21.7	0.0	0.0	21.7
330.0	0.0	0.0	15.6	0.0	0.0	15.6
340.0	0.0	0.0	10.0	0.0	0.0	10.0
350.0	0.0	0.0	4.8	0.0	0.0	4.8
360.0	0.0	0.0	0.0	0.0	0.0	0.0

Case 19 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-316.6	0.0	0.0	-316.6
20.0	0.0	0.0	-593.0	0.0	0.0	-593.0
30.0	0.0	0.0	-793.7	0.0	0.0	-793.7
40.0	0.0	0.0	-892.8	0.0	0.0	-892.8
50.0	0.0	0.0	-876.4	0.0	0.0	-876.4
60.0	0.0	0.0	-745.2	0.0	0.0	-745.2
70.0	0.0	0.0	-513.8	0.0	0.0	-513.8
80.0	0.0	0.0	-209.2	0.0	0.0	-209.2
90.0	0.0	0.0	132.4	0.0	0.0	132.4
100.0	0.0	0.0	470.0	0.0	0.0	470.0
110.0	0.0	0.0	762.6	0.0	0.0	762.6
120.0	0.0	0.0	974.5	0.0	0.0	974.5
130.0	0.0	0.0	1079.2	0.0	0.0	1079.2
140.0	0.0	0.0	1063.0	0.0	0.0	1063.0
150.0	0.0	0.0	926.1	0.0	0.0	926.1
160.0	0.0	0.0	683.5	0.0	0.0	683.5
170.0	0.0	0.0	362.6	0.0	0.0	362.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	-362.6	0.0	0.0	-362.6
200.0	0.0	0.0	-683.5	0.0	0.0	-683.5
210.0	0.0	0.0	-926.1	0.0	0.0	-926.1
220.0	0.0	0.0	-1063.0	0.0	0.0	-1063.0
230.0	0.0	0.0	-1079.2	0.0	0.0	-1079.2
240.0	0.0	0.0	-974.5	0.0	0.0	-974.5
250.0	0.0	0.0	-762.6	0.0	0.0	-762.6
260.0	0.0	0.0	-470.0	0.0	0.0	-470.0
270.0	0.0	0.0	-132.4	0.0	0.0	-132.4
280.0	0.0	0.0	209.2	0.0	0.0	209.2
290.0	0.0	0.0	513.8	0.0	0.0	513.8
300.0	0.0	0.0	745.2	0.0	0.0	745.2
310.0	0.0	0.0	876.4	0.0	0.0	876.4
320.0	0.0	0.0	892.8	0.0	0.0	892.8
330.0	0.0	0.0	793.7	0.0	0.0	793.7
340.0	0.0	0.0	593.0	0.0	0.0	593.0
350.0	0.0	0.0	316.6	0.0	0.0	316.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.19.4 Thruster use

Case 19 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	5.1	180.0	5.1	180.0	0.0	90.0	10.2	180.0
10.0	3.4	196.9	7.0	187.9	6.8	90.0	11.3	154.6
20.0	2.2	228.1	9.0	190.3	13.2	90.0	14.4	136.0
30.0	1.5	240.2	10.1	192.7	19.2	90.0	18.9	124.1
40.0	1.3	299.8	11.7	185.3	23.9	90.0	24.4	116.8
50.0	4.1	7.4	15.6	178.3	27.0	90.0	30.3	112.4
60.0	11.5	15.8	23.5	172.8	27.8	90.0	36.0	109.8
70.0	14.0	24.2	26.3	167.9	27.4	90.0	40.8	108.5
80.0	7.4	86.1	16.0	152.5	27.1	90.0	44.1	108.1
90.0	10.0	101.9	15.7	142.4	23.6	90.0	45.4	108.7
100.0	12.4	108.5	16.1	135.1	18.8	90.0	44.6	110.1
110.0	14.2	114.2	16.1	129.4	13.3	90.0	41.9	112.6
120.0	15.4	119.7	15.7	125.7	7.8	90.0	37.8	116.3
130.0	15.6	125.2	14.7	124.2	3.0	90.0	32.9	121.8
140.0	15.1	131.3	13.4	125.7	-0.5	90.0	28.1	129.3
150.0	13.9	138.6	11.7	131.0	-2.4	90.0	23.9	139.1
160.0	12.2	148.1	10.0	141.8	-2.7	90.0	20.8	151.3
170.0	10.4	161.5	9.0	159.1	-1.7	90.0	18.9	165.2
180.0	9.1	180.0	9.1	180.0	0.0	90.0	18.2	180.0
190.0	9.0	200.9	10.4	198.5	1.7	90.0	18.9	194.8
200.0	10.0	218.2	12.2	211.9	2.7	90.0	20.8	208.7
210.0	11.7	229.0	13.9	221.4	2.4	90.0	23.9	220.9
220.0	13.4	234.3	15.1	223.7	0.5	90.0	28.1	230.7
230.0	14.7	235.8	15.0	234.8	-3.0	90.0	32.9	238.2
240.0	15.7	234.3	15.1	240.3	-7.8	90.0	37.8	243.7
250.0	16.1	236.5	17.2	245.8	-13.3	90.0	41.9	247.4
260.0	16.1	227.9	12.4	251.5	-18.8	90.0	44.6	249.9
270.0	15.7	217.6	10.0	258.1	-23.6	90.0	45.4	251.3
280.0	16.0	207.5	7.4	273.9	-27.1	90.0	44.1	251.9
290.0	26.3	192.1	14.0	335.8	-27.4	90.0	40.8	251.5
300.0	23.5	187.2	11.5	344.2	-27.8	90.0	36.0	250.2
310.0	15.6	181.7	4.1	352.6	-27.0	90.0	30.3	247.6
320.0	11.7	174.7	1.3	60.2	-23.9	90.0	24.4	243.2
330.0	10.1	167.3	1.5	119.8	-19.2	90.0	18.9	235.9
340.0	9.0	169.7	2.2	131.9	-13.2	90.0	14.4	224.0
350.0	7.0	172.1	3.4	163.1	-6.8	90.0	11.3	205.4
360.0	5.1	180.0	5.1	180.0	0.0	90.0	10.2	180.0

6.19.5 Thruster loss

Case 19 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.79	0.79	1.00
10.0	0.87	0.85	0.81
20.0	0.90	0.87	0.81
30.0	0.90	0.88	0.82
40.0	0.89	0.83	0.83
50.0	0.88	0.79	0.85
60.0	0.88	0.82	0.87
70.0	0.88	0.84	0.86
80.0	0.85	0.85	0.85
90.0	0.85	0.84	0.84
100.0	0.85	0.82	0.85
110.0	0.85	0.81	0.85
120.0	0.85	0.81	0.86
130.0	0.85	0.81	0.86
140.0	0.85	0.81	0.92
150.0	0.85	0.81	0.92
160.0	0.84	0.81	0.91
170.0	0.81	0.79	0.91
180.0	0.71	0.71	1.00
190.0	0.79	0.81	0.91
200.0	0.81	0.84	0.91
210.0	0.81	0.85	0.92
220.0	0.81	0.85	0.92
230.0	0.81	0.85	0.86
240.0	0.81	0.85	0.86
250.0	0.81	0.85	0.85
260.0	0.82	0.85	0.85
270.0	0.84	0.85	0.84
280.0	0.85	0.85	0.85
290.0	0.84	0.88	0.86
300.0	0.82	0.88	0.87
310.0	0.79	0.88	0.85
320.0	0.83	0.89	0.83
330.0	0.88	0.90	0.82
340.0	0.87	0.90	0.81
350.0	0.85	0.87	0.81
360.0	0.79	0.79	1.00

Preliminary Design, @IDR5

6.20 Case 20 - Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 5

6.20.1 Environment and thrust utilisation

Case 20 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	0.0	0.0	0.0	35.0	4.0	6.7	9.4	2.00	9.7
10.0	0.0	0.0	10.0	35.0	4.0	6.7	9.4	2.00	21.3
20.0	0.0	0.0	20.0	35.0	4.0	6.7	9.4	2.00	38.2
30.0	0.0	0.0	30.0	35.0	4.0	6.7	9.4	2.00	53.0
40.0	0.0	0.0	40.0	35.0	4.0	6.7	9.4	2.00	64.5
50.0	0.0	0.0	50.0	35.0	4.0	6.7	9.4	2.00	71.8
60.0	0.0	0.0	60.0	35.0	4.0	6.7	9.4	2.00	74.3
70.0	0.0	0.0	70.0	35.0	4.0	6.7	9.4	2.00	74.3
80.0	0.0	0.0	80.0	35.0	4.0	6.7	9.4	2.00	69.1
90.0	0.0	0.0	90.0	35.0	4.0	6.7	9.4	2.00	60.1
100.0	0.0	0.0	100.0	35.0	4.0	6.7	9.4	2.00	48.1
110.0	0.0	0.0	110.0	35.0	4.0	6.7	9.4	2.00	34.2
120.0	0.0	0.0	120.0	35.0	4.0	6.7	9.4	2.00	25.6
130.0	0.0	0.0	130.0	35.0	4.0	6.7	9.4	2.00	14.2
140.0	0.0	0.0	140.0	35.0	4.0	6.7	9.4	2.00	13.1
150.0	0.0	0.0	150.0	35.0	4.0	6.7	9.4	2.00	10.7
160.0	0.0	0.0	160.0	35.0	4.0	6.7	9.4	2.00	8.7
170.0	0.0	0.0	170.0	35.0	4.0	6.7	9.4	2.00	6.4
180.0	0.0	0.0	180.0	35.0	4.0	6.7	9.4	2.00	5.1
190.0	0.0	0.0	190.0	35.0	4.0	6.7	9.4	2.00	6.4
200.0	0.0	0.0	200.0	35.0	4.0	6.7	9.4	2.00	8.7
210.0	0.0	0.0	210.0	35.0	4.0	6.7	9.4	2.00	10.7
220.0	0.0	0.0	220.0	35.0	4.0	6.7	9.4	2.00	13.1
230.0	0.0	0.0	230.0	35.0	4.0	6.7	9.4	2.00	14.2
240.0	0.0	0.0	240.0	35.0	4.0	6.7	9.4	2.00	25.6
250.0	0.0	0.0	250.0	35.0	4.0	6.7	9.4	2.00	34.2
260.0	0.0	0.0	260.0	35.0	4.0	6.7	9.4	2.00	48.1
270.0	0.0	0.0	270.0	35.0	4.0	6.7	9.4	2.00	60.1
280.0	0.0	0.0	280.0	35.0	4.0	6.7	9.4	2.00	69.1
290.0	0.0	0.0	290.0	35.0	4.0	6.7	9.4	2.00	74.1
300.0	0.0	0.0	300.0	35.0	4.0	6.7	9.4	2.00	74.3
310.0	0.0	0.0	310.0	35.0	4.0	6.7	9.4	2.00	71.8
320.0	0.0	0.0	320.0	35.0	4.0	6.7	9.4	2.00	64.5
330.0	0.0	0.0	330.0	35.0	4.0	6.7	9.4	2.00	53.0
340.0	0.0	0.0	340.0	35.0	4.0	6.7	9.4	2.00	38.2
350.0	0.0	0.0	350.0	35.0	4.0	6.7	9.4	2.00	21.3
360.0	0.0	0.0	360.0	35.0	4.0	6.7	9.4	2.00	9.7

6.20.2 Relative contributions of force components

Case 20 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	35.4	25.0	18.9	0.0	20.6	100.0
10.0	33.3	23.5	23.8	0.0	19.4	100.0
20.0	27.9	19.7	36.2	0.0	16.2	100.0
30.0	21.2	15.0	51.4	0.0	12.3	100.0
40.0	15.3	10.8	65.1	0.0	8.9	100.0
50.0	10.9	7.7	75.1	0.0	6.3	100.0
60.0	8.0	5.6	81.7	0.0	4.6	100.0
70.0	6.2	4.4	85.7	0.0	3.6	100.0
80.0	5.2	3.7	88.0	0.0	3.0	100.0
90.0	4.8	3.4	89.0	0.0	2.8	100.0
100.0	4.8	3.4	89.0	0.0	2.8	100.0
110.0	5.3	3.7	87.9	0.0	3.1	100.0
120.0	6.5	4.6	85.2	0.0	3.8	100.0
130.0	8.7	6.1	80.2	0.0	5.0	100.0
140.0	12.8	9.0	70.8	0.0	7.4	100.0
150.0	20.4	14.4	53.4	0.0	11.8	100.0
160.0	33.6	23.7	23.2	0.0	19.5	100.0
170.0	51.4	36.3	-17.6	0.0	29.9	100.0
180.0	60.7	42.9	-38.9	0.0	35.3	100.0
190.0	51.4	36.3	-17.6	0.0	29.9	100.0
200.0	33.6	23.7	23.2	0.0	19.5	100.0
210.0	20.4	14.4	53.4	0.0	11.8	100.0
220.0	12.8	9.0	70.8	0.0	7.4	100.0
230.0	8.7	6.1	80.2	0.0	5.0	100.0
240.0	6.5	4.6	85.2	0.0	3.8	100.0
250.0	5.3	3.7	87.9	0.0	3.1	100.0
260.0	4.8	3.4	89.0	0.0	2.8	100.0
270.0	4.8	3.4	89.0	0.0	2.8	100.0
280.0	5.2	3.7	88.0	0.0	3.0	100.0
290.0	6.2	4.4	85.7	0.0	3.6	100.0
300.0	8.0	5.6	81.7	0.0	4.6	100.0
310.0	10.9	7.7	75.1	0.0	6.3	100.0
320.0	15.3	10.8	65.1	0.0	8.9	100.0
330.0	21.2	15.0	51.4	0.0	12.3	100.0
340.0	27.9	19.7	36.2	0.0	16.2	100.0
350.0	33.3	23.5	23.8	0.0	19.4	100.0
360.0	35.4	25.0	18.9	0.0	20.6	100.0

6.20.3 Environment forces

Case 20 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	-4.8	-3.6	0.0	-3.9	-19.0
10.0	-6.7	-4.8	-3.6	0.0	-3.9	-19.0
20.0	-6.7	-4.8	-3.5	0.0	-3.9	-18.9
30.0	-6.7	-4.8	-3.2	0.0	-3.9	-18.6
40.0	-6.7	-4.8	-2.8	0.0	-3.9	-18.2
50.0	-6.7	-4.8	-2.3	0.0	-3.9	-17.7
60.0	-6.7	-4.8	-1.6	0.0	-3.9	-17.0
70.0	-6.7	-4.8	-0.9	0.0	-3.9	-16.3
80.0	-6.7	-4.8	-0.1	0.0	-3.9	-15.5
90.0	-6.7	-4.8	0.7	0.0	-3.9	-14.7
100.0	-6.7	-4.8	1.5	0.0	-3.9	-13.9
110.0	-6.7	-4.8	2.3	0.0	-3.9	-13.1
120.0	-6.7	-4.8	3.0	0.0	-3.9	-12.5
130.0	-6.7	-4.8	3.5	0.0	-3.9	-11.9
140.0	-6.7	-4.8	4.0	0.0	-3.9	-11.4
150.0	-6.7	-4.8	4.3	0.0	-3.9	-11.1
160.0	-6.7	-4.8	4.4	0.0	-3.9	-11.0
170.0	-6.7	-4.8	4.4	0.0	-3.9	-11.0
180.0	-6.7	-4.8	4.3	0.0	-3.9	-11.1
190.0	-6.7	-4.8	4.4	0.0	-3.9	-11.0
200.0	-6.7	-4.8	4.4	0.0	-3.9	-11.0
210.0	-6.7	-4.8	4.3	0.0	-3.9	-11.1
220.0	-6.7	-4.8	4.0	0.0	-3.9	-11.4
230.0	-6.7	-4.8	3.5	0.0	-3.9	-11.9
240.0	-6.7	-4.8	3.0	0.0	-3.9	-12.5
250.0	-6.7	-4.8	2.3	0.0	-3.9	-13.1
260.0	-6.7	-4.8	1.5	0.0	-3.9	-13.9
270.0	-6.7	-4.8	0.7	0.0	-3.9	-14.7
280.0	-6.7	-4.8	-0.1	0.0	-3.9	-15.5
290.0	-6.7	-4.8	-0.9	0.0	-3.9	-16.3
300.0	-6.7	-4.8	-1.6	0.0	-3.9	-17.0
310.0	-6.7	-4.8	-2.3	0.0	-3.9	-17.7
320.0	-6.7	-4.8	-2.8	0.0	-3.9	-18.2
330.0	-6.7	-4.8	-3.2	0.0	-3.9	-18.6
340.0	-6.7	-4.8	-3.5	0.0	-3.9	-18.9
350.0	-6.7	-4.8	-3.6	0.0	-3.9	-19.0
360.0	-6.7	-4.8	-3.6	0.0	-3.9	-19.0

Case 20 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-4.8	0.0	0.0	-4.8
20.0	0.0	0.0	-10.0	0.0	0.0	-10.0
30.0	0.0	0.0	-15.6	0.0	0.0	-15.6
40.0	0.0	0.0	-21.7	0.0	0.0	-21.7
50.0	0.0	0.0	-28.0	0.0	0.0	-28.0
60.0	0.0	0.0	-33.8	0.0	0.0	-33.8
70.0	0.0	0.0	-38.7	0.0	0.0	-38.7
80.0	0.0	0.0	-41.9	0.0	0.0	-41.9
90.0	0.0	0.0	-43.0	0.0	0.0	-43.0
100.0	0.0	0.0	-41.9	0.0	0.0	-41.9
110.0	0.0	0.0	-38.7	0.0	0.0	-38.7
120.0	0.0	0.0	-33.8	0.0	0.0	-33.8
130.0	0.0	0.0	-28.0	0.0	0.0	-28.0
140.0	0.0	0.0	-21.7	0.0	0.0	-21.7
150.0	0.0	0.0	-15.6	0.0	0.0	-15.6
160.0	0.0	0.0	-10.0	0.0	0.0	-10.0
170.0	0.0	0.0	-4.8	0.0	0.0	-4.8
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	4.8	0.0	0.0	4.8
200.0	0.0	0.0	10.0	0.0	0.0	10.0
210.0	0.0	0.0	15.6	0.0	0.0	15.6
220.0	0.0	0.0	21.7	0.0	0.0	21.7
230.0	0.0	0.0	28.0	0.0	0.0	28.0
240.0	0.0	0.0	33.8	0.0	0.0	33.8
250.0	0.0	0.0	38.7	0.0	0.0	38.7
260.0	0.0	0.0	41.9	0.0	0.0	41.9
270.0	0.0	0.0	43.0	0.0	0.0	43.0
280.0	0.0	0.0	41.9	0.0	0.0	41.9
290.0	0.0	0.0	38.7	0.0	0.0	38.7
300.0	0.0	0.0	33.8	0.0	0.0	33.8
310.0	0.0	0.0	28.0	0.0	0.0	28.0
320.0	0.0	0.0	21.7	0.0	0.0	21.7
330.0	0.0	0.0	15.6	0.0	0.0	15.6
340.0	0.0	0.0	10.0	0.0	0.0	10.0
350.0	0.0	0.0	4.8	0.0	0.0	4.8
360.0	0.0	0.0	0.0	0.0	0.0	0.0

Case 20 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-316.6	0.0	0.0	-316.6
20.0	0.0	0.0	-593.0	0.0	0.0	-593.0
30.0	0.0	0.0	-793.7	0.0	0.0	-793.7
40.0	0.0	0.0	-892.8	0.0	0.0	-892.8
50.0	0.0	0.0	-876.4	0.0	0.0	-876.4
60.0	0.0	0.0	-745.2	0.0	0.0	-745.2
70.0	0.0	0.0	-513.8	0.0	0.0	-513.8
80.0	0.0	0.0	-209.2	0.0	0.0	-209.2
90.0	0.0	0.0	132.4	0.0	0.0	132.4
100.0	0.0	0.0	470.0	0.0	0.0	470.0
110.0	0.0	0.0	762.6	0.0	0.0	762.6
120.0	0.0	0.0	974.5	0.0	0.0	974.5
130.0	0.0	0.0	1079.2	0.0	0.0	1079.2
140.0	0.0	0.0	1063.0	0.0	0.0	1063.0
150.0	0.0	0.0	926.1	0.0	0.0	926.1
160.0	0.0	0.0	683.5	0.0	0.0	683.5
170.0	0.0	0.0	362.6	0.0	0.0	362.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	-362.6	0.0	0.0	-362.6
200.0	0.0	0.0	-683.5	0.0	0.0	-683.5
210.0	0.0	0.0	-926.1	0.0	0.0	-926.1
220.0	0.0	0.0	-1063.0	0.0	0.0	-1063.0
230.0	0.0	0.0	-1079.2	0.0	0.0	-1079.2
240.0	0.0	0.0	-974.5	0.0	0.0	-974.5
250.0	0.0	0.0	-762.6	0.0	0.0	-762.6
260.0	0.0	0.0	-470.0	0.0	0.0	-470.0
270.0	0.0	0.0	-132.4	0.0	0.0	-132.4
280.0	0.0	0.0	209.2	0.0	0.0	209.2
290.0	0.0	0.0	513.8	0.0	0.0	513.8
300.0	0.0	0.0	745.2	0.0	0.0	745.2
310.0	0.0	0.0	876.4	0.0	0.0	876.4
320.0	0.0	0.0	892.8	0.0	0.0	892.8
330.0	0.0	0.0	793.7	0.0	0.0	793.7
340.0	0.0	0.0	593.0	0.0	0.0	593.0
350.0	0.0	0.0	316.6	0.0	0.0	316.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.20.4 Thruster use

Case 20 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	9.5	0.0	9.5	0.0	0.0	90.0	19.0	360.0
10.0	11.4	355.1	7.7	352.7	6.8	90.0	19.6	14.3
20.0	13.1	352.9	6.1	344.2	13.3	90.0	21.4	27.9
30.0	14.6	353.3	4.5	337.2	19.1	90.0	24.3	40.0
40.0	15.6	356.1	2.9	337.9	23.9	90.0	28.4	50.1
50.0	21.0	1.9	3.4	169.0	26.7	90.0	33.1	57.7
60.0	28.3	6.6	11.5	164.2	27.4	90.0	37.9	63.3
70.0	30.3	11.2	14.6	157.1	27.1	90.0	42.0	67.2
80.0	21.0	33.8	4.0	119.8	26.8	90.0	44.7	69.7
90.0	15.2	47.7	8.9	60.2	24.0	90.0	45.4	71.1
100.0	15.6	57.5	11.0	60.2	19.1	90.0	44.1	71.6
110.0	15.7	64.2	12.7	60.2	13.5	90.0	40.8	71.2
120.0	15.2	68.0	13.6	60.2	8.0	90.0	36.1	69.8
130.0	14.1	68.6	13.6	60.2	3.1	90.0	30.4	67.0
140.0	12.3	66.6	12.7	59.1	-0.5	90.0	24.6	62.2
150.0	10.2	64.2	11.1	52.8	-2.4	90.0	19.2	54.5
160.0	7.9	55.3	9.0	43.6	-2.7	90.0	14.8	42.3
170.0	5.9	34.1	6.8	27.9	-1.7	90.0	12.0	23.8
180.0	5.5	0.0	5.5	0.0	0.0	90.0	11.0	360.0
190.0	6.8	332.1	5.9	325.9	1.7	90.0	12.0	336.2
200.0	9.0	316.4	7.9	304.7	2.7	90.0	14.8	317.7
210.0	11.1	307.2	10.2	295.8	2.1	90.0	19.2	305.5
220.0	12.7	300.9	12.3	293.4	0.5	90.0	24.6	297.8
230.0	13.6	299.8	14.1	291.4	-3.1	90.0	30.4	293.0
240.0	13.6	299.8	15.2	292.0	-8.0	90.0	36.1	290.2
250.0	12.7	299.8	15.7	295.8	-13.5	90.0	40.8	288.8
260.0	11.0	291.8	15.6	302.5	-19.1	90.0	44.1	288.4
270.0	8.9	299.8	15.2	312.3	-24.0	90.0	45.4	288.9
280.0	4.0	240.2	21.0	326.2	-26.8	90.0	44.7	290.3
290.0	14.6	202.9	30.3	348.8	-27.1	90.0	42.0	292.8
300.0	11.5	195.8	28.3	353.4	-27.4	90.0	37.9	296.7
310.0	3.4	191.0	21.0	358.1	-26.7	90.0	33.1	302.3
320.0	2.9	22.1	15.6	3.9	-23.9	90.0	28.4	309.9
330.0	4.5	22.8	14.6	6.7	-19.1	90.0	24.3	320.0
340.0	6.1	15.8	13.1	7.1	-13.3	90.0	21.4	332.1
350.0	7.7	7.3	11.4	4.9	-6.8	90.0	19.6	345.7
360.0	9.5	0.0	9.5	0.0	0.0	90.0	19.0	360.0

6.20.5 Thruster loss

Case 20 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.86	1.00
10.0	0.84	0.85	0.80
20.0	0.84	0.86	0.80
30.0	0.85	0.87	0.81
40.0	0.87	0.88	0.82
50.0	0.88	0.83	0.84
60.0	0.88	0.84	0.86
70.0	0.89	0.86	0.85
80.0	0.86	0.82	0.84
90.0	0.86	0.81	0.83
100.0	0.86	0.82	0.84
110.0	0.86	0.83	0.84
120.0	0.87	0.84	0.85
130.0	0.88	0.85	0.85
140.0	0.90	0.87	0.91
150.0	0.92	0.88	0.90
160.0	0.92	0.88	0.90
170.0	0.93	0.89	0.90
180.0	0.95	0.95	1.00
190.0	0.89	0.93	0.90
200.0	0.88	0.92	0.90
210.0	0.88	0.92	0.90
220.0	0.87	0.90	0.91
230.0	0.85	0.88	0.85
240.0	0.84	0.87	0.85
250.0	0.83	0.86	0.84
260.0	0.82	0.86	0.84
270.0	0.81	0.86	0.83
280.0	0.82	0.86	0.84
290.0	0.86	0.89	0.85
300.0	0.84	0.88	0.86
310.0	0.83	0.88	0.84
320.0	0.88	0.87	0.82
330.0	0.87	0.85	0.81
340.0	0.86	0.84	0.80
350.0	0.85	0.84	0.80
360.0	0.86	0.86	1.00

Preliminary Design, @IDR5

6.21 Case 21 - Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 5

6.21.1 Environment and thrust utilisation

Case 21 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	10.0	10.0	0.0	35.0	4.0	6.7	9.4	2.00	28.4
10.0	10.0	10.0	10.0	35.0	4.0	6.7	9.4	2.00	46.5
20.0	10.0	10.0	20.0	35.0	4.0	6.7	9.4	2.00	63.3
30.0	10.0	10.0	30.0	35.0	4.0	6.7	9.4	2.00	77.9
40.0	10.0	10.0	40.0	35.0	4.0	6.7	9.4	2.00	89.0
50.0	10.0	10.0	50.0	35.0	4.0	6.7	9.4	2.00	95.9
60.0	10.0	10.0	60.0	35.0	4.0	6.7	9.4	2.00	97.8
70.0	10.0	10.0	70.0	35.0	4.0	6.7	9.4	2.00	97.8
80.0	10.0	10.0	80.0	35.0	4.0	6.7	9.4	2.00	92.8
90.0	10.0	10.0	90.0	35.0	4.0	6.7	9.4	2.00	84.7
100.0	10.0	10.0	100.0	35.0	4.0	6.7	9.4	2.00	68.4
110.0	10.0	10.0	110.0	35.0	4.0	6.7	9.4	2.00	54.5
120.0	10.0	10.0	120.0	35.0	4.0	6.7	9.4	2.00	40.7
130.0	10.0	10.0	130.0	35.0	4.0	6.7	9.4	2.00	29.1
140.0	10.0	10.0	140.0	35.0	4.0	6.7	9.4	2.00	22.2
150.0	10.0	10.0	150.0	35.0	4.0	6.7	9.4	2.00	18.9
160.0	10.0	10.0	160.0	35.0	4.0	6.7	9.4	2.00	17.1
170.0	10.0	10.0	170.0	35.0	4.0	6.7	9.4	2.00	16.9
180.0	10.0	10.0	180.0	35.0	4.0	6.7	9.4	2.00	24.2
190.0	10.0	10.0	190.0	35.0	4.0	6.7	9.4	2.00	28.4
200.0	10.0	10.0	200.0	35.0	4.0	6.7	9.4	2.00	25.5
210.0	10.0	10.0	210.0	35.0	4.0	6.7	9.4	2.00	25.0
220.0	10.0	10.0	220.0	35.0	4.0	6.7	9.4	2.00	20.8
230.0	10.0	10.0	230.0	35.0	4.0	6.7	9.4	2.00	15.0
240.0	10.0	10.0	240.0	35.0	4.0	6.7	9.4	2.00	15.7
250.0	10.0	10.0	250.0	35.0	4.0	6.7	9.4	2.00	20.5
260.0	10.0	10.0	260.0	35.0	4.0	6.7	9.4	2.00	30.4
270.0	10.0	10.0	270.0	35.0	4.0	6.7	9.4	2.00	42.5
280.0	10.0	10.0	280.0	35.0	4.0	6.7	9.4	2.00	51.4
290.0	10.0	10.0	290.0	35.0	4.0	6.7	9.4	2.00	59.8
300.0	10.0	10.0	300.0	35.0	4.0	6.7	9.4	2.00	60.1
310.0	10.0	10.0	310.0	35.0	4.0	6.7	9.4	2.00	57.2
320.0	10.0	10.0	320.0	35.0	4.0	6.7	9.4	2.00	49.6
330.0	10.0	10.0	330.0	35.0	4.0	6.7	9.4	2.00	37.9
340.0	10.0	10.0	340.0	35.0	4.0	6.7	9.4	2.00	23.0
350.0	10.0	10.0	350.0	35.0	4.0	6.7	9.4	2.00	10.2
360.0	10.0	10.0	360.0	35.0	4.0	6.7	9.4	2.00	28.4

6.21.2 Relative contributions of force components

Case 21 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	39.1	25.7	14.7	0.0	20.4	100.0
10.0	35.4	22.8	23.9	0.0	17.9	100.0
20.0	30.8	19.3	34.8	0.0	15.1	100.0
30.0	26.0	16.0	45.5	0.0	12.5	100.0
40.0	21.7	13.1	55.0	0.0	10.2	100.0
50.0	18.2	10.9	62.5	0.0	8.4	100.0
60.0	15.7	9.2	68.1	0.0	7.1	100.0
70.0	13.9	8.1	71.8	0.0	6.2	100.0
80.0	12.9	7.5	73.9	0.0	5.7	100.0
90.0	12.5	7.2	74.8	0.0	5.5	100.0
100.0	12.7	7.3	74.4	0.0	5.6	100.0
110.0	13.6	7.8	72.6	0.0	5.9	100.0
120.0	15.2	8.8	69.4	0.0	6.7	100.0
130.0	17.7	10.3	64.1	0.0	7.8	100.0
140.0	21.5	12.6	56.3	0.0	9.6	100.0
150.0	26.9	16.0	44.8	0.0	12.3	100.0
160.0	34.5	20.8	28.6	0.0	15.1	100.0
170.0	44.6	27.5	6.5	0.0	21.4	100.0
180.0	56.8	36.1	-21.3	0.0	28.4	100.0
190.0	68.2	45.1	-49.2	0.0	35.9	100.0
200.0	39.3	30.6	-1.9	0.0	37.0	100.0
210.0	12.1	12.7	46.2	0.0	29.0	100.0
220.0	-0.9	3.1	77.2	0.0	20.3	100.0
230.0	-3.8	-0.4	91.0	0.0	14.7	100.0
240.0	-5.4	-1.7	96.8	0.0	11.4	100.0
250.0	-6.5	-2.1	99.0	0.0	9.5	100.0
260.0	-6.2	-2.1	99.7	0.0	8.6	100.0
270.0	-5.8	-1.9	99.3	0.0	8.4	100.0
280.0	-5.3	-1.5	98.1	0.0	8.8	100.0
290.0	-4.4	-0.8	95.4	0.0	9.8	100.0
300.0	-2.7	0.6	90.5	0.0	11.6	100.0
310.0	0.8	3.2	81.7	0.0	14.3	100.0
320.0	7.3	7.8	67.1	0.0	17.8	100.0
330.0	17.4	14.4	47.2	0.0	21.0	100.0
340.0	28.8	21.4	27.9	0.0	21.9	100.0
350.0	40.0	27.1	11.1	0.0	21.8	100.0
360.0	39.1	25.7	14.7	0.0	20.4	100.0

6.21.3 Environment forces

Case 21 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.8	-4.8	-3.6	0.0	-3.9	-19.2
10.0	-6.8	-4.8	-3.6	0.0	-3.9	-19.2
20.0	-6.8	-4.8	-3.5	0.0	-3.9	-19.1
30.0	-6.8	-4.8	-3.2	0.0	-3.9	-18.8
40.0	-6.8	-4.8	-2.8	0.0	-3.9	-18.4
50.0	-6.8	-4.8	-2.3	0.0	-3.9	-17.9
60.0	-6.8	-4.8	-1.6	0.0	-3.9	-17.2
70.0	-6.8	-4.8	-0.9	0.0	-3.9	-16.5
80.0	-6.8	-4.8	-0.1	0.0	-3.9	-15.7
90.0	-6.8	-4.8	0.7	0.0	-3.9	-14.9
100.0	-6.8	-4.8	1.5	0.0	-3.9	-14.1
110.0	-6.8	-4.8	2.3	0.0	-3.9	-13.3
120.0	-6.8	-4.8	3.0	0.0	-3.9	-12.6
130.0	-6.8	-4.8	3.5	0.0	-3.9	-12.1
140.0	-6.8	-4.8	4.0	0.0	-3.9	-11.6
150.0	-6.8	-4.8	4.3	0.0	-3.9	-11.3
160.0	-6.8	-4.8	4.4	0.0	-3.9	-11.2
170.0	-6.8	-4.8	4.4	0.0	-3.9	-11.2
180.0	-6.8	-4.8	4.3	0.0	-3.9	-11.3
190.0	-6.8	-4.8	4.4	0.0	-3.9	-11.2
200.0	-6.8	-4.8	4.4	0.0	-3.9	-11.2
210.0	-6.8	-4.8	4.3	0.0	-3.9	-11.3
220.0	-6.8	-4.8	4.0	0.0	-3.9	-11.6
230.0	-6.8	-4.8	3.5	0.0	-3.9	-12.1
240.0	-6.8	-4.8	3.0	0.0	-3.9	-12.6
250.0	-6.8	-4.8	2.3	0.0	-3.9	-13.3
260.0	-6.8	-4.8	1.5	0.0	-3.9	-14.1
270.0	-6.8	-4.8	0.7	0.0	-3.9	-14.9
280.0	-6.8	-4.8	-0.1	0.0	-3.9	-15.7
290.0	-6.8	-4.8	-0.9	0.0	-3.9	-16.5
300.0	-6.8	-4.8	-1.6	0.0	-3.9	-17.2
310.0	-6.8	-4.8	-2.3	0.0	-3.9	-17.9
320.0	-6.8	-4.8	-2.8	0.0	-3.9	-18.4
330.0	-6.8	-4.8	-3.2	0.0	-3.9	-18.8
340.0	-6.8	-4.8	-3.5	0.0	-3.9	-19.1
350.0	-6.8	-4.8	-3.6	0.0	-3.9	-19.2
360.0	-6.8	-4.8	-3.6	0.0	-3.9	-19.2

Case 21 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.3	-2.8	0.0	0.0	-2.0	-10.1
10.0	-5.3	-2.8	-4.8	0.0	-2.0	-14.9
20.0	-5.3	-2.8	-10.0	0.0	-2.0	-20.0
30.0	-5.3	-2.8	-15.6	0.0	-2.0	-25.7
40.0	-5.3	-2.8	-21.7	0.0	-2.0	-31.8
50.0	-5.3	-2.8	-28.0	0.0	-2.0	-38.0
60.0	-5.3	-2.8	-33.8	0.0	-2.0	-43.9
70.0	-5.3	-2.8	-38.7	0.0	-2.0	-48.7
80.0	-5.3	-2.8	-41.9	0.0	-2.0	-51.9
90.0	-5.3	-2.8	-43.0	0.0	-2.0	-53.1
100.0	-5.3	-2.8	-41.9	0.0	-2.0	-51.9
110.0	-5.3	-2.8	-38.7	0.0	-2.0	-48.7
120.0	-5.3	-2.8	-33.8	0.0	-2.0	-43.9
130.0	-5.3	-2.8	-28.0	0.0	-2.0	-38.0
140.0	-5.3	-2.8	-21.7	0.0	-2.0	-31.8
150.0	-5.3	-2.8	-15.6	0.0	-2.0	-25.7
160.0	-5.3	-2.8	-10.0	0.0	-2.0	-20.0
170.0	-5.3	-2.8	-4.8	0.0	-2.0	-14.9
180.0	-5.3	-2.8	0.0	0.0	-2.0	-10.1
190.0	-5.3	-2.8	4.8	0.0	-2.0	-5.2
200.0	-5.3	-2.8	10.0	0.0	2.0	4.0
210.0	-5.3	-2.8	15.6	0.0	2.0	9.6
220.0	-5.3	-2.8	21.7	0.0	2.0	15.7
230.0	-5.3	-2.8	28.0	0.0	2.0	22.0
240.0	-5.3	-2.8	33.8	0.0	2.0	27.8
250.0	-5.3	-2.8	38.7	0.0	2.0	32.7
260.0	-5.3	-2.8	41.9	0.0	2.0	35.9
270.0	-5.3	-2.8	43.0	0.0	2.0	37.0
280.0	-5.3	-2.8	41.9	0.0	2.0	35.9
290.0	-5.3	-2.8	38.7	0.0	2.0	32.7
300.0	-5.3	-2.8	33.8	0.0	2.0	27.8
310.0	-5.3	-2.8	28.0	0.0	2.0	22.0
320.0	-5.3	-2.8	21.7	0.0	2.0	15.7
330.0	-5.3	-2.8	15.6	0.0	2.0	9.6
340.0	-5.3	-2.8	10.0	0.0	2.0	4.0
350.0	-5.3	-2.8	4.8	0.0	-2.0	-5.2
360.0	-5.3	-2.8	0.0	0.0	-2.0	-10.1

Case 21 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-184.0	-55.8	0.0	0.0	-55.6	-295.3
10.0	-184.0	-55.8	-316.6	0.0	-55.6	-612.0
20.0	-184.0	-55.8	-593.0	0.0	-55.6	-888.3
30.0	-184.0	-55.8	-793.7	0.0	-55.6	-1089.0
40.0	-184.0	-55.8	-892.8	0.0	-55.6	-1188.1
50.0	-184.0	-55.8	-876.4	0.0	-55.6	-1171.8
60.0	-184.0	-55.8	-745.2	0.0	-55.6	-1040.6
70.0	-184.0	-55.8	-513.8	0.0	-55.6	-809.2
80.0	-184.0	-55.8	-209.2	0.0	-55.6	-504.6
90.0	-184.0	-55.8	132.4	0.0	-55.6	-163.0
100.0	-184.0	-55.8	470.0	0.0	55.6	285.7
110.0	-184.0	-55.8	762.6	0.0	55.6	578.4
120.0	-184.0	-55.8	974.5	0.0	55.6	790.3
130.0	-184.0	-55.8	1079.2	0.0	55.6	895.0
140.0	-184.0	-55.8	1063.0	0.0	55.6	873.7
150.0	-184.0	-55.8	926.1	0.0	55.6	741.8
160.0	-184.0	-55.8	683.5	0.0	55.6	499.3
170.0	-184.0	-55.8	362.6	0.0	55.6	178.4
180.0	-184.0	-55.8	0.0	0.0	-55.6	-295.3
190.0	-184.0	-55.8	-362.6	0.0	-55.6	-657.9
200.0	-184.0	-55.8	-683.5	0.0	-55.6	-978.9
210.0	-184.0	-55.8	-926.1	0.0	-55.6	-1221.4
220.0	-184.0	-55.8	-1063.0	0.0	-55.6	-1358.3
230.0	-184.0	-55.8	-1079.2	0.0	-55.6	-1374.6
240.0	-184.0	-55.8	-974.5	0.0	-55.6	-1269.9
250.0	-184.0	-55.8	-762.6	0.0	-55.6	-1058.0
260.0	-184.0	-55.8	-470.0	0.0	-55.6	-765.3
270.0	-184.0	-55.8	-132.4	0.0	-55.6	-427.7
280.0	-184.0	-55.8	209.2	0.0	-55.6	-86.1
290.0	-184.0	-55.8	513.8	0.0	55.6	329.6
300.0	-184.0	-55.8	745.2	0.0	55.6	561.0
310.0	-184.0	-55.8	876.4	0.0	55.6	692.2
320.0	-184.0	-55.8	892.8	0.0	55.6	708.5
330.0	-184.0	-55.8	793.7	0.0	55.6	609.4
340.0	-184.0	-55.8	593.0	0.0	55.6	408.7
350.0	-184.0	-55.8	316.6	0.0	55.6	132.4
360.0	-184.0	-55.8	0.0	0.0	-55.6	-295.3

6.21.4 Thruster use

Case 21 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	12.2	1.1	7.0	1.9	9.6	90.0	21.7	27.7
10.0	14.1	357.0	5.2	351.9	16.4	90.0	24.3	37.8
20.0	15.8	355.0	3.6	337.2	22.8	90.0	27.7	46.4
30.0	38.0	0.0	19.2	180.0	25.7	90.0	31.8	53.8
40.0	70.1	2.5	51.7	177.0	26.1	90.0	36.7	59.9
50.0	90.9	3.8	73.0	175.7	26.6	90.0	42.0	64.8
60.0	98.2	5.1	81.0	174.5	27.4	90.0	47.2	68.6
70.0	100.1	6.5	83.6	172.9	27.1	90.0	51.5	71.3
80.0	88.1	8.6	72.5	170.5	26.8	90.0	54.3	73.2
90.0	63.6	12.7	48.8	165.1	26.5	90.0	55.1	74.3
100.0	27.4	54.8	3.5	119.8	26.6	90.0	53.8	74.8
110.0	17.5	65.8	12.4	60.2	22.0	90.0	50.5	74.7
120.0	17.1	69.2	13.3	60.2	16.4	90.0	45.7	73.9
130.0	15.9	69.9	13.3	60.2	11.5	90.0	39.9	72.4
140.0	14.2	67.4	12.4	60.2	7.9	90.0	33.9	69.9
150.0	12.1	60.2	10.7	60.2	5.9	90.0	28.1	66.2
160.0	10.0	48.2	8.4	57.4	5.5	90.0	22.9	60.9
170.0	8.3	31.1	5.8	45.2	6.5	90.0	18.6	53.1
180.0	8.2	1.7	3.1	4.4	9.6	90.0	15.2	41.7
190.0	9.1	340.9	4.0	309.5	11.3	90.0	12.3	25.1
200.0	10.9	321.3	7.6	290.9	9.5	90.0	11.9	340.4
210.0	12.9	312.4	10.1	285.2	9.6	90.0	14.9	319.6
220.0	14.4	306.1	12.2	281.9	7.7	90.0	19.6	306.5
230.0	15.2	301.4	13.3	277.4	4.3	90.0	25.1	298.8
240.0	15.1	299.8	14.8	289.9	-0.6	90.0	30.6	294.4
250.0	14.2	299.8	15.5	293.8	-6.1	90.0	35.3	292.2
260.0	12.6	291.8	15.3	300.6	-11.7	90.0	38.5	291.4
270.0	10.5	299.8	14.9	310.6	-16.6	90.0	39.9	291.9
280.0	8.2	299.8	14.5	323.4	-20.1	90.0	39.2	293.6
290.0	5.1	299.8	14.8	340.6	-23.3	90.0	36.6	296.8
300.0	3.4	321.2	14.7	350.9	-23.4	90.0	32.7	301.7
310.0	3.2	356.0	14.7	359.1	-21.5	90.0	28.3	309.1
320.0	4.5	15.2	14.1	4.7	-18.1	90.0	24.2	319.5
330.0	6.1	17.5	13.1	7.9	-13.3	90.0	21.1	332.9
340.0	7.7	13.1	11.7	8.4	-7.4	90.0	19.5	348.2
350.0	10.1	11.0	9.4	11.5	1.4	90.0	19.9	15.2
360.0	12.2	1.1	7.0	1.9	9.6	90.0	21.7	27.7

6.21.5 Thruster loss

Case 21 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.85	0.81
10.0	0.85	0.85	0.80
20.0	0.85	0.86	0.80
30.0	0.87	0.78	0.81
40.0	0.87	0.79	0.82
50.0	0.88	0.80	0.84
60.0	0.89	0.80	0.86
70.0	0.89	0.81	0.85
80.0	0.90	0.82	0.84
90.0	0.91	0.82	0.83
100.0	0.86	0.80	0.84
110.0	0.86	0.83	0.84
120.0	0.87	0.84	0.85
130.0	0.88	0.85	0.85
140.0	0.90	0.86	0.85
150.0	0.92	0.88	0.86
160.0	0.92	0.88	0.87
170.0	0.93	0.89	0.88
180.0	0.95	0.94	0.90
190.0	0.90	0.93	0.90
200.0	0.89	0.92	0.90
210.0	0.88	0.90	0.90
220.0	0.87	0.89	0.91
230.0	0.85	0.88	0.92
240.0	0.84	0.87	0.85
250.0	0.83	0.86	0.84
260.0	0.82	0.86	0.84
270.0	0.81	0.86	0.83
280.0	0.80	0.86	0.84
290.0	0.80	0.87	0.85
300.0	0.81	0.88	0.86
310.0	0.87	0.88	0.84
320.0	0.88	0.86	0.82
330.0	0.87	0.85	0.81
340.0	0.86	0.84	0.80
350.0	0.85	0.83	0.81
360.0	0.85	0.85	0.81

Preliminary Design, @IDR5

6.22 Case 22 - Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 5

6.22.1 Environment and thrust utilisation

Case 22 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	20.0	20.0	0.0	35.0	4.0	6.7	9.4	2.00	54.6
10.0	20.0	20.0	10.0	35.0	4.0	6.7	9.4	2.00	72.9
20.0	20.0	20.0	20.0	35.0	4.0	6.7	9.4	2.00	89.6
30.0	20.0	20.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	20.0	20.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	20.0	20.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	20.0	20.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	20.0	20.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	20.0	20.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	20.0	20.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	20.0	20.0	100.0	35.0	4.0	6.7	9.4	2.00	90.7
110.0	20.0	20.0	110.0	35.0	4.0	6.7	9.4	2.00	76.6
120.0	20.0	20.0	120.0	35.0	4.0	6.7	9.4	2.00	62.6
130.0	20.0	20.0	130.0	35.0	4.0	6.7	9.4	2.00	50.8
140.0	20.0	20.0	140.0	35.0	4.0	6.7	9.4	2.00	42.0
150.0	20.0	20.0	150.0	35.0	4.0	6.7	9.4	2.00	37.1
160.0	20.0	20.0	160.0	35.0	4.0	6.7	9.4	2.00	36.0
170.0	20.0	20.0	170.0	35.0	4.0	6.7	9.4	2.00	44.3
180.0	20.0	20.0	180.0	35.0	4.0	6.7	9.4	2.00	48.4
190.0	20.0	20.0	190.0	35.0	4.0	6.7	9.4	2.00	53.1
200.0	20.0	20.0	200.0	35.0	4.0	6.7	9.4	2.00	55.9
210.0	20.0	20.0	210.0	35.0	4.0	6.7	9.4	2.00	54.9
220.0	20.0	20.0	220.0	35.0	4.0	6.7	9.4	2.00	38.0
230.0	20.0	20.0	230.0	35.0	4.0	6.7	9.4	2.00	29.8
240.0	20.0	20.0	240.0	35.0	4.0	6.7	9.4	2.00	19.4
250.0	20.0	20.0	250.0	35.0	4.0	6.7	9.4	2.00	16.0
260.0	20.0	20.0	260.0	35.0	4.0	6.7	9.4	2.00	15.2
270.0	20.0	20.0	270.0	35.0	4.0	6.7	9.4	2.00	24.9
280.0	20.0	20.0	280.0	35.0	4.0	6.7	9.4	2.00	33.6
290.0	20.0	20.0	290.0	35.0	4.0	6.7	9.4	2.00	44.8
300.0	20.0	20.0	300.0	35.0	4.0	6.7	9.4	2.00	45.1
310.0	20.0	20.0	310.0	35.0	4.0	6.7	9.4	2.00	41.9
320.0	20.0	20.0	320.0	35.0	4.0	6.7	9.4	2.00	34.0
330.0	20.0	20.0	330.0	35.0	4.0	6.7	9.4	2.00	10.9
340.0	20.0	20.0	340.0	35.0	4.0	6.7	9.4	2.00	12.8
350.0	20.0	20.0	350.0	35.0	4.0	6.7	9.4	2.00	36.7
360.0	20.0	20.0	360.0	35.0	4.0	6.7	9.4	2.00	54.6

6.22.2 Relative contributions of force components

Case 22 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	44.6	26.9	8.3	0.0	20.2	100.0
10.0	40.0	23.8	18.3	0.0	17.8	100.0
20.0	35.6	21.0	27.9	0.0	15.6	100.0
30.0	31.4	18.3	36.7	0.0	13.6	100.0
40.0	27.6	16.0	44.6	0.0	11.8	100.0
50.0	24.4	14.0	51.2	0.0	10.3	100.0
60.0	22.0	12.5	56.4	0.0	9.2	100.0
70.0	20.2	11.5	60.0	0.0	8.4	100.0
80.0	19.2	10.8	62.1	0.0	7.9	100.0
90.0	18.8	10.6	62.9	0.0	7.7	100.0
100.0	19.1	10.8	62.3	0.0	7.8	100.0
110.0	20.1	11.3	60.3	0.0	8.3	100.0
120.0	21.9	12.3	56.7	0.0	9.0	100.0
130.0	24.5	13.9	51.5	0.0	10.1	100.0
140.0	28.1	15.9	44.3	0.0	11.7	100.0
150.0	32.7	18.6	35.0	0.0	13.7	100.0
160.0	38.4	22.0	23.4	0.0	16.2	100.0
170.0	45.3	26.2	9.2	0.0	19.3	100.0
180.0	53.7	31.4	-8.4	0.0	23.3	100.0
190.0	64.9	38.5	-32.0	0.0	28.7	100.0
200.0	78.7	47.7	-62.4	0.0	36.0	100.0
210.0	86.1	54.7	-82.3	0.0	42.0	100.0
220.0	-6.6	21.1	65.1	0.0	38.7	100.0
230.0	-21.2	-7.7	98.9	0.0	30.0	100.0
240.0	-23.4	-10.2	110.2	0.0	23.4	100.0
250.0	-22.5	-10.3	113.3	0.0	19.5	100.0
260.0	-21.2	-9.8	113.6	0.0	17.4	100.0
270.0	-20.1	-9.3	112.6	0.0	16.8	100.0
280.0	-19.2	-8.7	110.6	0.0	17.2	100.0
290.0	-17.8	-7.6	106.6	0.0	18.8	100.0
300.0	-14.7	-5.2	98.5	0.0	21.5	100.0
310.0	-7.2	-0.1	82.7	0.0	24.6	100.0
320.0	7.6	9.3	56.9	0.0	26.2	100.0
330.0	49.8	32.6	-7.7	0.0	25.3	100.0
340.0	51.9	32.6	-9.4	0.0	24.9	100.0
350.0	48.9	30.0	-1.6	0.0	22.7	100.0
360.0	44.6	26.9	8.3	0.0	20.2	100.0

6.22.3 Environment forces

Case 22 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-7.0	-5.0	-3.6	0.0	-4.0	-19.6
10.0	-7.0	-5.0	-3.6	0.0	-4.0	-19.6
20.0	-7.0	-5.0	-3.5	0.0	-4.0	-19.4
30.0	-7.0	-5.0	-3.2	0.0	-4.0	-19.2
40.0	-7.0	-5.0	-2.8	0.0	-4.0	-18.8
50.0	-7.0	-5.0	-2.3	0.0	-4.0	-18.2
60.0	-7.0	-5.0	-1.6	0.0	-4.0	-17.6
70.0	-7.0	-5.0	-0.9	0.0	-4.0	-16.9
80.0	-7.0	-5.0	-0.1	0.0	-4.0	-16.1
90.0	-7.0	-5.0	0.7	0.0	-4.0	-15.3
100.0	-7.0	-5.0	1.5	0.0	-4.0	-14.5
110.0	-7.0	-5.0	2.3	0.0	-4.0	-13.7
120.0	-7.0	-5.0	3.0	0.0	-4.0	-13.0
130.0	-7.0	-5.0	3.5	0.0	-4.0	-12.4
140.0	-7.0	-5.0	4.0	0.0	-4.0	-12.0
150.0	-7.0	-5.0	4.3	0.0	-4.0	-11.7
160.0	-7.0	-5.0	4.4	0.0	-4.0	-11.5
170.0	-7.0	-5.0	4.4	0.0	-4.0	-11.5
180.0	-7.0	-5.0	4.3	0.0	-4.0	-11.7
190.0	-7.0	-5.0	4.4	0.0	-4.0	-11.5
200.0	-7.0	-5.0	4.4	0.0	-4.0	-11.5
210.0	-7.0	-5.0	4.3	0.0	-4.0	-11.7
220.0	-7.0	-5.0	4.0	0.0	-4.0	-12.0
230.0	-7.0	-5.0	3.5	0.0	-4.0	-12.4
240.0	-7.0	-5.0	3.0	0.0	-4.0	-13.0
250.0	-7.0	-5.0	2.3	0.0	-4.0	-13.7
260.0	-7.0	-5.0	1.5	0.0	-4.0	-14.5
270.0	-7.0	-5.0	0.7	0.0	-4.0	-15.3
280.0	-7.0	-5.0	-0.1	0.0	-4.0	-16.1
290.0	-7.0	-5.0	-0.9	0.0	-4.0	-16.9
300.0	-7.0	-5.0	-1.6	0.0	-4.0	-17.6
310.0	-7.0	-5.0	-2.3	0.0	-4.0	-18.2
320.0	-7.0	-5.0	-2.8	0.0	-4.0	-18.8
330.0	-7.0	-5.0	-3.2	0.0	-4.0	-19.2
340.0	-7.0	-5.0	-3.5	0.0	-4.0	-19.4
350.0	-7.0	-5.0	-3.6	0.0	-4.0	-19.6
360.0	-7.0	-5.0	-3.6	0.0	-4.0	-19.6

Case 22 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-11.2	-6.0	0.0	0.0	-4.3	-21.5
10.0	-11.2	-6.0	-4.8	0.0	-4.3	-26.4
20.0	-11.2	-6.0	-10.0	0.0	-4.3	-31.5
30.0	-11.2	-6.0	-15.6	0.0	-4.3	-37.2
40.0	-11.2	-6.0	-21.7	0.0	-4.3	-43.3
50.0	-11.2	-6.0	-28.0	0.0	-4.3	-49.5
60.0	-11.2	-6.0	-33.8	0.0	-4.3	-55.4
70.0	-11.2	-6.0	-38.7	0.0	-4.3	-60.2
80.0	-11.2	-6.0	-41.9	0.0	-4.3	-63.4
90.0	-11.2	-6.0	-43.0	0.0	-4.3	-64.5
100.0	-11.2	-6.0	-41.9	0.0	-4.3	-63.4
110.0	-11.2	-6.0	-38.7	0.0	-4.3	-60.2
120.0	-11.2	-6.0	-33.8	0.0	-4.3	-55.4
130.0	-11.2	-6.0	-28.0	0.0	-4.3	-49.5
140.0	-11.2	-6.0	-21.7	0.0	-4.3	-43.3
150.0	-11.2	-6.0	-15.6	0.0	-4.3	-37.2
160.0	-11.2	-6.0	-10.0	0.0	-4.3	-31.5
170.0	-11.2	-6.0	-4.8	0.0	-4.3	-26.4
180.0	-11.2	-6.0	0.0	0.0	-4.3	-21.5
190.0	-11.2	-6.0	4.8	0.0	-4.3	-16.7
200.0	-11.2	-6.0	10.0	0.0	-4.3	-11.5
210.0	-11.2	-6.0	15.6	0.0	-4.3	-5.9
220.0	-11.2	-6.0	21.7	0.0	4.3	8.9
230.0	-11.2	-6.0	28.0	0.0	4.3	15.1
240.0	-11.2	-6.0	33.8	0.0	4.3	21.0
250.0	-11.2	-6.0	38.7	0.0	4.3	25.8
260.0	-11.2	-6.0	41.9	0.0	4.3	29.0
270.0	-11.2	-6.0	43.0	0.0	4.3	30.1
280.0	-11.2	-6.0	41.9	0.0	4.3	29.0
290.0	-11.2	-6.0	38.7	0.0	4.3	25.8
300.0	-11.2	-6.0	33.8	0.0	4.3	21.0
310.0	-11.2	-6.0	28.0	0.0	4.3	15.1
320.0	-11.2	-6.0	21.7	0.0	4.3	8.9
330.0	-11.2	-6.0	15.6	0.0	-4.3	-5.9
340.0	-11.2	-6.0	10.0	0.0	-4.3	-11.5
350.0	-11.2	-6.0	4.8	0.0	-4.3	-16.7
360.0	-11.2	-6.0	0.0	0.0	-4.3	-21.5

Case 22 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-351.6	-105.4	0.0	0.0	-104.4	-561.4
10.0	-351.6	-105.4	-316.6	0.0	-104.4	-878.0
20.0	-351.6	-105.4	-593.0	0.0	-104.4	-1154.3
30.0	-351.6	-105.4	-793.7	0.0	-104.4	-1355.0
40.0	-351.6	-105.4	-892.8	0.0	-104.4	-1454.1
50.0	-351.6	-105.4	-876.4	0.0	-104.4	-1437.8
60.0	-351.6	-105.4	-745.2	0.0	-104.4	-1306.6
70.0	-351.6	-105.4	-513.8	0.0	-104.4	-1075.2
80.0	-351.6	-105.4	-209.2	0.0	-104.4	-770.6
90.0	-351.6	-105.4	132.4	0.0	-104.4	-429.0
100.0	-351.6	-105.4	470.0	0.0	104.4	117.5
110.0	-351.6	-105.4	762.6	0.0	104.4	410.1
120.0	-351.6	-105.4	974.5	0.0	104.4	622.0
130.0	-351.6	-105.4	1079.2	0.0	104.4	728.7
140.0	-351.6	-105.4	1063.0	0.0	104.4	719.4
150.0	-351.6	-105.4	926.1	0.0	104.4	573.0
160.0	-351.6	-105.4	683.5	0.0	104.4	331.0
170.0	-351.6	-105.4	362.6	0.0	-104.4	-198.8
180.0	-351.6	-105.4	0.0	0.0	-104.4	-561.4
190.0	-351.6	-105.4	-362.6	0.0	-104.4	-924.0
200.0	-351.6	-105.4	-683.5	0.0	-104.4	-1244.9
210.0	-351.6	-105.4	-926.1	0.0	-104.4	-1487.4
220.0	-351.6	-105.4	-1063.0	0.0	-104.4	-1624.3
230.0	-351.6	-105.4	-1079.2	0.0	-104.4	-1640.6
240.0	-351.6	-105.4	-974.5	0.0	-104.4	-1535.9
250.0	-351.6	-105.4	-762.6	0.0	-104.4	-1324.0
260.0	-351.6	-105.4	-470.0	0.0	-104.4	-1031.3
270.0	-351.6	-105.4	-132.4	0.0	-104.4	-693.8
280.0	-351.6	-105.4	209.2	0.0	-104.4	-352.1
290.0	-351.6	-105.4	513.8	0.0	104.4	161.3
300.0	-351.6	-105.4	745.2	0.0	104.4	392.7
310.0	-351.6	-105.4	876.4	0.0	104.4	523.9
320.0	-351.6	-105.4	892.8	0.0	104.4	540.3
330.0	-351.6	-105.4	793.7	0.0	104.4	441.2
340.0	-351.6	-105.4	593.0	0.0	104.4	240.5
350.0	-351.6	-105.4	316.6	0.0	-104.4	-244.7
360.0	-351.6	-105.4	0.0	0.0	-104.4	-561.4

6.22.4 Thruster use

Case 22 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	15.1	3.7	4.6	11.6	19.6	90.0	29.1	47.7
10.0	24.1	1.2	4.5	174.0	25.4	90.0	32.8	53.4
20.0	70.6	2.6	51.2	176.7	25.5	90.0	37.0	58.3
30.0	97.1	0.1	79.7	174.1	25.7	90.0	38.4	62.4
40.0	98.0	0.1	83.7	175.2	26.1	90.0	36.2	66.2
50.0	99.1	0.1	86.4	174.6	26.6	90.0	37.3	69.4
60.0	100.4	0.1	88.5	172.4	27.4	90.0	41.4	72.1
70.0	102.0	0.2	91.0	169.4	27.1	90.0	45.8	74.2
80.0	100.3	6.9	87.7	173.0	26.8	90.0	51.1	75.8
90.0	103.0	9.0	89.8	170.9	26.5	90.0	58.4	77.1
100.0	82.4	13.8	67.7	165.3	26.6	90.0	65.0	77.2
110.0	42.4	24.8	29.3	147.7	26.7	90.0	61.7	77.2
120.0	19.3	70.7	13.3	60.2	25.6	90.0	56.9	76.8
130.0	18.2	71.4	13.3	60.2	20.7	90.0	51.1	75.9
140.0	16.5	69.3	12.5	60.2	17.1	90.0	44.9	74.5
150.0	14.3	63.6	10.7	60.2	15.0	90.0	39.0	72.5
160.0	12.1	52.5	8.4	60.2	14.6	90.0	33.6	69.9
170.0	10.6	26.5	4.1	60.2	18.1	90.0	26.8	66.4
180.0	11.1	5.1	1.1	54.7	19.6	90.0	24.1	61.6
190.0	11.7	348.5	2.3	272.5	21.3	90.0	20.3	55.4
200.0	13.0	335.3	5.4	267.6	22.3	90.0	16.3	45.0
210.0	14.4	325.7	8.0	268.7	22.1	90.0	13.1	26.7
220.0	16.0	311.3	12.0	273.9	15.1	90.0	14.9	323.6
230.0	16.6	306.7	13.7	269.7	11.6	90.0	19.6	309.5
240.0	16.4	303.2	14.7	285.8	6.9	90.0	24.7	301.8
250.0	15.6	301.0	15.0	292.3	1.4	90.0	29.2	298.0
260.0	13.9	291.8	14.8	300.6	-4.2	90.0	32.4	296.5
270.0	11.8	299.9	14.3	310.8	-9.0	90.0	33.8	296.9
280.0	9.5	303.3	13.8	322.1	-12.6	90.0	33.2	299.0
290.0	5.9	315.0	13.5	340.6	-17.2	90.0	30.8	303.2
300.0	4.7	337.4	13.4	351.7	-17.2	90.0	27.4	310.0
310.0	5.0	1.7	13.2	0.6	-15.4	90.0	23.7	320.4
320.0	6.4	14.2	12.7	6.9	-11.9	90.0	20.8	334.7
330.0	9.8	24.4	10.9	20.9	-2.1	90.0	20.1	17.1
340.0	11.3	20.5	9.6	23.3	3.8	90.0	22.6	30.7
350.0	13.3	8.5	6.7	16.4	12.8	90.0	25.7	40.5
360.0	15.1	3.7	4.6	11.6	19.6	90.0	29.1	47.7

6.22.5 Thruster loss

Case 22 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.83	0.81
10.0	0.86	0.81	0.80
20.0	0.86	0.80	0.80
30.0	0.87	0.81	0.81
40.0	0.87	0.80	0.82
50.0	0.88	0.80	0.84
60.0	0.90	0.81	0.86
70.0	0.91	0.83	0.85
80.0	0.91	0.81	0.84
90.0	0.92	0.81	0.83
100.0	0.92	0.81	0.84
110.0	0.92	0.81	0.84
120.0	0.87	0.84	0.85
130.0	0.88	0.85	0.85
140.0	0.89	0.86	0.85
150.0	0.92	0.88	0.86
160.0	0.92	0.88	0.87
170.0	0.93	0.88	0.88
180.0	0.95	0.88	0.90
190.0	0.92	0.91	0.90
200.0	0.90	0.89	0.90
210.0	0.89	0.88	0.90
220.0	0.88	0.88	0.91
230.0	0.86	0.87	0.92
240.0	0.84	0.86	0.93
250.0	0.83	0.86	0.93
260.0	0.82	0.86	0.84
270.0	0.81	0.86	0.83
280.0	0.81	0.86	0.84
290.0	0.81	0.87	0.85
300.0	0.83	0.88	0.86
310.0	0.88	0.88	0.84
320.0	0.88	0.86	0.82
330.0	0.87	0.84	0.81
340.0	0.86	0.83	0.83
350.0	0.85	0.83	0.81
360.0	0.85	0.83	0.81

Preliminary Design, @IDR5

6.23 Case 23 - Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 5

6.23.1 Environment and thrust utilisation

Case 23 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	30.0	30.0	0.0	35.0	6.4	6.7	9.4	2.00	> 100.0
10.0	30.0	30.0	10.0	35.0	6.4	6.7	9.4	2.00	> 100.0
20.0	30.0	30.0	20.0	35.0	6.4	6.7	9.4	2.00	> 100.0
30.0	30.0	30.0	30.0	35.0	6.4	6.7	9.4	2.00	> 100.0
40.0	30.0	30.0	40.0	35.0	6.4	6.7	9.4	2.00	> 100.0
50.0	30.0	30.0	50.0	35.0	6.4	6.7	9.4	2.00	> 100.0
60.0	30.0	30.0	60.0	35.0	6.4	6.7	9.4	2.00	> 100.0
70.0	30.0	30.0	70.0	35.0	6.4	6.7	9.4	2.00	> 100.0
80.0	30.0	30.0	80.0	35.0	6.4	6.7	9.4	2.00	> 100.0
90.0	30.0	30.0	90.0	35.0	6.4	6.7	9.4	2.00	> 100.0
100.0	30.0	30.0	100.0	35.0	6.4	6.7	9.4	2.00	> 100.0
110.0	30.0	30.0	110.0	35.0	6.4	6.7	9.4	2.00	> 100.0
120.0	30.0	30.0	120.0	35.0	6.4	6.7	9.4	2.00	> 100.0
130.0	30.0	30.0	130.0	35.0	6.4	6.7	9.4	2.00	> 100.0
140.0	30.0	30.0	140.0	35.0	6.4	6.7	9.4	2.00	> 100.0
150.0	30.0	30.0	150.0	35.0	6.4	6.7	9.4	2.00	> 100.0
160.0	30.0	30.0	160.0	35.0	6.4	6.7	9.4	2.00	> 100.0
170.0	30.0	30.0	170.0	35.0	6.4	6.7	9.4	2.00	> 100.0
180.0	30.0	30.0	180.0	35.0	6.4	6.7	9.4	2.00	> 100.0
190.0	30.0	30.0	190.0	35.0	6.4	6.7	9.4	2.00	> 100.0
200.0	30.0	30.0	200.0	35.0	6.4	6.7	9.4	2.00	> 100.0
210.0	30.0	30.0	210.0	35.0	6.4	6.7	9.4	2.00	> 100.0
220.0	30.0	30.0	220.0	35.0	6.4	6.7	9.4	2.00	> 100.0
230.0	30.0	30.0	230.0	35.0	6.4	6.7	9.4	2.00	> 100.0
240.0	30.0	30.0	240.0	35.0	6.4	6.7	9.4	2.00	> 100.0
250.0	30.0	30.0	250.0	35.0	6.4	6.7	9.4	2.00	91.7
260.0	30.0	30.0	260.0	35.0	6.4	6.7	9.4	2.00	78.4
270.0	30.0	30.0	270.0	35.0	6.4	6.7	9.4	2.00	23.1
280.0	30.0	30.0	280.0	35.0	6.4	6.7	9.4	2.00	58.0
290.0	30.0	30.0	290.0	35.0	6.4	6.7	9.4	2.00	53.4
300.0	30.0	30.0	300.0	35.0	6.4	6.7	9.4	2.00	53.3
310.0	30.0	30.0	310.0	35.0	6.4	6.7	9.4	2.00	39.5
320.0	30.0	30.0	320.0	35.0	6.4	6.7	9.4	2.00	49.0
330.0	30.0	30.0	330.0	35.0	6.4	6.7	9.4	2.00	84.3
340.0	30.0	30.0	340.0	35.0	6.4	6.7	9.4	2.00	> 100.0
350.0	30.0	30.0	350.0	35.0	6.4	6.7	9.4	2.00	> 100.0
360.0	30.0	30.0	360.0	35.0	6.4	6.7	9.4	2.00	> 100.0

6.23.2 Relative contributions of force components

Case 23 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	28.5	41.7	2.7	0.0	27.2	100.0
10.0	26.9	39.2	8.4	0.0	25.5	100.0
20.0	25.3	36.9	13.9	0.0	23.9	100.0
30.0	23.8	34.5	19.3	0.0	22.4	100.0
40.0	22.3	32.2	24.6	0.0	20.9	100.0
50.0	20.9	30.2	29.4	0.0	19.5	100.0
60.0	19.8	28.4	33.5	0.0	18.3	100.0
70.0	18.9	27.1	36.6	0.0	17.4	100.0
80.0	18.4	26.3	38.5	0.0	16.9	100.0
90.0	18.2	26.0	39.1	0.0	16.7	100.0
100.0	18.4	26.3	38.4	0.0	16.9	100.0
110.0	19.0	27.2	36.4	0.0	17.4	100.0
120.0	20.0	28.6	33.1	0.0	18.4	100.0
130.0	21.3	30.5	28.6	0.0	19.6	100.0
140.0	22.9	32.8	23.2	0.0	21.1	100.0
150.0	24.6	35.4	17.2	0.0	22.8	100.0
160.0	26.5	38.1	10.8	0.0	24.6	100.0
170.0	28.4	41.0	4.2	0.0	26.5	100.0
180.0	30.3	43.9	-2.7	0.0	28.4	100.0
190.0	32.6	47.3	-10.6	0.0	30.7	100.0
200.0	35.2	51.4	-20.1	0.0	33.4	100.0
210.0	38.4	56.4	-31.5	0.0	36.8	100.0
220.0	42.0	62.1	-45.1	0.0	40.8	100.0
230.0	45.6	68.3	-59.0	0.0	45.0	100.0
240.0	49.1	73.0	-69.5	0.0	48.5	100.0
250.0	48.3	74.6	-72.8	0.0	49.9	100.0
260.0	46.7	73.1	-69.1	0.0	49.3	100.0
270.0	-7.5	-1.8	61.4	0.0	47.9	100.0
280.0	43.9	69.0	-59.5	0.0	46.6	100.0
290.0	43.3	67.3	-55.8	0.0	45.2	100.0
300.0	42.0	64.5	-49.5	0.0	43.0	100.0
310.0	39.8	60.4	-40.2	0.0	40.0	100.0
320.0	37.1	55.7	-29.6	0.0	36.7	100.0
330.0	34.5	51.3	-19.5	0.0	33.7	100.0
340.0	32.1	47.5	-10.8	0.0	31.1	100.0
350.0	30.2	44.4	-3.5	0.0	29.0	100.0
360.0	28.5	41.7	2.7	0.0	27.2	100.0

6.23.3 Environment forces

Case 23 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-7.1	-13.0	-3.6	0.0	-9.4	-33.1
10.0	-7.1	-13.0	-3.6	0.0	-9.4	-33.1
20.0	-7.1	-13.0	-3.5	0.0	-9.4	-33.0
30.0	-7.1	-13.0	-3.2	0.0	-9.4	-32.7
40.0	-7.1	-13.0	-2.8	0.0	-9.4	-32.3
50.0	-7.1	-13.0	-2.3	0.0	-9.4	-31.8
60.0	-7.1	-13.0	-1.6	0.0	-9.4	-31.1
70.0	-7.1	-13.0	-0.9	0.0	-9.4	-30.4
80.0	-7.1	-13.0	-0.1	0.0	-9.4	-29.6
90.0	-7.1	-13.0	0.7	0.0	-9.4	-28.8
100.0	-7.1	-13.0	1.5	0.0	-9.4	-28.0
110.0	-7.1	-13.0	2.3	0.0	-9.4	-27.2
120.0	-7.1	-13.0	3.0	0.0	-9.4	-26.6
130.0	-7.1	-13.0	3.5	0.0	-9.4	-26.0
140.0	-7.1	-13.0	4.0	0.0	-9.4	-25.5
150.0	-7.1	-13.0	4.3	0.0	-9.4	-25.2
160.0	-7.1	-13.0	4.4	0.0	-9.4	-25.1
170.0	-7.1	-13.0	4.4	0.0	-9.4	-25.1
180.0	-7.1	-13.0	4.3	0.0	-9.4	-25.2
190.0	-7.1	-13.0	4.4	0.0	-9.4	-25.1
200.0	-7.1	-13.0	4.4	0.0	-9.4	-25.1
210.0	-7.1	-13.0	4.3	0.0	-9.4	-25.2
220.0	-7.1	-13.0	4.0	0.0	-9.4	-25.5
230.0	-7.1	-13.0	3.5	0.0	-9.4	-26.0
240.0	-7.1	-13.0	3.0	0.0	-9.4	-26.6
250.0	-7.1	-13.0	2.3	0.0	-9.4	-27.2
260.0	-7.1	-13.0	1.5	0.0	-9.4	-28.0
270.0	-7.1	-13.0	0.7	0.0	-9.4	-28.8
280.0	-7.1	-13.0	-0.1	0.0	-9.4	-29.6
290.0	-7.1	-13.0	-0.9	0.0	-9.4	-30.4
300.0	-7.1	-13.0	-1.6	0.0	-9.4	-31.1
310.0	-7.1	-13.0	-2.3	0.0	-9.4	-31.8
320.0	-7.1	-13.0	-2.8	0.0	-9.4	-32.3
330.0	-7.1	-13.0	-3.2	0.0	-9.4	-32.7
340.0	-7.1	-13.0	-3.5	0.0	-9.4	-33.0
350.0	-7.1	-13.0	-3.6	0.0	-9.4	-33.1
360.0	-7.1	-13.0	-3.6	0.0	-9.4	-33.1

Case 23 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-17.9	-24.7	0.0	0.0	-15.6	-58.2
10.0	-17.9	-24.7	-4.8	0.0	-15.6	-63.0
20.0	-17.9	-24.7	-10.0	0.0	-15.6	-68.2
30.0	-17.9	-24.7	-15.6	0.0	-15.6	-73.8
40.0	-17.9	-24.7	-21.7	0.0	-15.6	-79.9
50.0	-17.9	-24.7	-28.0	0.0	-15.6	-86.2
60.0	-17.9	-24.7	-33.8	0.0	-15.6	-92.0
70.0	-17.9	-24.7	-38.7	0.0	-15.6	-96.9
80.0	-17.9	-24.7	-41.9	0.0	-15.6	-100.1
90.0	-17.9	-24.7	-43.0	0.0	-15.6	-101.2
100.0	-17.9	-24.7	-41.9	0.0	-15.6	-100.1
110.0	-17.9	-24.7	-38.7	0.0	-15.6	-96.9
120.0	-17.9	-24.7	-33.8	0.0	-15.6	-92.0
130.0	-17.9	-24.7	-28.0	0.0	-15.6	-86.2
140.0	-17.9	-24.7	-21.7	0.0	-15.6	-79.9
150.0	-17.9	-24.7	-15.6	0.0	-15.6	-73.8
160.0	-17.9	-24.7	-10.0	0.0	-15.6	-68.2
170.0	-17.9	-24.7	-4.8	0.0	-15.6	-63.0
180.0	-17.9	-24.7	0.0	0.0	-15.6	-58.2
190.0	-17.9	-24.7	4.8	0.0	-15.6	-53.4
200.0	-17.9	-24.7	10.0	0.0	-15.6	-48.2
210.0	-17.9	-24.7	15.6	0.0	-15.6	-42.6
220.0	-17.9	-24.7	21.7	0.0	-15.6	-36.5
230.0	-17.9	-24.7	28.0	0.0	-15.6	-30.2
240.0	-17.9	-24.7	33.8	0.0	-15.6	-24.4
250.0	-17.9	-24.7	38.7	0.0	-15.6	-19.5
260.0	-17.9	-24.7	41.9	0.0	-15.6	-16.3
270.0	-17.9	-24.7	43.0	0.0	15.6	16.0
280.0	-17.9	-24.7	41.9	0.0	-15.6	-16.3
290.0	-17.9	-24.7	38.7	0.0	-15.6	-19.5
300.0	-17.9	-24.7	33.8	0.0	-15.6	-24.4
310.0	-17.9	-24.7	28.0	0.0	-15.6	-30.2
320.0	-17.9	-24.7	21.7	0.0	-15.6	-36.5
330.0	-17.9	-24.7	15.6	0.0	-15.6	-42.6
340.0	-17.9	-24.7	10.0	0.0	-15.6	-48.2
350.0	-17.9	-24.7	4.8	0.0	-15.6	-53.4
360.0	-17.9	-24.7	0.0	0.0	-15.6	-58.2

Case 23 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-501.2	-375.0	0.0	0.0	-322.0	-1198.1
10.0	-501.2	-375.0	-316.6	0.0	-322.0	-1514.7
20.0	-501.2	-375.0	-593.0	0.0	-322.0	-1791.1
30.0	-501.2	-375.0	-793.7	0.0	-322.0	-1991.8
40.0	-501.2	-375.0	-892.8	0.0	-322.0	-2090.9
50.0	-501.2	-375.0	-876.4	0.0	-322.0	-2074.5
60.0	-501.2	-375.0	-745.2	0.0	-322.0	-1943.3
70.0	-501.2	-375.0	-513.8	0.0	-322.0	-1711.9
80.0	-501.2	-375.0	-209.2	0.0	-322.0	-1407.3
90.0	-501.2	-375.0	132.4	0.0	-322.0	-1065.7
100.0	-501.2	-375.0	470.0	0.0	-322.0	-728.1
110.0	-501.2	-375.0	762.6	0.0	-322.0	-435.5
120.0	-501.2	-375.0	974.5	0.0	322.0	420.4
130.0	-501.2	-375.0	1079.2	0.0	322.0	538.1
140.0	-501.2	-375.0	1063.0	0.0	322.0	503.8
150.0	-501.2	-375.0	926.1	0.0	322.0	371.9
160.0	-501.2	-375.0	683.5	0.0	-322.0	-514.6
170.0	-501.2	-375.0	362.6	0.0	-322.0	-835.5
180.0	-501.2	-375.0	0.0	0.0	-322.0	-1198.1
190.0	-501.2	-375.0	-362.6	0.0	-322.0	-1560.7
200.0	-501.2	-375.0	-683.5	0.0	-322.0	-1881.6
210.0	-501.2	-375.0	-926.1	0.0	-322.0	-2124.2
220.0	-501.2	-375.0	-1063.0	0.0	-322.0	-2261.1
230.0	-501.2	-375.0	-1079.2	0.0	-322.0	-2277.4
240.0	-501.2	-375.0	-974.5	0.0	-322.0	-2172.6
250.0	-501.2	-375.0	-762.6	0.0	-322.0	-1960.7
260.0	-501.2	-375.0	-470.0	0.0	-322.0	-1668.1
270.0	-501.2	-375.0	-132.4	0.0	-322.0	-1330.5
280.0	-501.2	-375.0	209.2	0.0	-322.0	-988.9
290.0	-501.2	-375.0	513.8	0.0	-322.0	-684.3
300.0	-501.2	-375.0	745.2	0.0	-322.0	-452.9
310.0	-501.2	-375.0	876.4	0.0	322.0	322.3
320.0	-501.2	-375.0	892.8	0.0	322.0	338.6
330.0	-501.2	-375.0	793.7	0.0	-322.0	-404.4
340.0	-501.2	-375.0	593.0	0.0	-322.0	-605.1
350.0	-501.2	-375.0	316.6	0.0	-322.0	-881.5
360.0	-501.2	-375.0	0.0	0.0	-322.0	-1198.1

6.23.4 Thruster use

Case 23 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	91.6	0.1	72.5	172.7	24.5	90.0	39.2	59.9
10.0	91.7	0.0	77.2	177.7	24.2	90.0	31.0	61.8
20.0	92.1	360.0	81.3	181.6	24.3	90.0	24.5	63.8
30.0	92.7	359.9	84.6	184.0	24.5	90.0	20.3	65.8
40.0	93.5	359.9	86.7	184.9	24.8	90.0	18.7	67.6
50.0	90.9	355.4	83.7	179.9	25.4	90.0	19.4	69.4
60.0	91.2	357.4	83.5	180.0	26.2	90.0	23.4	71.1
70.0	91.8	0.4	83.4	180.0	25.8	90.0	27.8	72.3
80.0	93.4	4.4	83.2	180.0	25.5	90.0	34.1	73.2
90.0	95.8	8.7	83.2	180.0	25.3	90.0	41.4	73.9
100.0	97.3	7.0	83.9	173.1	25.3	90.0	49.1	74.4
110.0	98.5	8.9	83.2	171.0	25.5	90.0	55.8	74.3
120.0	99.9	11.0	81.9	160.6	25.7	90.0	74.8	73.9
130.0	100.1	10.5	81.8	158.4	25.7	90.0	77.4	73.2
140.0	100.2	11.7	79.5	159.7	25.8	90.0	77.4	72.3
150.0	100.4	12.8	77.0	162.9	26.0	90.0	75.0	71.1
160.0	99.9	8.6	80.1	171.4	26.3	90.0	56.8	69.8
170.0	96.5	11.6	75.8	180.0	26.8	90.0	43.9	68.0
180.0	93.6	7.2	75.7	180.0	27.2	90.0	42.5	66.2
190.0	90.6	2.4	75.8	180.0	27.2	90.0	34.4	64.5
200.0	88.9	357.9	76.1	180.0	27.3	90.0	27.3	62.2
210.0	88.6	354.7	76.6	179.9	27.4	90.0	22.5	58.9
220.0	89.8	353.0	77.3	180.0	27.6	90.0	20.4	54.5
230.0	93.9	353.5	78.1	180.0	27.9	90.0	23.0	48.9
240.0	101.1	359.9	79.1	185.2	28.2	90.0	31.3	42.0
250.0	77.9	350.5	80.6	184.5	28.2	90.0	33.5	35.6
260.0	38.4	350.9	11.5	210.1	28.2	90.0	32.4	30.2
270.0	20.1	325.6	17.0	315.7	7.3	90.0	32.9	331.0
280.0	20.4	352.1	9.8	343.1	22.0	90.0	33.8	28.9
290.0	20.0	359.2	10.4	358.5	20.1	90.0	36.1	32.7
300.0	20.4	6.1	11.1	11.2	20.0	90.0	39.5	38.0
310.0	20.6	23.8	15.3	32.3	13.7	90.0	43.9	43.6
320.0	22.2	25.9	15.6	37.7	17.2	90.0	48.7	48.5
330.0	54.1	8.8	22.4	157.8	25.8	90.0	53.7	52.5
340.0	92.1	0.2	63.4	160.8	25.1	90.0	56.4	55.2
350.0	91.7	0.2	68.0	166.9	24.6	90.0	47.7	57.7
360.0	91.6	0.1	72.5	172.7	24.5	90.0	39.2	59.9

6.23.5 Thruster loss

Case 23 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.82	0.79	0.77
10.0	0.82	0.76	0.76
20.0	0.82	0.76	0.76
30.0	0.83	0.78	0.77
40.0	0.83	0.79	0.78
50.0	0.84	0.75	0.80
60.0	0.85	0.74	0.82
70.0	0.87	0.74	0.81
80.0	0.87	0.74	0.80
90.0	0.88	0.74	0.80
100.0	0.89	0.76	0.80
110.0	0.89	0.75	0.80
120.0	0.89	0.77	0.81
130.0	0.89	0.76	0.81
140.0	0.89	0.76	0.81
150.0	0.89	0.75	0.82
160.0	0.90	0.72	0.83
170.0	0.90	0.68	0.84
180.0	0.90	0.67	0.86
190.0	0.91	0.68	0.86
200.0	0.90	0.68	0.85
210.0	0.89	0.68	0.86
220.0	0.88	0.69	0.87
230.0	0.88	0.70	0.88
240.0	0.90	0.74	0.89
250.0	0.89	0.74	0.89
260.0	0.87	0.83	0.89
270.0	0.80	0.83	0.89
280.0	0.85	0.86	0.89
290.0	0.86	0.88	0.90
300.0	0.86	0.85	0.90
310.0	0.86	0.84	0.87
320.0	0.85	0.84	0.84
330.0	0.83	0.84	0.81
340.0	0.82	0.84	0.79
350.0	0.82	0.82	0.77
360.0	0.82	0.79	0.77

Preliminary Design, @IDR5

6.24 Case 24 - Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 5

6.24.1 Environment and thrust utilisation

Case 24 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	40.0	40.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	40.0	40.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	40.0	40.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	40.0	40.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	40.0	40.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	40.0	40.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	40.0	40.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	40.0	40.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	40.0	40.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	40.0	40.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	40.0	40.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	40.0	40.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	40.0	40.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	40.0	40.0	130.0	35.0	4.0	6.7	9.4	2.00	98.0
140.0	40.0	40.0	140.0	35.0	4.0	6.7	9.4	2.00	89.0
150.0	40.0	40.0	150.0	35.0	4.0	6.7	9.4	2.00	84.3
160.0	40.0	40.0	160.0	35.0	4.0	6.7	9.4	2.00	95.8
170.0	40.0	40.0	170.0	35.0	4.0	6.7	9.4	2.00	97.6
180.0	40.0	40.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	40.0	40.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	40.0	40.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	40.0	40.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	40.0	40.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	40.0	40.0	230.0	35.0	4.0	6.7	9.4	2.00	92.1
240.0	40.0	40.0	240.0	35.0	4.0	6.7	9.4	2.00	79.1
250.0	40.0	40.0	250.0	35.0	4.0	6.7	9.4	2.00	38.8
260.0	40.0	40.0	260.0	35.0	4.0	6.7	9.4	2.00	26.0
270.0	40.0	40.0	270.0	35.0	4.0	6.7	9.4	2.00	15.4
280.0	40.0	40.0	280.0	35.0	4.0	6.7	9.4	2.00	11.6
290.0	40.0	40.0	290.0	35.0	4.0	6.7	9.4	2.00	10.2
300.0	40.0	40.0	300.0	35.0	4.0	6.7	9.4	2.00	27.9
310.0	40.0	40.0	310.0	35.0	4.0	6.7	9.4	2.00	22.8
320.0	40.0	40.0	320.0	35.0	4.0	6.7	9.4	2.00	31.6
330.0	40.0	40.0	330.0	35.0	4.0	6.7	9.4	2.00	44.5
340.0	40.0	40.0	340.0	35.0	4.0	6.7	9.4	2.00	71.5
350.0	40.0	40.0	350.0	35.0	4.0	6.7	9.4	2.00	89.5
360.0	40.0	40.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.24.2 Relative contributions of force components

Case 24 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	48.9	28.3	2.6	0.0	20.2	100.0
10.0	45.1	26.0	10.3	0.0	18.6	100.0
20.0	41.6	24.0	17.3	0.0	17.1	100.0
30.0	38.4	22.0	24.0	0.0	15.7	100.0
40.0	35.3	20.2	30.1	0.0	14.4	100.0
50.0	32.6	18.6	35.6	0.0	13.2	100.0
60.0	30.4	17.3	40.0	0.0	12.3	100.0
70.0	28.8	16.3	43.3	0.0	11.6	100.0
80.0	27.8	15.8	45.2	0.0	11.2	100.0
90.0	27.5	15.6	45.9	0.0	11.0	100.0
100.0	27.8	15.8	45.2	0.0	11.2	100.0
110.0	28.9	16.3	43.2	0.0	11.6	100.0
120.0	30.6	17.3	39.8	0.0	12.3	100.0
130.0	32.9	18.6	35.2	0.0	13.2	100.0
140.0	35.9	20.3	29.4	0.0	14.4	100.0
150.0	39.3	22.3	22.6	0.0	15.8	100.0
160.0	43.1	24.4	15.1	0.0	17.1	100.0
170.0	47.1	26.8	7.0	0.0	19.1	100.0
180.0	51.7	29.5	-2.1	0.0	21.0	100.0
190.0	57.1	32.7	-13.1	0.0	23.3	100.0
200.0	64.3	36.9	-21.4	0.0	26.3	100.0
210.0	74.0	42.7	-47.1	0.0	30.5	100.0
220.0	87.3	50.1	-74.5	0.0	36.3	100.0
230.0	103.9	61.2	-109.1	0.0	44.0	100.0
240.0	117.8	71.0	-140.0	0.0	51.3	100.0
250.0	-53.9	-22.7	123.9	0.0	52.6	100.0
260.0	-59.4	-27.3	138.4	0.0	48.3	100.0
270.0	-57.0	-26.4	137.9	0.0	45.5	100.0
280.0	-50.2	-22.2	128.1	0.0	44.3	100.0
290.0	-34.9	-12.7	104.9	0.0	42.8	100.0
300.0	91.2	56.0	-87.9	0.0	40.7	100.0
310.0	83.8	50.5	-70.7	0.0	36.4	100.0
320.0	74.1	44.0	-49.8	0.0	31.7	100.0
330.0	65.4	38.5	-31.4	0.0	27.6	100.0
340.0	58.5	34.2	-17.1	0.0	24.5	100.0
350.0	53.1	30.9	-6.1	0.0	22.1	100.0
360.0	48.9	28.3	2.6	0.0	20.2	100.0

6.24.3 Environment forces

Case 24 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	-5.3	-3.6	0.0	-4.0	-19.6
10.0	-6.7	-5.3	-3.6	0.0	-4.0	-19.6
20.0	-6.7	-5.3	-3.5	0.0	-4.0	-19.5
30.0	-6.7	-5.3	-3.2	0.0	-4.0	-19.2
40.0	-6.7	-5.3	-2.8	0.0	-4.0	-18.8
50.0	-6.7	-5.3	-2.3	0.0	-4.0	-18.3
60.0	-6.7	-5.3	-1.6	0.0	-4.0	-17.6
70.0	-6.7	-5.3	-0.9	0.0	-4.0	-16.9
80.0	-6.7	-5.3	-0.1	0.0	-4.0	-16.1
90.0	-6.7	-5.3	0.7	0.0	-4.0	-15.3
100.0	-6.7	-5.3	1.5	0.0	-4.0	-14.5
110.0	-6.7	-5.3	2.3	0.0	-4.0	-13.7
120.0	-6.7	-5.3	3.0	0.0	-4.0	-13.0
130.0	-6.7	-5.3	3.5	0.0	-4.0	-12.5
140.0	-6.7	-5.3	4.0	0.0	-4.0	-12.0
150.0	-6.7	-5.3	4.3	0.0	-4.0	-11.7
160.0	-6.7	-5.3	4.4	0.0	-4.0	-11.6
170.0	-6.7	-5.3	4.4	0.0	-4.0	-11.6
180.0	-6.7	-5.3	4.3	0.0	-4.0	-11.7
190.0	-6.7	-5.3	4.4	0.0	-4.0	-11.6
200.0	-6.7	-5.3	4.4	0.0	-4.0	-11.6
210.0	-6.7	-5.3	4.3	0.0	-4.0	-11.7
220.0	-6.7	-5.3	4.0	0.0	-4.0	-12.0
230.0	-6.7	-5.3	3.5	0.0	-4.0	-12.5
240.0	-6.7	-5.3	3.0	0.0	-4.0	-13.0
250.0	-6.7	-5.3	2.3	0.0	-4.0	-13.7
260.0	-6.7	-5.3	1.5	0.0	-4.0	-14.5
270.0	-6.7	-5.3	0.7	0.0	-4.0	-15.3
280.0	-6.7	-5.3	-0.1	0.0	-4.0	-16.1
290.0	-6.7	-5.3	-0.9	0.0	-4.0	-16.9
300.0	-6.7	-5.3	-1.6	0.0	-4.0	-17.6
310.0	-6.7	-5.3	-2.3	0.0	-4.0	-18.3
320.0	-6.7	-5.3	-2.8	0.0	-4.0	-18.8
330.0	-6.7	-5.3	-3.2	0.0	-4.0	-19.2
340.0	-6.7	-5.3	-3.5	0.0	-4.0	-19.5
350.0	-6.7	-5.3	-3.6	0.0	-4.0	-19.6
360.0	-6.7	-5.3	-3.6	0.0	-4.0	-19.6

Case 24 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-24.5	-13.6	0.0	0.0	-9.6	-47.8
10.0	-24.5	-13.6	-4.8	0.0	-9.6	-52.7
20.0	-24.5	-13.6	-10.0	0.0	-9.6	-57.8
30.0	-24.5	-13.6	-15.6	0.0	-9.6	-63.5
40.0	-24.5	-13.6	-21.7	0.0	-9.6	-69.6
50.0	-24.5	-13.6	-28.0	0.0	-9.6	-75.8
60.0	-24.5	-13.6	-33.8	0.0	-9.6	-81.7
70.0	-24.5	-13.6	-38.7	0.0	-9.6	-86.5
80.0	-24.5	-13.6	-41.9	0.0	-9.6	-89.7
90.0	-24.5	-13.6	-43.0	0.0	-9.6	-90.8
100.0	-24.5	-13.6	-41.9	0.0	-9.6	-89.7
110.0	-24.5	-13.6	-38.7	0.0	-9.6	-86.5
120.0	-24.5	-13.6	-33.8	0.0	-9.6	-81.7
130.0	-24.5	-13.6	-28.0	0.0	-9.6	-75.8
140.0	-24.5	-13.6	-21.7	0.0	-9.6	-69.6
150.0	-24.5	-13.6	-15.6	0.0	-9.6	-63.5
160.0	-24.5	-13.6	-10.0	0.0	-9.6	-57.8
170.0	-24.5	-13.6	-4.8	0.0	-9.6	-52.7
180.0	-24.5	-13.6	0.0	0.0	-9.6	-47.8
190.0	-24.5	-13.6	4.8	0.0	-9.6	-43.0
200.0	-24.5	-13.6	10.0	0.0	-9.6	-37.9
210.0	-24.5	-13.6	15.6	0.0	-9.6	-32.2
220.0	-24.5	-13.6	21.7	0.0	-9.6	-26.1
230.0	-24.5	-13.6	28.0	0.0	-9.6	-19.8
240.0	-24.5	-13.6	33.8	0.0	-9.6	-14.0
250.0	-24.5	-13.6	38.7	0.0	9.6	10.1
260.0	-24.5	-13.6	41.9	0.0	9.6	13.3
270.0	-24.5	-13.6	43.0	0.0	9.6	14.4
280.0	-24.5	-13.6	41.9	0.0	9.6	13.3
290.0	-24.5	-13.6	38.7	0.0	9.6	10.1
300.0	-24.5	-13.6	33.8	0.0	-9.6	-14.0
310.0	-24.5	-13.6	28.0	0.0	-9.6	-19.8
320.0	-24.5	-13.6	21.7	0.0	-9.6	-26.1
330.0	-24.5	-13.6	15.6	0.0	-9.6	-32.2
340.0	-24.5	-13.6	10.0	0.0	-9.6	-37.9
350.0	-24.5	-13.6	4.8	0.0	-9.6	-43.0
360.0	-24.5	-13.6	0.0	0.0	-9.6	-47.8

Case 24 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-601.9	-187.8	0.0	0.0	-174.2	-963.9
10.0	-601.9	-187.8	-316.6	0.0	-174.2	-1280.5
20.0	-601.9	-187.8	-593.0	0.0	-174.2	-1556.9
30.0	-601.9	-187.8	-793.7	0.0	-174.2	-1757.6
40.0	-601.9	-187.8	-892.8	0.0	-174.2	-1856.7
50.0	-601.9	-187.8	-876.4	0.0	-174.2	-1840.3
60.0	-601.9	-187.8	-745.2	0.0	-174.2	-1709.1
70.0	-601.9	-187.8	-513.8	0.0	-174.2	-1477.7
80.0	-601.9	-187.8	-209.2	0.0	-174.2	-1173.1
90.0	-601.9	-187.8	132.4	0.0	-174.2	-831.5
100.0	-601.9	-187.8	470.0	0.0	-174.2	-493.9
110.0	-601.9	-187.8	762.6	0.0	-174.2	-201.3
120.0	-601.9	-187.8	974.5	0.0	174.2	358.9
130.0	-601.9	-187.8	1079.2	0.0	174.2	465.7
140.0	-601.9	-187.8	1063.0	0.0	174.2	447.4
150.0	-601.9	-187.8	926.1	0.0	174.2	310.3
160.0	-601.9	-187.8	683.5	0.0	-174.2	-780.4
170.0	-601.9	-187.8	362.6	0.0	-174.2	-601.3
180.0	-601.9	-187.8	0.0	0.0	-174.2	-963.9
190.0	-601.9	-187.8	-362.6	0.0	-174.2	-1326.5
200.0	-601.9	-187.8	-683.5	0.0	-174.2	-1647.4
210.0	-601.9	-187.8	-926.1	0.0	-174.2	-1890.0
220.0	-601.9	-187.8	-1063.0	0.0	-174.2	-2026.9
230.0	-601.9	-187.8	-1079.2	0.0	-174.2	-2043.1
240.0	-601.9	-187.8	-974.5	0.0	-174.2	-1938.4
250.0	-601.9	-187.8	-762.6	0.0	-174.2	-1726.5
260.0	-601.9	-187.8	-470.0	0.0	-174.2	-1433.9
270.0	-601.9	-187.8	-132.4	0.0	-174.2	-1096.3
280.0	-601.9	-187.8	209.2	0.0	-174.2	-754.7
290.0	-601.9	-187.8	513.8	0.0	-174.2	-450.1
300.0	-601.9	-187.8	745.2	0.0	-174.2	-218.7
310.0	-601.9	-187.8	876.4	0.0	174.2	260.8
320.0	-601.9	-187.8	892.8	0.0	174.2	277.2
330.0	-601.9	-187.8	793.7	0.0	174.2	178.1
340.0	-601.9	-187.8	593.0	0.0	-174.2	-370.9
350.0	-601.9	-187.8	316.6	0.0	-174.2	-647.3
360.0	-601.9	-187.8	0.0	0.0	-174.2	-963.9

6.24.4 Thruster use

Case 24 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.2	80.0	168.3	25.7	90.0	45.7	67.3
10.0	96.1	0.1	83.3	173.2	25.4	90.0	37.9	69.3
20.0	96.5	0.1	86.3	177.0	25.4	90.0	31.8	71.2
30.0	95.1	0.2	87.0	180.0	25.7	90.0	27.3	72.9
40.0	93.6	359.0	86.8	180.0	26.0	90.0	25.3	74.6
50.0	92.9	359.4	86.6	180.0	26.6	90.0	26.4	76.2
60.0	93.0	1.4	86.5	180.0	27.4	90.0	30.4	77.6
70.0	93.3	4.2	86.3	179.9	27.1	90.0	34.7	78.8
80.0	94.4	8.1	86.2	180.0	26.7	90.0	40.7	79.7
90.0	96.4	12.3	86.2	180.0	26.5	90.0	47.8	80.3
100.0	97.5	16.4	84.7	180.0	26.6	90.0	54.9	80.7
110.0	98.9	19.9	83.3	180.0	26.7	90.0	61.2	80.8
120.0	99.9	14.6	87.5	166.0	26.9	90.0	74.3	80.9
130.0	98.9	15.8	85.5	165.5	26.9	90.0	76.2	80.7
140.0	75.3	17.9	62.7	162.0	27.0	90.0	70.6	80.2
150.0	59.9	19.2	47.8	159.8	27.3	90.0	64.5	79.5
160.0	85.5	11.3	73.5	169.5	27.6	90.0	59.0	78.7
170.0	88.9	8.9	77.0	171.9	28.1	90.0	53.9	77.6
180.0	91.6	11.1	78.3	180.0	28.6	90.0	47.9	76.0
190.0	89.5	6.3	78.4	180.0	28.6	90.0	39.8	74.7
200.0	88.6	1.9	78.8	180.0	28.6	90.0	33.0	72.8
210.0	89.2	358.7	79.3	180.0	28.7	90.0	28.5	69.7
220.0	91.7	357.2	80.0	180.0	29.0	90.0	27.2	64.8
230.0	72.1	355.9	59.6	180.0	29.2	90.0	23.4	57.9
240.0	36.5	347.1	22.7	198.1	29.5	90.0	19.1	47.0
250.0	17.1	311.5	6.2	280.4	15.7	90.0	17.0	323.6
260.0	15.5	311.6	12.6	289.4	10.1	90.0	19.7	317.4
270.0	13.5	314.2	11.6	300.4	5.2	90.0	21.0	316.6
280.0	11.1	320.2	10.6	313.8	1.6	90.0	20.9	320.4
290.0	9.8	330.6	9.7	329.0	-0.3	90.0	19.7	329.1
300.0	11.5	7.6	6.4	13.5	11.0	90.0	22.5	38.4
310.0	12.4	28.0	9.2	37.6	8.4	90.0	27.0	47.4
320.0	14.0	30.9	9.8	46.1	11.9	90.0	32.2	54.2
330.0	15.5	30.1	9.6	53.2	16.7	90.0	37.5	59.2
340.0	22.6	28.9	0.7	119.8	26.4	90.0	42.6	62.8
350.0	71.1	7.0	51.7	170.6	25.8	90.0	47.3	65.5
360.0	96.0	0.2	80.0	168.3	25.7	90.0	45.7	67.3

6.24.5 Thruster loss

Case 24 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.84	0.81
10.0	0.86	0.82	0.80
20.0	0.86	0.79	0.80
30.0	0.87	0.78	0.81
40.0	0.87	0.77	0.82
50.0	0.88	0.77	0.84
60.0	0.89	0.77	0.86
70.0	0.90	0.77	0.85
80.0	0.90	0.77	0.84
90.0	0.91	0.77	0.83
100.0	0.92	0.75	0.84
110.0	0.93	0.74	0.84
120.0	0.93	0.78	0.85
130.0	0.93	0.78	0.85
140.0	0.93	0.78	0.85
150.0	0.93	0.78	0.86
160.0	0.94	0.75	0.87
170.0	0.94	0.74	0.88
180.0	0.94	0.70	0.90
190.0	0.95	0.70	0.90
200.0	0.95	0.70	0.90
210.0	0.95	0.71	0.90
220.0	0.94	0.71	0.91
230.0	0.93	0.75	0.92
240.0	0.91	0.82	0.93
250.0	0.84	0.85	0.93
260.0	0.83	0.85	0.93
270.0	0.82	0.85	0.93
280.0	0.82	0.85	0.94
290.0	0.82	0.86	0.85
300.0	0.90	0.88	0.95
310.0	0.91	0.88	0.91
320.0	0.89	0.88	0.88
330.0	0.88	0.87	0.85
340.0	0.87	0.89	0.83
350.0	0.85	0.83	0.81
360.0	0.86	0.84	0.81

Preliminary Design, @IDR5

6.25 Case 25 - Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 5

6.25.1 Environment and thrust utilisation

Case 25 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	50.0	50.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	50.0	50.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	50.0	50.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	50.0	50.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	50.0	50.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	50.0	50.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	50.0	50.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	50.0	50.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	50.0	50.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	50.0	50.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	50.0	50.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	50.0	50.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	50.0	50.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	50.0	50.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	50.0	50.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	50.0	50.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	50.0	50.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	50.0	50.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	50.0	50.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	50.0	50.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	50.0	50.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	50.0	50.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	50.0	50.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	50.0	50.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	50.0	50.0	240.0	35.0	4.0	6.7	9.4	2.00	95.6
250.0	50.0	50.0	250.0	35.0	4.0	6.7	9.4	2.00	81.5
260.0	50.0	50.0	260.0	35.0	4.0	6.7	9.4	2.00	67.4
270.0	50.0	50.0	270.0	35.0	4.0	6.7	9.4	2.00	55.9
280.0	50.0	50.0	280.0	35.0	4.0	6.7	9.4	2.00	47.7
290.0	50.0	50.0	290.0	35.0	4.0	6.7	9.4	2.00	43.2
300.0	50.0	50.0	300.0	35.0	4.0	6.7	9.4	2.00	43.1
310.0	50.0	50.0	310.0	35.0	4.0	6.7	9.4	2.00	37.9
320.0	50.0	50.0	320.0	35.0	4.0	6.7	9.4	2.00	47.5
330.0	50.0	50.0	330.0	35.0	4.0	6.7	9.4	2.00	72.1
340.0	50.0	50.0	340.0	35.0	4.0	6.7	9.4	2.00	88.3
350.0	50.0	50.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	50.0	50.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.25.2 Relative contributions of force components

Case 25 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	48.2	29.4	1.8	0.0	20.7	100.0
10.0	44.9	27.3	8.5	0.0	19.2	100.0
20.0	41.9	25.4	14.9	0.0	17.9	100.0
30.0	39.0	23.6	20.9	0.0	16.6	100.0
40.0	36.2	21.9	26.6	0.0	15.4	100.0
50.0	33.8	20.3	31.6	0.0	14.3	100.0
60.0	31.7	19.1	35.8	0.0	13.4	100.0
70.0	30.2	18.1	38.9	0.0	12.7	100.0
80.0	29.3	17.6	40.8	0.0	12.3	100.0
90.0	29.0	17.4	41.4	0.0	12.2	100.0
100.0	29.4	17.6	40.8	0.0	12.3	100.0
110.0	30.3	18.1	38.8	0.0	12.7	100.0
120.0	31.9	19.1	35.6	0.0	13.4	100.0
130.0	34.1	20.4	31.3	0.0	14.3	100.0
140.0	36.7	22.0	25.9	0.0	15.4	100.0
150.0	39.7	23.8	19.8	0.0	16.7	100.0
160.0	42.9	25.7	13.3	0.0	18.1	100.0
170.0	46.4	27.8	6.3	0.0	19.5	100.0
180.0	50.1	30.1	-1.3	0.0	21.1	100.0
190.0	54.4	32.8	-10.2	0.0	23.0	100.0
200.0	59.9	36.2	-2.5	0.0	25.4	100.0
210.0	67.3	40.7	-36.5	0.0	28.6	100.0
220.0	77.2	47.1	-57.2	0.0	33.0	100.0
230.0	89.1	55.2	-84.2	0.0	38.9	100.0
240.0	103.0	65.0	-115.8	0.0	45.9	100.0
250.0	117.9	73.9	-144.1	0.0	52.3	100.0
260.0	123.4	78.5	-157.6	0.0	55.7	100.0
270.0	120.9	77.6	-153.6	0.0	55.1	100.0
280.0	114.0	73.0	-138.9	0.0	51.9	100.0
290.0	104.2	66.2	-117.4	0.0	47.0	100.0
300.0	92.4	58.2	-91.8	0.0	41.2	100.0
310.0	80.7	50.3	-66.5	0.0	35.6	100.0
320.0	70.5	43.7	-45.0	0.0	30.8	100.0
330.0	62.6	38.5	-28.3	0.0	27.2	100.0
340.0	56.5	34.7	-15.6	0.0	24.4	100.0
350.0	51.9	31.7	-6.0	0.0	22.3	100.0
360.0	48.2	29.4	1.8	0.0	20.7	100.0

6.25.3 Environment forces

Case 25 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.6	-5.3	-3.6	0.0	-4.0	-18.5
10.0	-5.6	-5.3	-3.6	0.0	-4.0	-18.5
20.0	-5.6	-5.3	-3.5	0.0	-4.0	-18.3
30.0	-5.6	-5.3	-3.2	0.0	-4.0	-18.1
40.0	-5.6	-5.3	-2.8	0.0	-4.0	-17.7
50.0	-5.6	-5.3	-2.3	0.0	-4.0	-17.1
60.0	-5.6	-5.3	-1.6	0.0	-4.0	-16.5
70.0	-5.6	-5.3	-0.9	0.0	-4.0	-15.7
80.0	-5.6	-5.3	-0.1	0.0	-4.0	-15.0
90.0	-5.6	-5.3	0.7	0.0	-4.0	-14.1
100.0	-5.6	-5.3	1.5	0.0	-4.0	-13.3
110.0	-5.6	-5.3	2.3	0.0	-4.0	-12.6
120.0	-5.6	-5.3	3.0	0.0	-4.0	-11.9
130.0	-5.6	-5.3	3.5	0.0	-4.0	-11.3
140.0	-5.6	-5.3	4.0	0.0	-4.0	-10.9
150.0	-5.6	-5.3	4.3	0.0	-4.0	-10.6
160.0	-5.6	-5.3	4.4	0.0	-4.0	-10.4
170.0	-5.6	-5.3	4.4	0.0	-4.0	-10.4
180.0	-5.6	-5.3	4.3	0.0	-4.0	-10.5
190.0	-5.6	-5.3	4.4	0.0	-4.0	-10.4
200.0	-5.6	-5.3	4.4	0.0	-4.0	-10.4
210.0	-5.6	-5.3	4.3	0.0	-4.0	-10.6
220.0	-5.6	-5.3	4.0	0.0	-4.0	-10.9
230.0	-5.6	-5.3	3.5	0.0	-4.0	-11.3
240.0	-5.6	-5.3	3.0	0.0	-4.0	-11.9
250.0	-5.6	-5.3	2.3	0.0	-4.0	-12.6
260.0	-5.6	-5.3	1.5	0.0	-4.0	-13.3
270.0	-5.6	-5.3	0.7	0.0	-4.0	-14.1
280.0	-5.6	-5.3	-0.1	0.0	-4.0	-15.0
290.0	-5.6	-5.3	-0.9	0.0	-4.0	-15.7
300.0	-5.6	-5.3	-1.6	0.0	-4.0	-16.5
310.0	-5.6	-5.3	-2.3	0.0	-4.0	-17.1
320.0	-5.6	-5.3	-2.8	0.0	-4.0	-17.7
330.0	-5.6	-5.3	-3.2	0.0	-4.0	-18.1
340.0	-5.6	-5.3	-3.5	0.0	-4.0	-18.3
350.0	-5.6	-5.3	-3.6	0.0	-4.0	-18.5
360.0	-5.6	-5.3	-3.6	0.0	-4.0	-18.5

Case 25 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.3	-17.2	0.0	0.0	-12.1	-58.6
10.0	-29.3	-17.2	-4.8	0.0	-12.1	-63.4
20.0	-29.3	-17.2	-10.0	0.0	-12.1	-68.5
30.0	-29.3	-17.2	-15.6	0.0	-12.1	-74.2
40.0	-29.3	-17.2	-21.7	0.0	-12.1	-80.3
50.0	-29.3	-17.2	-28.0	0.0	-12.1	-86.5
60.0	-29.3	-17.2	-33.8	0.0	-12.1	-92.4
70.0	-29.3	-17.2	-38.7	0.0	-12.1	-97.2
80.0	-29.3	-17.2	-41.9	0.0	-12.1	-100.4
90.0	-29.3	-17.2	-43.0	0.0	-12.1	-101.6
100.0	-29.3	-17.2	-41.9	0.0	-12.1	-100.4
110.0	-29.3	-17.2	-38.7	0.0	-12.1	-97.2
120.0	-29.3	-17.2	-33.8	0.0	-12.1	-92.4
130.0	-29.3	-17.2	-28.0	0.0	-12.1	-86.5
140.0	-29.3	-17.2	-21.7	0.0	-12.1	-80.3
150.0	-29.3	-17.2	-15.6	0.0	-12.1	-74.2
160.0	-29.3	-17.2	-10.0	0.0	-12.1	-68.5
170.0	-29.3	-17.2	-4.8	0.0	-12.1	-63.4
180.0	-29.3	-17.2	0.0	0.0	-12.1	-58.6
190.0	-29.3	-17.2	4.8	0.0	-12.1	-53.7
200.0	-29.3	-17.2	10.0	0.0	-12.1	-48.6
210.0	-29.3	-17.2	15.6	0.0	-12.1	-42.9
220.0	-29.3	-17.2	21.7	0.0	-12.1	-36.8
230.0	-29.3	-17.2	28.0	0.0	-12.1	-30.6
240.0	-29.3	-17.2	33.8	0.0	-12.1	-24.7
250.0	-29.3	-17.2	38.7	0.0	-12.1	-19.9
260.0	-29.3	-17.2	41.9	0.0	-12.1	-16.7
270.0	-29.3	-17.2	43.0	0.0	-12.1	-15.6
280.0	-29.3	-17.2	41.9	0.0	-12.1	-16.7
290.0	-29.3	-17.2	38.7	0.0	-12.1	-19.9
300.0	-29.3	-17.2	33.8	0.0	-12.1	-24.7
310.0	-29.3	-17.2	28.0	0.0	-12.1	-30.6
320.0	-29.3	-17.2	21.7	0.0	-12.1	-36.8
330.0	-29.3	-17.2	15.6	0.0	-12.1	-42.9
340.0	-29.3	-17.2	10.0	0.0	-12.1	-48.6
350.0	-29.3	-17.2	4.8	0.0	-12.1	-53.7
360.0	-29.3	-17.2	0.0	0.0	-12.1	-58.6

Case 25 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-615.1	-204.5	0.0	0.0	-179.0	-998.6
10.0	-615.1	-204.5	-316.6	0.0	-179.0	-1315.2
20.0	-615.1	-204.5	-593.0	0.0	-179.0	-1591.6
30.0	-615.1	-204.5	-793.7	0.0	-179.0	-1792.3
40.0	-615.1	-204.5	-892.8	0.0	-179.0	-1891.4
50.0	-615.1	-204.5	-876.4	0.0	-179.0	-1875.0
60.0	-615.1	-204.5	-745.2	0.0	-179.0	-1743.8
70.0	-615.1	-204.5	-513.8	0.0	-179.0	-1512.4
80.0	-615.1	-204.5	-209.2	0.0	-179.0	-1207.8
90.0	-615.1	-204.5	132.4	0.0	-179.0	-866.2
100.0	-615.1	-204.5	470.0	0.0	-179.0	-528.6
110.0	-615.1	-204.5	762.6	0.0	-179.0	-236.0
120.0	-615.1	-204.5	974.5	0.0	179.0	333.9
130.0	-615.1	-204.5	1079.2	0.0	179.0	423.6
140.0	-615.1	-204.5	1063.0	0.0	179.0	423.3
150.0	-615.1	-204.5	926.1	0.0	179.0	235.4
160.0	-615.1	-204.5	683.5	0.0	-179.0	-115.1
170.0	-615.1	-204.5	362.6	0.0	-179.0	-636.0
180.0	-615.1	-204.5	0.0	0.0	-179.0	-998.6
190.0	-615.1	-204.5	-362.6	0.0	-179.0	-1361.2
200.0	-615.1	-204.5	-683.5	0.0	-179.0	-1682.1
210.0	-615.1	-204.5	-926.1	0.0	-179.0	-1924.7
220.0	-615.1	-204.5	-1063.0	0.0	-179.0	-2061.6
230.0	-615.1	-204.5	-1079.2	0.0	-179.0	-2077.8
240.0	-615.1	-204.5	-974.5	0.0	-179.0	-1973.1
250.0	-615.1	-204.5	-762.6	0.0	-179.0	-1761.2
260.0	-615.1	-204.5	-470.0	0.0	-179.0	-1468.6
270.0	-615.1	-204.5	-132.4	0.0	-179.0	-1131.0
280.0	-615.1	-204.5	209.2	0.0	-179.0	-789.4
290.0	-615.1	-204.5	513.8	0.0	-179.0	-484.8
300.0	-615.1	-204.5	745.2	0.0	-179.0	-253.4
310.0	-615.1	-204.5	876.4	0.0	179.0	235.8
320.0	-615.1	-204.5	892.8	0.0	179.0	252.1
330.0	-615.1	-204.5	793.7	0.0	-179.0	-204.9
340.0	-615.1	-204.5	593.0	0.0	-179.0	-405.6
350.0	-615.1	-204.5	316.6	0.0	-179.0	-682.0
360.0	-615.1	-204.5	0.0	0.0	-179.0	-998.6

6.25.4 Thruster use

Case 25 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.2	84.1	169.1	25.7	90.0	44.0	72.3
10.0	96.1	0.1	86.3	173.7	25.4	90.0	36.6	73.5
20.0	95.8	1.3	87.9	178.8	25.4	90.0	30.5	75.0
30.0	93.3	359.7	87.0	180.0	25.7	90.0	25.9	76.1
40.0	92.2	358.4	86.9	180.0	26.0	90.0	24.1	77.4
50.0	91.7	358.8	86.6	180.0	26.6	90.0	25.3	78.6
60.0	91.7	0.8	86.5	180.0	27.4	90.0	29.3	79.7
70.0	92.0	3.8	86.3	180.0	27.1	90.0	33.6	80.6
80.0	92.9	7.7	86.2	180.0	26.7	90.0	39.6	81.4
90.0	94.7	12.0	86.2	180.0	26.5	90.0	46.6	82.0
100.0	95.6	16.2	84.7	180.0	26.6	90.0	53.7	82.3
110.0	96.8	19.8	83.3	180.0	26.7	90.0	60.0	82.5
120.0	101.9	26.2	82.0	180.0	26.9	90.0	72.5	82.6
130.0	102.2	27.4	80.9	180.0	26.9	90.0	74.6	82.4
140.0	101.4	27.3	80.0	180.0	27.0	90.0	74.3	82.2
150.0	99.6	26.0	79.3	180.0	27.3	90.0	71.6	81.8
160.0	93.0	19.3	78.8	180.0	27.6	90.0	59.0	81.2
170.0	90.4	15.4	78.4	180.0	28.1	90.0	52.8	80.5
180.0	88.1	10.8	78.3	180.0	28.6	90.0	45.7	79.6
190.0	86.2	5.8	78.4	180.0	28.6	90.0	38.0	78.8
200.0	85.4	1.2	78.8	180.0	28.6	90.0	31.1	77.7
210.0	85.8	357.9	79.3	180.0	28.7	90.0	26.4	76.0
220.0	87.2	356.3	80.0	179.9	29.0	90.0	24.4	73.3
230.0	90.1	356.6	80.3	179.9	29.2	90.0	25.6	69.3
240.0	83.7	358.2	79.3	181.7	29.5	90.0	27.4	64.3
250.0	44.5	353.3	77.9	188.1	29.6	90.0	23.5	57.7
260.0	15.0	337.9	5.7	265.7	28.2	90.0	21.4	51.4
270.0	3.5	343.0	4.0	288.0	23.3	90.0	21.0	47.8
280.0	12.3	353.0	3.0	330.2	19.7	90.0	22.4	48.1
290.0	12.2	5.0	3.7	16.4	17.8	90.0	25.4	51.6
300.0	12.8	16.0	5.4	39.7	17.7	90.0	29.7	56.3
310.0	14.3	33.6	9.2	55.7	15.0	90.0	35.0	60.8
320.0	15.8	37.0	10.1	60.2	18.5	90.0	40.8	64.4
330.0	23.6	28.3	5.4	119.8	27.1	90.0	46.6	67.2
340.0	68.8	9.4	50.8	167.5	26.4	90.0	51.9	69.3
350.0	96.1	0.2	82.2	164.2	25.8	90.0	51.5	70.7
360.0	96.0	0.2	84.1	169.1	25.7	90.0	44.0	72.3

6.25.5 Thruster loss

Case 25 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.84	0.81
10.0	0.86	0.81	0.80
20.0	0.86	0.78	0.80
30.0	0.87	0.78	0.81
40.0	0.87	0.77	0.82
50.0	0.88	0.77	0.84
60.0	0.89	0.77	0.86
70.0	0.90	0.77	0.85
80.0	0.91	0.77	0.84
90.0	0.91	0.77	0.83
100.0	0.92	0.75	0.84
110.0	0.93	0.74	0.84
120.0	0.93	0.73	0.85
130.0	0.93	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.94	0.70	0.87
170.0	0.94	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.95	0.70	0.90
200.0	0.95	0.70	0.91
210.0	0.94	0.71	0.90
220.0	0.94	0.71	0.91
230.0	0.94	0.72	0.92
240.0	0.94	0.74	0.93
250.0	0.92	0.79	0.93
260.0	0.87	0.84	0.93
270.0	0.87	0.84	0.93
280.0	0.89	0.87	0.94
290.0	0.91	0.89	0.94
300.0	0.91	0.88	0.95
310.0	0.91	0.88	0.91
320.0	0.90	0.88	0.88
330.0	0.88	0.89	0.85
340.0	0.86	0.84	0.83
350.0	0.86	0.85	0.81
360.0	0.86	0.84	0.81

Preliminary Design, @IDR5

6.26 Case 26 - Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 5

6.26.1 Environment and thrust utilisation

Case 26 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	60.0	60.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	60.0	60.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	60.0	60.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	60.0	60.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	60.0	60.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	60.0	60.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	60.0	60.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	60.0	60.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	60.0	60.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	60.0	60.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	60.0	60.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	60.0	60.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	60.0	60.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	60.0	60.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	60.0	60.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	60.0	60.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	60.0	60.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	60.0	60.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	60.0	60.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	60.0	60.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	60.0	60.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	60.0	60.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	60.0	60.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	60.0	60.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	60.0	60.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	60.0	60.0	250.0	35.0	4.0	6.7	9.4	2.00	89.2
260.0	60.0	60.0	260.0	35.0	4.0	6.7	9.4	2.00	75.0
270.0	60.0	60.0	270.0	35.0	4.0	6.7	9.4	2.00	62.5
280.0	60.0	60.0	280.0	35.0	4.0	6.7	9.4	2.00	54.1
290.0	60.0	60.0	290.0	35.0	4.0	6.7	9.4	2.00	49.7
300.0	60.0	60.0	300.0	35.0	4.0	6.7	9.4	2.00	40.1
310.0	60.0	60.0	310.0	35.0	4.0	6.7	9.4	2.00	45.7
320.0	60.0	60.0	320.0	35.0	4.0	6.7	9.4	2.00	55.6
330.0	60.0	60.0	330.0	35.0	4.0	6.7	9.4	2.00	68.8
340.0	60.0	60.0	340.0	35.0	4.0	6.7	9.4	2.00	95.5
350.0	60.0	60.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	60.0	60.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.26.2 Relative contributions of force components

Case 26 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	45.8	31.3	1.3	0.0	21.6	100.0
10.0	42.9	29.3	7.6	0.0	20.2	100.0
20.0	40.2	27.4	13.5	0.0	18.9	100.0
30.0	37.6	25.6	19.2	0.0	17.6	100.0
40.0	35.1	23.9	24.6	0.0	16.4	100.0
50.0	32.9	22.3	29.5	0.0	15.3	100.0
60.0	31.1	21.0	33.5	0.0	14.4	100.0
70.0	29.7	20.0	36.5	0.0	13.8	100.0
80.0	28.8	19.4	38.4	0.0	13.4	100.0
90.0	28.6	19.2	39.0	0.0	13.2	100.0
100.0	28.9	19.4	38.3	0.0	13.4	100.0
110.0	29.8	20.0	36.4	0.0	13.8	100.0
120.0	31.2	21.0	33.3	0.0	14.4	100.0
130.0	33.2	22.3	29.2	0.0	15.3	100.0
140.0	35.5	23.9	24.1	0.0	16.4	100.0
150.0	38.2	25.7	18.4	0.0	17.5	100.0
160.0	41.0	27.6	12.4	0.0	18.9	100.0
170.0	44.0	29.7	6.0	0.0	20.4	100.0
180.0	47.1	31.8	-0.9	0.0	21.9	100.0
190.0	50.8	34.4	-8.8	0.0	23.6	100.0
200.0	55.4	37.5	-18.7	0.0	25.8	100.0
210.0	61.4	41.7	-31.7	0.0	28.7	100.0
220.0	69.4	47.1	-49.2	0.0	32.5	100.0
230.0	79.7	54.6	-71.9	0.0	37.6	100.0
240.0	93.0	63.4	-99.1	0.0	43.7	100.0
250.0	104.0	72.3	-126.2	0.0	49.9	100.0
260.0	111.8	78.5	-144.5	0.0	54.2	100.0
270.0	112.6	79.5	-147.1	0.0	54.9	100.0
280.0	106.7	75.4	-134.1	0.0	52.1	100.0
290.0	96.5	68.0	-111.4	0.0	46.9	100.0
300.0	85.0	59.5	-85.5	0.0	41.1	100.0
310.0	74.2	51.7	-61.5	0.0	35.6	100.0
320.0	65.3	45.2	-41.7	0.0	31.2	100.0
330.0	58.3	40.3	-26.3	0.0	27.7	100.0
340.0	53.1	36.5	-14.8	0.0	25.2	100.0
350.0	49.0	33.7	-5.9	0.0	23.2	100.0
360.0	45.8	31.3	1.3	0.0	21.6	100.0

6.26.3 Environment forces

Case 26 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-4.1	-5.2	-3.6	0.0	-3.8	-16.7
10.0	-4.1	-5.2	-3.6	0.0	-3.8	-16.7
20.0	-4.1	-5.2	-3.5	0.0	-3.8	-16.6
30.0	-4.1	-5.2	-3.2	0.0	-3.8	-16.3
40.0	-4.1	-5.2	-2.8	0.0	-3.8	-15.9
50.0	-4.1	-5.2	-2.3	0.0	-3.8	-15.4
60.0	-4.1	-5.2	-1.6	0.0	-3.8	-14.8
70.0	-4.1	-5.2	-0.9	0.0	-3.8	-14.0
80.0	-4.1	-5.2	-0.1	0.0	-3.8	-13.2
90.0	-4.1	-5.2	0.7	0.0	-3.8	-12.4
100.0	-4.1	-5.2	1.5	0.0	-3.8	-11.6
110.0	-4.1	-5.2	2.3	0.0	-3.8	-10.9
120.0	-4.1	-5.2	3.0	0.0	-3.8	-10.2
130.0	-4.1	-5.2	3.5	0.0	-3.8	-9.6
140.0	-4.1	-5.2	4.0	0.0	-3.8	-9.2
150.0	-4.1	-5.2	4.3	0.0	-3.8	-8.9
160.0	-4.1	-5.2	4.4	0.0	-3.8	-8.7
170.0	-4.1	-5.2	4.4	0.0	-3.8	-8.7
180.0	-4.1	-5.2	4.3	0.0	-3.8	-8.8
190.0	-4.1	-5.2	4.4	0.0	-3.8	-8.7
200.0	-4.1	-5.2	4.4	0.0	-3.8	-8.7
210.0	-4.1	-5.2	4.3	0.0	-3.8	-8.9
220.0	-4.1	-5.2	4.0	0.0	-3.8	-9.2
230.0	-4.1	-5.2	3.5	0.0	-3.8	-9.6
240.0	-4.1	-5.2	3.0	0.0	-3.8	-10.2
250.0	-4.1	-5.2	2.3	0.0	-3.8	-10.9
260.0	-4.1	-5.2	1.5	0.0	-3.8	-11.6
270.0	-4.1	-5.2	0.7	0.0	-3.8	-12.4
280.0	-4.1	-5.2	-0.1	0.0	-3.8	-13.2
290.0	-4.1	-5.2	-0.9	0.0	-3.8	-14.0
300.0	-4.1	-5.2	-1.6	0.0	-3.8	-14.8
310.0	-4.1	-5.2	-2.3	0.0	-3.8	-15.4
320.0	-4.1	-5.2	-2.8	0.0	-3.8	-15.9
330.0	-4.1	-5.2	-3.2	0.0	-3.8	-16.3
340.0	-4.1	-5.2	-3.5	0.0	-3.8	-16.6
350.0	-4.1	-5.2	-3.6	0.0	-3.8	-16.7
360.0	-4.1	-5.2	-3.6	0.0	-3.8	-16.7

Case 26 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-31.0	-20.6	0.0	0.0	-14.1	-65.7
10.0	-31.0	-20.6	-4.8	0.0	-14.1	-70.5
20.0	-31.0	-20.6	-10.0	0.0	-14.1	-75.7
30.0	-31.0	-20.6	-15.6	0.0	-14.1	-81.3
40.0	-31.0	-20.6	-21.7	0.0	-14.1	-87.4
50.0	-31.0	-20.6	-28.0	0.0	-14.1	-93.7
60.0	-31.0	-20.6	-33.8	0.0	-14.1	-99.5
70.0	-31.0	-20.6	-38.7	0.0	-14.1	-104.4
80.0	-31.0	-20.6	-41.9	0.0	-14.1	-107.6
90.0	-31.0	-20.6	-43.0	0.0	-14.1	-108.7
100.0	-31.0	-20.6	-41.9	0.0	-14.1	-107.6
110.0	-31.0	-20.6	-38.7	0.0	-14.1	-104.4
120.0	-31.0	-20.6	-33.8	0.0	-14.1	-99.5
130.0	-31.0	-20.6	-28.0	0.0	-14.1	-85.7
140.0	-31.0	-20.6	-21.7	0.0	-14.1	-87.4
150.0	-31.0	-20.6	-15.6	0.0	-14.1	-81.3
160.0	-31.0	-20.6	-10.0	0.0	-14.1	-75.7
170.0	-31.0	-20.6	-4.8	0.0	-14.1	-70.5
180.0	-31.0	-20.6	0.0	0.0	-14.1	-65.7
190.0	-31.0	-20.6	4.8	0.0	-14.1	-60.9
200.0	-31.0	-20.6	10.0	0.0	-14.1	-55.7
210.0	-31.0	-20.6	15.6	0.0	-14.1	-50.1
220.0	-31.0	-20.6	21.7	0.0	-14.1	-44.0
230.0	-31.0	-20.6	28.0	0.0	-14.1	-37.7
240.0	-31.0	-20.6	33.8	0.0	-14.1	-31.9
250.0	-31.0	-20.6	38.7	0.0	-14.1	-27.0
260.0	-31.0	-20.6	41.9	0.0	-14.1	-23.8
270.0	-31.0	-20.6	43.0	0.0	-14.1	-22.7
280.0	-31.0	-20.6	41.9	0.0	-14.1	-23.8
290.0	-31.0	-20.6	38.7	0.0	-14.1	-27.0
300.0	-31.0	-20.6	33.8	0.0	-14.1	-31.9
310.0	-31.0	-20.6	28.0	0.0	-14.1	-37.7
320.0	-31.0	-20.6	21.7	0.0	-14.1	-44.0
330.0	-31.0	-20.6	15.6	0.0	-14.1	-50.1
340.0	-31.0	-20.6	10.0	0.0	-14.1	-55.7
350.0	-31.0	-20.6	4.8	0.0	-14.1	-60.9
360.0	-31.0	-20.6	0.0	0.0	-14.1	-65.7

Case 26 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-543.1	-199.0	0.0	0.0	-161.4	-903.5
10.0	-543.1	-199.0	-316.6	0.0	-161.4	-1220.1
20.0	-543.1	-199.0	-593.0	0.0	-161.4	-1496.4
30.0	-543.1	-199.0	-793.7	0.0	-161.4	-1697.2
40.0	-543.1	-199.0	-892.8	0.0	-161.4	-1796.3
50.0	-543.1	-199.0	-876.4	0.0	-161.4	-1779.9
60.0	-543.1	-199.0	-745.2	0.0	-161.4	-1648.7
70.0	-543.1	-199.0	-513.8	0.0	-161.4	-1417.3
80.0	-543.1	-199.0	-209.2	0.0	-161.4	-1112.7
90.0	-543.1	-199.0	132.4	0.0	-161.4	-771.1
100.0	-543.1	-199.0	470.0	0.0	-161.4	-433.5
110.0	-543.1	-199.0	762.6	0.0	161.4	182.0
120.0	-543.1	-199.0	974.5	0.0	161.4	393.9
130.0	-543.1	-199.0	1079.2	0.0	161.4	498.6
140.0	-543.1	-199.0	1063.0	0.0	161.4	483.3
150.0	-543.1	-199.0	926.1	0.0	161.4	315.4
160.0	-543.1	-199.0	683.5	0.0	-161.4	-20.0
170.0	-543.1	-199.0	362.6	0.0	-161.4	-540.9
180.0	-543.1	-199.0	0.0	0.0	-161.4	-903.5
190.0	-543.1	-199.0	-362.6	0.0	-161.4	-1266.1
200.0	-543.1	-199.0	-683.5	0.0	-161.4	-1587.0
210.0	-543.1	-199.0	-926.1	0.0	-161.4	-1829.6
220.0	-543.1	-199.0	-1063.0	0.0	-161.4	-1966.4
230.0	-543.1	-199.0	-1079.2	0.0	-161.4	-1982.7
240.0	-543.1	-199.0	-974.5	0.0	-161.4	-1878.0
250.0	-543.1	-199.0	-762.6	0.0	-161.4	-1666.1
260.0	-543.1	-199.0	-470.0	0.0	-161.4	-1373.5
270.0	-543.1	-199.0	-132.4	0.0	-161.4	-1035.9
280.0	-543.1	-199.0	209.2	0.0	-161.4	-694.3
290.0	-543.1	-199.0	513.8	0.0	-161.4	-389.7
300.0	-543.1	-199.0	745.2	0.0	161.4	164.6
310.0	-543.1	-199.0	876.4	0.0	161.4	295.8
320.0	-543.1	-199.0	892.8	0.0	161.4	312.1
330.0	-543.1	-199.0	793.7	0.0	161.4	213.0
340.0	-543.1	-199.0	593.0	0.0	-161.4	-310.5
350.0	-543.1	-199.0	316.6	0.0	-161.4	-586.9
360.0	-543.1	-199.0	0.0	0.0	-161.4	-903.5

6.26.4 Thruster use

Case 26 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.2	86.5	167.9	25.7	90.0	45.6	75.5
10.0	96.2	0.1	87.9	172.4	25.4	90.0	38.3	76.4
20.0	94.3	3.5	87.2	180.0	25.5	90.0	32.0	77.5
30.0	92.6	0.9	87.0	180.0	25.7	90.0	27.7	78.4
40.0	91.6	359.6	86.8	180.0	26.1	90.0	25.9	79.5
50.0	91.1	0.0	86.6	180.0	26.7	90.0	27.1	80.5
60.0	91.1	2.1	86.4	180.0	27.4	90.0	31.1	81.4
70.0	91.4	5.1	86.3	180.0	27.1	90.0	35.5	82.2
80.0	92.5	9.0	86.2	180.0	26.8	90.0	41.5	82.9
90.0	94.2	13.2	86.2	180.0	26.5	90.0	48.4	83.4
100.0	95.1	17.5	84.7	180.0	26.6	90.0	55.5	83.8
110.0	99.6	24.7	83.3	180.0	26.7	90.0	68.7	83.9
120.0	100.7	27.2	82.0	180.0	26.9	90.0	73.4	84.1
130.0	100.9	28.5	80.9	180.0	26.9	90.0	75.4	84.1
140.0	100.0	28.4	80.0	180.0	27.1	90.0	75.1	83.9
150.0	98.0	27.1	79.3	180.0	27.3	90.0	72.3	83.7
160.0	91.7	20.8	78.8	180.0	27.6	90.0	60.5	83.4
170.0	89.0	16.9	78.4	180.0	28.1	90.0	54.3	82.9
180.0	86.7	12.2	78.3	180.0	28.6	90.0	47.1	82.2
190.0	84.8	7.1	78.4	180.0	28.6	90.0	39.5	81.7
200.0	84.0	2.5	78.8	180.0	28.6	90.0	32.7	81.0
210.0	84.2	359.1	79.3	180.0	28.7	90.0	27.9	79.8
220.0	85.4	357.4	80.0	180.0	29.0	90.0	25.7	78.0
230.0	87.6	357.6	80.3	180.0	29.2	90.0	26.5	75.5
240.0	91.4	359.6	82.0	180.0	29.6	90.0	30.4	72.0
250.0	64.9	356.7	77.1	181.2	29.6	90.0	29.1	68.1
260.0	25.3	357.1	13.8	191.3	29.6	90.0	26.5	64.0
270.0	2.9	351.7	1.8	258.3	26.3	90.0	25.9	61.3
280.0	12.3	2.7	1.1	30.0	22.7	90.0	27.3	61.0
290.0	12.4	14.9	3.7	55.9	20.8	90.0	30.4	62.6
300.0	13.3	36.7	8.3	60.2	16.7	90.0	35.1	65.2
310.0	14.9	45.0	9.9	60.2	18.7	90.0	40.7	67.8
320.0	16.4	49.5	10.6	60.2	22.3	90.0	46.8	70.1
330.0	19.8	52.2	8.5	60.2	27.1	90.0	52.7	71.9
340.0	89.9	9.5	73.5	168.6	26.4	90.0	58.1	73.4
350.0	96.2	0.3	85.6	163.2	25.8	90.0	52.9	74.4
360.0	96.0	0.2	86.5	167.9	25.7	90.0	45.6	75.5

6.26.5 Thruster loss

Case 26 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.84	0.81
10.0	0.86	0.82	0.80
20.0	0.86	0.78	0.80
30.0	0.87	0.78	0.81
40.0	0.87	0.77	0.82
50.0	0.88	0.77	0.84
60.0	0.89	0.77	0.86
70.0	0.90	0.77	0.85
80.0	0.90	0.77	0.84
90.0	0.91	0.77	0.83
100.0	0.92	0.75	0.84
110.0	0.92	0.74	0.84
120.0	0.93	0.73	0.85
130.0	0.93	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.94	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.95	0.70	0.90
200.0	0.95	0.70	0.91
210.0	0.95	0.71	0.90
220.0	0.94	0.71	0.91
230.0	0.94	0.72	0.92
240.0	0.94	0.73	0.93
250.0	0.94	0.75	0.93
260.0	0.92	0.82	0.93
270.0	0.90	0.84	0.93
280.0	0.93	0.89	0.94
290.0	0.92	0.89	0.94
300.0	0.92	0.88	0.95
310.0	0.92	0.88	0.91
320.0	0.92	0.88	0.88
330.0	0.91	0.88	0.85
340.0	0.86	0.84	0.83
350.0	0.86	0.86	0.81
360.0	0.86	0.84	0.81

Preliminary Design, @IDR5

6.27 Case 27 - Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 5

6.27.1 Environment and thrust utilisation

Case 27 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	70.0	70.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	70.0	70.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	70.0	70.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	70.0	70.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	70.0	70.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	70.0	70.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	70.0	70.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	70.0	70.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	70.0	70.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	70.0	70.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	70.0	70.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	70.0	70.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	70.0	70.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	70.0	70.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	70.0	70.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	70.0	70.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	70.0	70.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	70.0	70.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	70.0	70.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	70.0	70.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	70.0	70.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	70.0	70.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	70.0	70.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	70.0	70.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	70.0	70.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	70.0	70.0	250.0	35.0	4.0	6.7	9.4	2.00	90.9
260.0	70.0	70.0	260.0	35.0	4.0	6.7	9.4	2.00	76.6
270.0	70.0	70.0	270.0	35.0	4.0	6.7	9.4	2.00	64.0
280.0	70.0	70.0	280.0	35.0	4.0	6.7	9.4	2.00	54.6
290.0	70.0	70.0	290.0	35.0	4.0	6.7	9.4	2.00	50.2
300.0	70.0	70.0	300.0	35.0	4.0	6.7	9.4	2.00	44.2
310.0	70.0	70.0	310.0	35.0	4.0	6.7	9.4	2.00	49.9
320.0	70.0	70.0	320.0	35.0	4.0	6.7	9.4	2.00	59.7
330.0	70.0	70.0	330.0	35.0	4.0	6.7	9.4	2.00	73.4
340.0	70.0	70.0	340.0	35.0	4.0	6.7	9.4	2.00	89.5
350.0	70.0	70.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	70.0	70.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.27.2 Relative contributions of force components

Case 27 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	41.4	34.3	0.9	0.0	23.4	100.0
10.0	38.9	32.2	6.8	0.0	22.0	100.0
20.0	36.6	30.3	12.4	0.0	20.7	100.0
30.0	34.4	28.4	17.8	0.0	19.4	100.0
40.0	32.2	26.6	23.0	0.0	18.1	100.0
50.0	30.3	25.0	27.7	0.0	17.0	100.0
60.0	28.7	23.6	31.6	0.0	16.1	100.0
70.0	27.5	22.6	34.5	0.0	15.4	100.0
80.0	26.8	22.0	36.3	0.0	15.0	100.0
90.0	26.5	21.8	36.9	0.0	14.8	100.0
100.0	26.8	22.0	36.3	0.0	15.0	100.0
110.0	27.6	22.6	34.4	0.0	15.4	100.0
120.0	28.8	23.6	31.5	0.0	16.1	100.0
130.0	30.5	25.0	27.5	0.0	17.0	100.0
140.0	32.5	26.7	22.7	0.0	18.2	100.0
150.0	34.8	28.5	17.3	0.0	19.1	100.0
160.0	37.1	30.4	11.7	0.0	20.3	100.0
170.0	39.6	32.5	5.8	0.0	22.1	100.0
180.0	42.2	34.6	-0.5	0.0	23.6	100.0
190.0	45.2	37.1	-7.6	0.0	25.3	100.0
200.0	48.9	40.2	-16.4	0.0	27.4	100.0
210.0	53.7	44.1	-27.3	0.0	30.1	100.0
220.0	60.0	49.1	-43.0	0.0	33.7	100.0
230.0	68.0	56.2	-62.5	0.0	38.3	100.0
240.0	77.6	64.3	-85.8	0.0	43.8	100.0
250.0	87.5	72.7	-109.8	0.0	49.6	100.0
260.0	94.7	79.1	-127.8	0.0	54.0	100.0
270.0	96.7	81.0	-132.8	0.0	55.2	100.0
280.0	92.4	77.5	-122.9	0.0	52.9	100.0
290.0	84.1	70.5	-102.6	0.0	48.1	100.0
300.0	74.3	62.2	-79.0	0.0	42.4	100.0
310.0	65.3	54.5	-57.0	0.0	37.2	100.0
320.0	57.8	48.2	-38.9	0.0	32.9	100.0
330.0	52.0	43.3	-24.8	0.0	29.5	100.0
340.0	47.6	39.5	-14.1	0.0	27.0	100.0
350.0	44.2	36.7	-5.8	0.0	25.0	100.0
360.0	41.4	34.3	0.9	0.0	23.4	100.0

6.27.3 Environment forces

Case 27 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-2.6	-4.4	-3.6	0.0	-3.0	-13.5
10.0	-2.6	-4.4	-3.6	0.0	-3.0	-13.5
20.0	-2.6	-4.4	-3.5	0.0	-3.0	-13.4
30.0	-2.6	-4.4	-3.2	0.0	-3.0	-13.1
40.0	-2.6	-4.4	-2.8	0.0	-3.0	-12.7
50.0	-2.6	-4.4	-2.3	0.0	-3.0	-12.2
60.0	-2.6	-4.4	-1.6	0.0	-3.0	-11.6
70.0	-2.6	-4.4	-0.9	0.0	-3.0	-10.8
80.0	-2.6	-4.4	-0.1	0.0	-3.0	-10.0
90.0	-2.6	-4.4	0.7	0.0	-3.0	-9.2
100.0	-2.6	-4.4	1.5	0.0	-3.0	-8.4
110.0	-2.6	-4.4	2.3	0.0	-3.0	-7.7
120.0	-2.6	-4.4	3.0	0.0	-3.0	-7.0
130.0	-2.6	-4.4	3.5	0.0	-3.0	-6.4
140.0	-2.6	-4.4	4.0	0.0	-3.0	-6.0
150.0	-2.6	-4.4	4.3	0.0	-3.0	-5.7
160.0	-2.6	-4.4	4.4	0.0	-3.0	-5.5
170.0	-2.6	-4.4	4.4	0.0	-3.0	-5.5
180.0	-2.6	-4.4	4.3	0.0	-3.0	-5.6
190.0	-2.6	-4.4	4.4	0.0	-3.0	-5.5
200.0	-2.6	-4.4	4.4	0.0	-3.0	-5.5
210.0	-2.6	-4.4	4.3	0.0	-3.0	-5.7
220.0	-2.6	-4.4	4.0	0.0	-3.0	-6.0
230.0	-2.6	-4.4	3.5	0.0	-3.0	-6.4
240.0	-2.6	-4.4	3.0	0.0	-3.0	-7.0
250.0	-2.6	-4.4	2.3	0.0	-3.0	-7.7
260.0	-2.6	-4.4	1.5	0.0	-3.0	-8.4
270.0	-2.6	-4.4	0.7	0.0	-3.0	-9.2
280.0	-2.6	-4.4	-0.1	0.0	-3.0	-10.0
290.0	-2.6	-4.4	-0.9	0.0	-3.0	-10.8
300.0	-2.6	-4.4	-1.6	0.0	-3.0	-11.6
310.0	-2.6	-4.4	-2.3	0.0	-3.0	-12.2
320.0	-2.6	-4.4	-2.8	0.0	-3.0	-12.7
330.0	-2.6	-4.4	-3.2	0.0	-3.0	-13.1
340.0	-2.6	-4.4	-3.5	0.0	-3.0	-13.4
350.0	-2.6	-4.4	-3.6	0.0	-3.0	-13.5
360.0	-2.6	-4.4	-3.6	0.0	-3.0	-13.5

Case 27 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.7	-25.0	0.0	0.0	-17.0	-72.7
10.0	-30.7	-25.0	-4.8	0.0	-17.0	-77.5
20.0	-30.7	-25.0	-10.0	0.0	-17.0	-82.6
30.0	-30.7	-25.0	-15.6	0.0	-17.0	-88.3
40.0	-30.7	-25.0	-21.7	0.0	-17.0	-94.4
50.0	-30.7	-25.0	-28.0	0.0	-17.0	-100.6
60.0	-30.7	-25.0	-33.8	0.0	-17.0	-106.5
70.0	-30.7	-25.0	-38.7	0.0	-17.0	-111.3
80.0	-30.7	-25.0	-41.9	0.0	-17.0	-114.5
90.0	-30.7	-25.0	-43.0	0.0	-17.0	-115.6
100.0	-30.7	-25.0	-41.9	0.0	-17.0	-114.5
110.0	-30.7	-25.0	-38.7	0.0	-17.0	-111.3
120.0	-30.7	-25.0	-33.8	0.0	-17.0	-106.5
130.0	-30.7	-25.0	-28.0	0.0	-17.0	-100.6
140.0	-30.7	-25.0	-21.7	0.0	-17.0	-94.4
150.0	-30.7	-25.0	-15.6	0.0	-17.0	-88.3
160.0	-30.7	-25.0	-10.0	0.0	-17.0	-82.6
170.0	-30.7	-25.0	-4.8	0.0	-17.0	-77.5
180.0	-30.7	-25.0	0.0	0.0	-17.0	-72.7
190.0	-30.7	-25.0	4.8	0.0	-17.0	-67.8
200.0	-30.7	-25.0	10.0	0.0	-17.0	-62.7
210.0	-30.7	-25.0	15.6	0.0	-17.0	-57.0
220.0	-30.7	-25.0	21.7	0.0	-17.0	-50.9
230.0	-30.7	-25.0	28.0	0.0	-17.0	-44.7
240.0	-30.7	-25.0	33.8	0.0	-17.0	-38.8
250.0	-30.7	-25.0	38.7	0.0	-17.0	-34.0
260.0	-30.7	-25.0	41.9	0.0	-17.0	-30.8
270.0	-30.7	-25.0	43.0	0.0	-17.0	-29.7
280.0	-30.7	-25.0	41.9	0.0	-17.0	-30.8
290.0	-30.7	-25.0	38.7	0.0	-17.0	-34.0
300.0	-30.7	-25.0	33.8	0.0	-17.0	-38.8
310.0	-30.7	-25.0	28.0	0.0	-17.0	-44.7
320.0	-30.7	-25.0	21.7	0.0	-17.0	-50.9
330.0	-30.7	-25.0	15.6	0.0	-17.0	-57.0
340.0	-30.7	-25.0	10.0	0.0	-17.0	-62.7
350.0	-30.7	-25.0	4.8	0.0	-17.0	-67.8
360.0	-30.7	-25.0	0.0	0.0	-17.0	-72.7

Case 27 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-430.1	-89.4	0.0	0.0	-100.4	-619.9
10.0	-430.1	-89.4	-316.6	0.0	-100.4	-936.5
20.0	-430.1	-89.4	-593.0	0.0	-100.4	-1212.9
30.0	-430.1	-89.4	-793.7	0.0	-100.4	-1413.6
40.0	-430.1	-89.4	-892.8	0.0	-100.4	-1512.7
50.0	-430.1	-89.4	-876.4	0.0	-100.4	-1496.3
60.0	-430.1	-89.4	-745.2	0.0	-100.4	-1365.1
70.0	-430.1	-89.4	-513.8	0.0	-100.4	-1133.8
80.0	-430.1	-89.4	-209.2	0.0	-100.4	-829.1
90.0	-430.1	-89.4	132.4	0.0	-100.4	-487.5
100.0	-430.1	-89.4	470.0	0.0	-100.4	-149.9
110.0	-430.1	-89.4	762.6	0.0	100.4	343.5
120.0	-430.1	-89.4	974.5	0.0	100.4	555.4
130.0	-430.1	-89.4	1079.2	0.0	100.4	660.1
140.0	-430.1	-89.4	1063.0	0.0	100.4	643.8
150.0	-430.1	-89.4	926.1	0.0	100.4	506.9
160.0	-430.1	-89.4	683.5	0.0	100.4	264.4
170.0	-430.1	-89.4	362.6	0.0	-100.4	-257.3
180.0	-430.1	-89.4	0.0	0.0	-100.4	-619.9
190.0	-430.1	-89.4	-362.6	0.0	-100.4	-982.5
200.0	-430.1	-89.4	-683.5	0.0	-100.4	-1303.5
210.0	-430.1	-89.4	-926.1	0.0	-100.4	-1546.0
220.0	-430.1	-89.4	-1063.0	0.0	-100.4	-1682.9
230.0	-430.1	-89.4	-1079.2	0.0	-100.4	-1699.2
240.0	-430.1	-89.4	-974.5	0.0	-100.4	-1594.4
250.0	-430.1	-89.4	-762.6	0.0	-100.4	-1382.6
260.0	-430.1	-89.4	-470.0	0.0	-100.4	-1089.9
270.0	-430.1	-89.4	-132.4	0.0	-100.4	-752.3
280.0	-430.1	-89.4	209.2	0.0	-100.4	-410.7
290.0	-430.1	-89.4	513.8	0.0	-100.4	-106.1
300.0	-430.1	-89.4	745.2	0.0	100.4	326.1
310.0	-430.1	-89.4	876.4	0.0	100.4	457.3
320.0	-430.1	-89.4	892.8	0.0	100.4	473.6
330.0	-430.1	-89.4	793.7	0.0	100.4	374.5
340.0	-430.1	-89.4	593.0	0.0	100.4	173.8
350.0	-430.1	-89.4	316.6	0.0	-100.4	-303.3
360.0	-430.1	-89.4	0.0	0.0	-100.4	-619.9

6.27.4 Thruster use

Case 27 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.3	89.8	164.2	25.7	90.0	51.4	79.3
10.0	96.2	0.2	90.2	168.6	25.4	90.0	44.2	79.9
20.0	96.6	0.1	91.2	172.3	25.5	90.0	38.5	80.8
30.0	92.3	4.6	87.0	180.0	25.7	90.0	33.5	81.4
40.0	91.3	3.4	86.8	180.0	26.1	90.0	31.8	82.2
50.0	90.9	3.8	86.7	179.9	26.7	90.0	33.0	83.0
60.0	91.0	5.9	86.4	180.0	27.5	90.0	37.0	83.7
70.0	91.5	8.8	86.3	180.0	27.1	90.0	41.3	84.3
80.0	92.6	12.7	86.2	180.0	26.8	90.0	47.3	84.9
90.0	94.6	16.9	86.2	180.0	26.5	90.0	54.3	85.4
100.0	95.6	21.1	84.7	180.0	26.6	90.0	61.2	85.7
110.0	99.0	26.9	83.3	180.0	26.7	90.0	71.7	86.0
120.0	100.0	29.5	82.0	180.0	26.9	90.0	76.3	86.2
130.0	100.1	30.8	80.9	180.0	26.9	90.0	78.3	86.3
140.0	99.0	30.8	80.0	180.0	27.1	90.0	77.9	86.3
150.0	96.7	29.6	79.3	180.0	27.3	90.0	75.2	86.3
160.0	93.8	27.0	78.8	180.0	27.6	90.0	70.4	86.1
170.0	88.6	20.9	78.4	180.0	28.1	90.0	63.9	85.9
180.0	85.9	16.3	78.3	180.0	28.6	90.0	52.1	85.5
190.0	83.8	11.3	78.4	180.0	28.6	90.0	45.1	85.3
200.0	82.7	6.6	78.8	180.0	28.6	90.0	38.3	84.9
210.0	82.8	3.2	79.3	180.0	28.3	90.0	33.5	84.2
220.0	83.7	1.3	80.0	180.0	29.0	90.0	31.2	83.2
230.0	85.5	1.4	80.3	180.0	29.3	90.0	31.7	81.7
240.0	88.5	3.3	82.0	180.0	29.6	90.0	35.2	79.7
250.0	67.0	2.1	80.4	178.1	29.6	90.0	34.8	77.3
260.0	27.2	1.4	18.8	178.3	29.6	90.0	31.9	74.7
270.0	1.3	7.4	2.4	146.1	26.9	90.0	31.1	72.7
280.0	12.7	21.8	3.5	119.8	23.1	90.0	32.4	72.0
290.0	11.1	43.1	5.5	60.2	21.6	90.0	35.7	72.3
300.0	13.6	59.1	9.2	60.2	19.2	90.0	40.5	73.4
310.0	15.8	64.4	10.8	60.2	21.1	90.0	46.3	74.7
320.0	17.6	66.7	11.6	60.2	24.7	90.0	52.5	76.0
330.0	29.4	30.5	19.4	129.0	27.1	90.0	58.5	77.0
340.0	74.7	14.1	61.8	162.9	26.4	90.0	64.1	77.9
350.0	96.2	0.3	90.0	159.9	25.9	90.0	58.5	78.5
360.0	96.0	0.3	89.8	164.2	25.7	90.0	51.4	79.3

6.27.5 Thruster loss

Case 27 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.85	0.81
10.0	0.86	0.84	0.80
20.0	0.86	0.82	0.80
30.0	0.86	0.78	0.81
40.0	0.87	0.77	0.82
50.0	0.88	0.77	0.84
60.0	0.88	0.77	0.86
70.0	0.89	0.77	0.85
80.0	0.90	0.77	0.84
90.0	0.90	0.77	0.83
100.0	0.91	0.75	0.84
110.0	0.91	0.74	0.84
120.0	0.93	0.73	0.85
130.0	0.93	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.94	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.94	0.70	0.90
200.0	0.95	0.70	0.91
210.0	0.95	0.71	0.90
220.0	0.95	0.71	0.91
230.0	0.95	0.72	0.92
240.0	0.94	0.73	0.93
250.0	0.94	0.76	0.93
260.0	0.94	0.77	0.93
270.0	0.94	0.88	0.93
280.0	0.93	0.89	0.94
290.0	0.93	0.89	0.94
300.0	0.93	0.88	0.95
310.0	0.93	0.88	0.91
320.0	0.92	0.88	0.88
330.0	0.88	0.89	0.85
340.0	0.86	0.86	0.83
350.0	0.86	0.87	0.81
360.0	0.86	0.85	0.81

Preliminary Design, @IDR5

6.28 Case 28 - Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 5

6.28.1 Environment and thrust utilisation

Case 28 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	80.0	80.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	80.0	80.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	80.0	80.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	80.0	80.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	80.0	80.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	80.0	80.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	80.0	80.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	80.0	80.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	80.0	80.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	80.0	80.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	80.0	80.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	80.0	80.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	80.0	80.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	80.0	80.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	80.0	80.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	80.0	80.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	80.0	80.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	80.0	80.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	80.0	80.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	80.0	80.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	80.0	80.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	80.0	80.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	80.0	80.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	80.0	80.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	80.0	80.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	80.0	80.0	250.0	35.0	4.0	6.7	9.4	2.00	92.0
260.0	80.0	80.0	260.0	35.0	4.0	6.7	9.4	2.00	77.7
270.0	80.0	80.0	270.0	35.0	4.0	6.7	9.4	2.00	65.1
280.0	80.0	80.0	280.0	35.0	4.0	6.7	9.4	2.00	55.0
290.0	80.0	80.0	290.0	35.0	4.0	6.7	9.4	2.00	46.3
300.0	80.0	80.0	300.0	35.0	4.0	6.7	9.4	2.00	46.3
310.0	80.0	80.0	310.0	35.0	4.0	6.7	9.4	2.00	52.1
320.0	80.0	80.0	320.0	35.0	4.0	6.7	9.4	2.00	62.1
330.0	80.0	80.0	330.0	35.0	4.0	6.7	9.4	2.00	75.6
340.0	80.0	80.0	340.0	35.0	4.0	6.7	9.4	2.00	91.6
350.0	80.0	80.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	80.0	80.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.28.2 Relative contributions of force components

Case 28 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	37.9	36.6	0.6	0.0	24.9	100.0
10.0	35.7	34.5	6.3	0.0	23.4	100.0
20.0	33.7	32.5	11.7	0.0	22.1	100.0
30.0	31.7	30.6	16.9	0.0	20.8	100.0
40.0	29.8	28.7	21.9	0.0	19.5	100.0
50.0	28.1	27.0	26.5	0.0	18.4	100.0
60.0	26.7	25.6	30.3	0.0	17.4	100.0
70.0	25.6	24.6	33.1	0.0	16.7	100.0
80.0	24.9	23.9	34.9	0.0	16.3	100.0
90.0	24.7	23.7	35.5	0.0	16.1	100.0
100.0	24.9	23.9	34.9	0.0	16.3	100.0
110.0	25.6	24.6	33.1	0.0	16.7	100.0
120.0	26.7	25.6	30.2	0.0	17.4	100.0
130.0	28.2	27.0	26.4	0.0	18.4	100.0
140.0	30.0	28.7	21.7	0.0	19.5	100.0
150.0	32.0	30.6	16.6	0.0	20.8	100.0
160.0	34.0	32.6	11.2	0.0	22.2	100.0
170.0	36.1	34.6	5.7	0.0	23.5	100.0
180.0	38.4	36.8	-0.2	0.0	25.0	100.0
190.0	40.9	39.2	-6.8	0.0	26.7	100.0
200.0	44.0	42.2	-14.9	0.0	28.7	100.0
210.0	48.0	46.1	-25.1	0.0	31.3	100.0
220.0	53.3	51.1	-39.1	0.0	34.7	100.0
230.0	59.9	57.5	-56.5	0.0	39.1	100.0
240.0	67.7	65.2	-77.2	0.0	44.3	100.0
250.0	75.8	73.1	-98.6	0.0	49.7	100.0
260.0	82.0	79.3	-115.1	0.0	53.9	100.0
270.0	84.0	81.4	-120.7	0.0	55.3	100.0
280.0	81.0	78.5	-112.8	0.0	53.3	100.0
290.0	74.2	72.0	-95.1	0.0	48.9	100.0
300.0	66.1	64.1	-73.8	0.0	43.6	100.0
310.0	58.5	56.7	-53.7	0.0	38.5	100.0
320.0	52.1	50.5	-36.9	0.0	34.3	100.0
330.0	47.1	45.6	-23.8	0.0	31.0	100.0
340.0	43.3	41.9	-13.7	0.0	28.5	100.0
350.0	40.3	39.0	-5.8	0.0	26.5	100.0
360.0	37.9	36.6	0.6	0.0	24.9	100.0

6.28.3 Environment forces

Case 28 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-1.2	-3.3	-3.6	0.0	-2.2	-10.3
10.0	-1.2	-3.3	-3.6	0.0	-2.2	-10.3
20.0	-1.2	-3.3	-3.5	0.0	-2.2	-10.2
30.0	-1.2	-3.3	-3.2	0.0	-2.2	-9.9
40.0	-1.2	-3.3	-2.8	0.0	-2.2	-9.5
50.0	-1.2	-3.3	-2.3	0.0	-2.2	-9.0
60.0	-1.2	-3.3	-1.6	0.0	-2.2	-8.3
70.0	-1.2	-3.3	-0.9	0.0	-2.2	-7.6
80.0	-1.2	-3.3	-0.1	0.0	-2.2	-6.8
90.0	-1.2	-3.3	0.7	0.0	-2.2	-6.0
100.0	-1.2	-3.3	1.5	0.0	-2.2	-5.2
110.0	-1.2	-3.3	2.3	0.0	-2.2	-4.4
120.0	-1.2	-3.3	3.0	0.0	-2.2	-3.7
130.0	-1.2	-3.3	3.5	0.0	-2.2	-3.2
140.0	-1.2	-3.3	4.0	0.0	-2.2	-2.7
150.0	-1.2	-3.3	4.3	0.0	-2.2	-2.4
160.0	-1.2	-3.3	4.4	0.0	-2.2	-2.3
170.0	-1.2	-3.3	4.4	0.0	-2.2	-2.3
180.0	-1.2	-3.3	4.3	0.0	-2.2	-2.4
190.0	-1.2	-3.3	4.4	0.0	-2.2	-2.3
200.0	-1.2	-3.3	4.4	0.0	-2.2	-2.3
210.0	-1.2	-3.3	4.3	0.0	-2.2	-2.4
220.0	-1.2	-3.3	4.0	0.0	-2.2	-2.7
230.0	-1.2	-3.3	3.5	0.0	-2.2	-3.2
240.0	-1.2	-3.3	3.0	0.0	-2.2	-3.7
250.0	-1.2	-3.3	2.3	0.0	-2.2	-4.4
260.0	-1.2	-3.3	1.5	0.0	-2.2	-5.2
270.0	-1.2	-3.3	0.7	0.0	-2.2	-6.0
280.0	-1.2	-3.3	-0.1	0.0	-2.2	-6.8
290.0	-1.2	-3.3	-0.9	0.0	-2.2	-7.6
300.0	-1.2	-3.3	-1.6	0.0	-2.2	-8.3
310.0	-1.2	-3.3	-2.3	0.0	-2.2	-9.0
320.0	-1.2	-3.3	-2.8	0.0	-2.2	-9.5
330.0	-1.2	-3.3	-3.2	0.0	-2.2	-9.9
340.0	-1.2	-3.3	-3.5	0.0	-2.2	-10.2
350.0	-1.2	-3.3	-3.6	0.0	-2.2	-10.3
360.0	-1.2	-3.3	-3.6	0.0	-2.2	-10.3

Case 28 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.8	-28.5	0.0	0.0	-19.4	-77.7
10.0	-29.8	-28.5	-4.8	0.0	-19.4	-82.5
20.0	-29.8	-28.5	-10.0	0.0	-19.4	-87.7
30.0	-29.8	-28.5	-15.6	0.0	-19.4	-93.3
40.0	-29.8	-28.5	-21.7	0.0	-19.4	-99.4
50.0	-29.8	-28.5	-28.0	0.0	-19.4	-105.7
60.0	-29.8	-28.5	-33.8	0.0	-19.4	-111.5
70.0	-29.8	-28.5	-38.7	0.0	-19.4	-116.4
80.0	-29.8	-28.5	-41.9	0.0	-19.4	-119.6
90.0	-29.8	-28.5	-43.0	0.0	-19.4	-120.7
100.0	-29.8	-28.5	-41.9	0.0	-19.4	-119.6
110.0	-29.8	-28.5	-38.7	0.0	-19.4	-116.4
120.0	-29.8	-28.5	-33.8	0.0	-19.4	-111.5
130.0	-29.8	-28.5	-28.0	0.0	-19.4	-105.7
140.0	-29.8	-28.5	-21.7	0.0	-19.4	-99.4
150.0	-29.8	-28.5	-15.6	0.0	-19.4	-93.3
160.0	-29.8	-28.5	-10.0	0.0	-19.4	-87.7
170.0	-29.8	-28.5	-4.8	0.0	-19.4	-82.5
180.0	-29.8	-28.5	0.0	0.0	-19.4	-77.7
190.0	-29.8	-28.5	4.8	0.0	-19.4	-72.9
200.0	-29.8	-28.5	10.0	0.0	-19.4	-67.7
210.0	-29.8	-28.5	15.6	0.0	-19.4	-62.1
220.0	-29.8	-28.5	21.7	0.0	-19.4	-55.9
230.0	-29.8	-28.5	28.0	0.0	-19.4	-49.7
240.0	-29.8	-28.5	33.8	0.0	-19.4	-43.8
250.0	-29.8	-28.5	38.7	0.0	-19.4	-39.0
260.0	-29.8	-28.5	41.9	0.0	-19.4	-35.8
270.0	-29.8	-28.5	43.0	0.0	-19.4	-34.7
280.0	-29.8	-28.5	41.9	0.0	-19.4	-35.8
290.0	-29.8	-28.5	38.7	0.0	-19.4	-39.0
300.0	-29.8	-28.5	33.8	0.0	-19.4	-43.8
310.0	-29.8	-28.5	28.0	0.0	-19.4	-49.7
320.0	-29.8	-28.5	21.7	0.0	-19.4	-55.9
330.0	-29.8	-28.5	15.6	0.0	-19.4	-62.1
340.0	-29.8	-28.5	10.0	0.0	-19.4	-67.7
350.0	-29.8	-28.5	4.8	0.0	-19.4	-72.9
360.0	-29.8	-28.5	0.0	0.0	-19.4	-77.7

Case 28 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-314.1	-25.9	0.0	0.0	-70.2	-410.1
10.0	-314.1	-25.9	-316.6	0.0	-70.2	-726.7
20.0	-314.1	-25.9	-593.0	0.0	-70.2	-1003.1
30.0	-314.1	-25.9	-793.7	0.0	-70.2	-1203.8
40.0	-314.1	-25.9	-892.8	0.0	-70.2	-1302.9
50.0	-314.1	-25.9	-876.4	0.0	-70.2	-1286.6
60.0	-314.1	-25.9	-745.2	0.0	-70.2	-1155.4
70.0	-314.1	-25.9	-513.8	0.0	-70.2	-924.0
80.0	-314.1	-25.9	-209.2	0.0	-70.2	-619.4
90.0	-314.1	-25.9	132.4	0.0	-70.2	-277.7
100.0	-314.1	-25.9	470.0	0.0	70.2	200.2
110.0	-314.1	-25.9	762.6	0.0	70.2	492.8
120.0	-314.1	-25.9	974.5	0.0	70.2	704.7
130.0	-314.1	-25.9	1079.2	0.0	70.2	809.5
140.0	-314.1	-25.9	1063.0	0.0	70.2	793.2
150.0	-314.1	-25.9	926.1	0.0	70.2	606.6
160.0	-314.1	-25.9	683.5	0.0	70.2	413.7
170.0	-314.1	-25.9	362.6	0.0	70.2	92.8
180.0	-314.1	-25.9	0.0	0.0	-70.2	-410.1
190.0	-314.1	-25.9	-362.6	0.0	-70.2	-772.7
200.0	-314.1	-25.9	-683.5	0.0	-70.2	-1093.7
210.0	-314.1	-25.9	-926.1	0.0	-70.2	-1336.2
220.0	-314.1	-25.9	-1063.0	0.0	-70.2	-1473.1
230.0	-314.1	-25.9	-1079.2	0.0	-70.2	-1489.4
240.0	-314.1	-25.9	-974.5	0.0	-70.2	-1384.7
250.0	-314.1	-25.9	-762.6	0.0	-70.2	-1172.8
260.0	-314.1	-25.9	-470.0	0.0	-70.2	-880.1
270.0	-314.1	-25.9	-132.4	0.0	-70.2	-542.5
280.0	-314.1	-25.9	209.2	0.0	-70.2	-200.9
290.0	-314.1	-25.9	513.8	0.0	70.2	244.0
300.0	-314.1	-25.9	745.2	0.0	70.2	475.4
310.0	-314.1	-25.9	876.4	0.0	70.2	606.6
320.0	-314.1	-25.9	892.8	0.0	70.2	623.0
330.0	-314.1	-25.9	793.7	0.0	70.2	523.9
340.0	-314.1	-25.9	593.0	0.0	70.2	323.2
350.0	-314.1	-25.9	316.6	0.0	-70.2	-93.5
360.0	-314.1	-25.9	0.0	0.0	-70.2	-410.1

6.28.4 Thruster use

Case 28 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.3	93.2	161.8	25.7	90.0	55.7	82.3
10.0	96.2	0.2	92.8	166.0	25.4	90.0	48.6	82.8
20.0	96.6	0.2	93.1	169.6	25.5	90.0	42.9	83.4
30.0	91.8	7.4	87.0	180.0	25.7	90.0	37.7	83.9
40.0	90.9	6.2	86.8	180.0	26.1	90.0	36.1	84.5
50.0	90.5	6.7	86.6	180.0	26.7	90.0	37.3	85.1
60.0	90.6	8.7	86.4	180.0	27.5	90.0	41.3	85.6
70.0	91.2	11.7	86.3	180.0	27.1	90.0	45.6	86.2
80.0	92.5	15.5	86.2	180.0	26.8	90.0	51.6	86.7
90.0	94.6	19.7	86.2	180.0	26.5	90.0	58.5	87.1
100.0	97.1	25.5	84.7	180.0	26.6	90.0	68.4	87.5
110.0	98.5	29.0	83.3	180.0	26.7	90.0	74.6	87.8
120.0	99.5	31.6	82.0	180.0	26.9	90.0	79.1	88.0
130.0	93.5	27.8	80.9	172.7	27.0	90.0	80.9	88.3
140.0	98.2	33.1	80.0	180.0	27.1	90.0	80.7	88.4
150.0	95.8	31.9	79.3	180.0	27.3	90.0	77.9	88.5
160.0	92.6	29.4	78.8	180.0	27.6	90.0	73.1	88.5
170.0	89.2	25.8	78.4	180.0	28.1	90.0	67.0	88.4
180.0	85.0	19.5	78.3	180.0	28.6	90.0	57.1	88.2
190.0	82.6	14.4	78.4	180.0	28.6	90.0	49.2	88.2
200.0	81.4	9.8	78.8	180.0	28.6	90.0	42.5	88.0
210.0	81.3	6.2	79.3	180.0	28.3	90.0	37.6	87.7
220.0	82.0	4.4	80.0	180.0	29.0	90.0	35.3	87.2
230.0	83.5	4.3	80.3	175.9	29.3	90.0	35.7	86.3
240.0	85.9	6.1	82.0	180.0	29.6	90.0	38.9	85.0
250.0	67.8	4.4	80.3	176.2	29.6	90.0	39.3	83.5
260.0	28.0	2.9	22.8	172.7	29.6	90.0	36.2	81.8
270.0	0.2	22.0	5.1	133.7	27.2	90.0	35.2	80.2
280.0	12.1	35.2	6.2	119.8	23.4	90.0	36.5	79.2
290.0	17.0	46.3	8.4	119.8	19.4	90.0	39.7	79.0
300.0	15.1	77.0	9.9	60.2	20.5	90.0	44.6	79.2
310.0	23.7	50.9	12.1	119.8	20.8	90.0	50.5	79.8
320.0	25.7	50.7	13.6	119.8	24.2	90.0	56.7	80.4
330.0	35.9	29.0	27.8	140.8	27.1	90.0	62.8	80.9
340.0	81.3	14.7	71.4	163.2	26.4	90.0	68.5	81.5
350.0	96.2	0.4	94.3	157.7	25.9	90.0	62.8	81.8
360.0	96.0	0.3	93.2	161.8	25.7	90.0	55.7	82.3

6.28.5 Thruster loss

Case 28 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.86	0.81
10.0	0.86	0.85	0.80
20.0	0.86	0.83	0.80
30.0	0.86	0.78	0.81
40.0	0.86	0.77	0.82
50.0	0.87	0.77	0.84
60.0	0.88	0.77	0.86
70.0	0.88	0.77	0.85
80.0	0.89	0.77	0.84
90.0	0.90	0.77	0.83
100.0	0.90	0.75	0.84
110.0	0.91	0.74	0.84
120.0	0.92	0.73	0.85
130.0	0.93	0.75	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.93	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.94	0.70	0.90
200.0	0.94	0.70	0.90
210.0	0.95	0.71	0.90
220.0	0.95	0.71	0.91
230.0	0.94	0.73	0.92
240.0	0.94	0.73	0.93
250.0	0.94	0.77	0.93
260.0	0.94	0.81	0.93
270.0	0.93	0.89	0.93
280.0	0.93	0.89	0.94
290.0	0.93	0.89	0.94
300.0	0.93	0.88	0.95
310.0	0.92	0.89	0.91
320.0	0.92	0.89	0.88
330.0	0.88	0.89	0.85
340.0	0.86	0.86	0.83
350.0	0.86	0.87	0.81
360.0	0.86	0.86	0.81

Preliminary Design, @IDR5

6.29 Case 29 - Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 5

6.29.1 Environment and thrust utilisation

Case 29 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	90.0	90.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	90.0	90.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	90.0	90.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	90.0	90.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	90.0	90.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	90.0	90.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	90.0	90.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	90.0	90.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	90.0	90.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	90.0	90.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	90.0	90.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	90.0	90.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	90.0	90.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	90.0	90.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	90.0	90.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	90.0	90.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	90.0	90.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	90.0	90.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	90.0	90.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	90.0	90.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	90.0	90.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	90.0	90.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	90.0	90.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	90.0	90.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	90.0	90.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	90.0	90.0	250.0	35.0	4.0	6.7	9.4	2.00	94.3
260.0	90.0	90.0	260.0	35.0	4.0	6.7	9.4	2.00	79.6
270.0	90.0	90.0	270.0	35.0	4.0	6.7	9.4	2.00	66.9
280.0	90.0	90.0	280.0	35.0	4.0	6.7	9.4	2.00	57.4
290.0	90.0	90.0	290.0	35.0	4.0	6.7	9.4	2.00	48.7
300.0	90.0	90.0	300.0	35.0	4.0	6.7	9.4	2.00	48.5
310.0	90.0	90.0	310.0	35.0	4.0	6.7	9.4	2.00	54.4
320.0	90.0	90.0	320.0	35.0	4.0	6.7	9.4	2.00	64.4
330.0	90.0	90.0	330.0	35.0	4.0	6.7	9.4	2.00	78.0
340.0	90.0	90.0	340.0	35.0	4.0	6.7	9.4	2.00	94.4
350.0	90.0	90.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	90.0	90.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.29.2 Relative contributions of force components

Case 29 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	35.7	38.0	0.4	0.0	25.8	100.0
10.0	33.8	35.9	5.9	0.0	24.4	100.0
20.0	31.9	33.9	11.1	0.0	23.1	100.0
30.0	30.1	32.0	16.2	0.0	21.7	100.0
40.0	28.3	30.1	21.1	0.0	20.5	100.0
50.0	26.7	28.4	25.5	0.0	19.3	100.0
60.0	25.4	27.0	29.3	0.0	18.3	100.0
70.0	24.4	25.9	32.1	0.0	17.6	100.0
80.0	23.8	25.2	33.8	0.0	17.1	100.0
90.0	23.6	25.0	34.4	0.0	17.0	100.0
100.0	23.8	25.2	33.8	0.0	17.1	100.0
110.0	24.4	25.8	32.1	0.0	17.6	100.0
120.0	25.5	26.9	29.3	0.0	18.3	100.0
130.0	26.8	28.3	25.6	0.0	19.3	100.0
140.0	28.4	30.0	21.1	0.0	20.5	100.0
150.0	30.2	31.9	16.2	0.0	21.7	100.0
160.0	32.0	33.8	11.1	0.0	23.1	100.0
170.0	33.9	35.8	5.8	0.0	24.5	100.0
180.0	35.9	37.9	0.2	0.0	25.9	100.0
190.0	38.2	40.3	-6.0	0.0	27.5	100.0
200.0	40.9	43.1	-13.5	0.0	29.5	100.0
210.0	44.4	46.5	-23.2	0.0	32.0	100.0
220.0	48.0	51.1	-35.7	0.0	35.3	100.0
230.0	51.6	57.6	-51.6	0.0	39.4	100.0
240.0	61.3	64.7	-70.2	0.0	44.2	100.0
250.0	68.2	72.1	-89.5	0.0	49.2	100.0
260.0	73.6	78.2	-105.0	0.0	53.1	100.0
270.0	75.6	80.4	-110.5	0.0	54.6	100.0
280.0	73.2	78.0	-104.2	0.0	53.0	100.0
290.0	67.7	72.1	-88.7	0.0	49.0	100.0
300.0	60.8	64.8	-69.5	0.0	44.0	100.0
310.0	54.1	57.7	-51.0	0.0	39.2	100.0
320.0	48.5	51.7	-35.4	0.0	35.1	100.0
330.0	44.1	47.0	-22.9	0.0	31.9	100.0
340.0	40.6	43.3	-13.3	0.0	29.4	100.0
350.0	37.9	40.4	-5.8	0.0	27.5	100.0
360.0	35.7	38.0	0.4	0.0	25.8	100.0

6.29.3 Environment forces

Case 29 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	-2.1	-3.6	0.0	-1.4	-7.1
10.0	0.0	-2.1	-3.6	0.0	-1.4	-7.1
20.0	0.0	-2.1	-3.5	0.0	-1.4	-6.9
30.0	0.0	-2.1	-3.2	0.0	-1.4	-6.7
40.0	0.0	-2.1	-2.8	0.0	-1.4	-6.3
50.0	0.0	-2.1	-2.3	0.0	-1.4	-5.7
60.0	0.0	-2.1	-1.6	0.0	-1.4	-5.1
70.0	0.0	-2.1	-0.9	0.0	-1.4	-4.3
80.0	0.0	-2.1	-0.1	0.0	-1.4	-3.6
90.0	0.0	-2.1	0.7	0.0	-1.4	-2.7
100.0	0.0	-2.1	1.5	0.0	-1.4	-1.9
110.0	0.0	-2.1	2.3	0.0	1.4	1.6
120.0	0.0	-2.1	3.0	0.0	1.4	2.3
130.0	0.0	-2.1	3.5	0.0	1.4	2.9
140.0	0.0	-2.1	4.0	0.0	1.4	3.3
150.0	0.0	-2.1	4.3	0.0	1.4	3.6
160.0	0.0	-2.1	4.4	0.0	1.4	3.8
170.0	0.0	-2.1	4.4	0.0	1.4	3.8
180.0	0.0	-2.1	4.3	0.0	1.4	3.6
190.0	0.0	-2.1	4.4	0.0	1.4	3.8
200.0	0.0	-2.1	4.4	0.0	1.4	3.8
210.0	0.0	-2.1	4.3	0.0	1.4	3.6
220.0	0.0	-2.1	4.0	0.0	1.4	3.3
230.0	0.0	-2.1	3.5	0.0	1.4	2.9
240.0	0.0	-2.1	3.0	0.0	1.4	2.3
250.0	0.0	-2.1	2.3	0.0	1.4	1.6
260.0	0.0	-2.1	1.5	0.0	-1.4	-1.9
270.0	0.0	-2.1	0.7	0.0	-1.4	-2.7
280.0	0.0	-2.1	-0.1	0.0	-1.4	-3.6
290.0	0.0	-2.1	-0.9	0.0	-1.4	-4.3
300.0	0.0	-2.1	-1.6	0.0	-1.4	-5.1
310.0	0.0	-2.1	-2.3	0.0	-1.4	-5.7
320.0	0.0	-2.1	-2.8	0.0	-1.4	-6.3
330.0	0.0	-2.1	-3.2	0.0	-1.4	-6.7
340.0	0.0	-2.1	-3.5	0.0	-1.4	-6.9
350.0	0.0	-2.1	-3.6	0.0	-1.4	-7.1
360.0	0.0	-2.1	-3.6	0.0	-1.4	-7.1

Case 29 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.4	-31.2	0.0	0.0	-21.2	-81.7
10.0	-29.4	-31.2	-4.8	0.0	-21.2	-86.6
20.0	-29.4	-31.2	-10.0	0.0	-21.2	-91.7
30.0	-29.4	-31.2	-15.6	0.0	-21.2	-97.4
40.0	-29.4	-31.2	-21.7	0.0	-21.2	-103.5
50.0	-29.4	-31.2	-28.0	0.0	-21.2	-109.7
60.0	-29.4	-31.2	-33.8	0.0	-21.2	-115.6
70.0	-29.4	-31.2	-38.7	0.0	-21.2	-120.4
80.0	-29.4	-31.2	-41.9	0.0	-21.2	-123.6
90.0	-29.4	-31.2	-43.0	0.0	-21.2	-124.7
100.0	-29.4	-31.2	-41.9	0.0	-21.2	-123.6
110.0	-29.4	-31.2	-38.7	0.0	-21.2	-120.4
120.0	-29.4	-31.2	-33.8	0.0	-21.2	-115.6
130.0	-29.4	-31.2	-28.0	0.0	-21.2	-109.7
140.0	-29.4	-31.2	-21.7	0.0	-21.2	-103.5
150.0	-29.4	-31.2	-15.6	0.0	-21.2	-97.4
160.0	-29.4	-31.2	-10.0	0.0	-21.2	-91.7
170.0	-29.4	-31.2	-4.8	0.0	-21.2	-86.6
180.0	-29.4	-31.2	0.0	0.0	-21.2	-81.7
190.0	-29.4	-31.2	4.8	0.0	-21.2	-76.9
200.0	-29.4	-31.2	10.0	0.0	-21.2	-71.8
210.0	-29.4	-31.2	15.6	0.0	-21.2	-66.1
220.0	-29.4	-31.2	21.7	0.0	-21.2	-60.0
230.0	-29.4	-31.2	28.0	0.0	-21.2	-53.8
240.0	-29.4	-31.2	33.8	0.0	-21.2	-47.9
250.0	-29.4	-31.2	38.7	0.0	-21.2	-43.1
260.0	-29.4	-31.2	41.9	0.0	-21.2	-39.9
270.0	-29.4	-31.2	43.0	0.0	-21.2	-38.8
280.0	-29.4	-31.2	41.9	0.0	-21.2	-39.9
290.0	-29.4	-31.2	38.7	0.0	-21.2	-43.1
300.0	-29.4	-31.2	33.8	0.0	-21.2	-47.9
310.0	-29.4	-31.2	28.0	0.0	-21.2	-53.8
320.0	-29.4	-31.2	21.7	0.0	-21.2	-60.0
330.0	-29.4	-31.2	15.6	0.0	-21.2	-66.1
340.0	-29.4	-31.2	10.0	0.0	-21.2	-71.8
350.0	-29.4	-31.2	4.8	0.0	-21.2	-76.9
360.0	-29.4	-31.2	0.0	0.0	-21.2	-81.7

Case 29 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-207.2	-8.3	0.0	0.0	-48.3	-263.8
10.0	-207.2	-8.3	-316.6	0.0	-48.3	-580.4
20.0	-207.2	-8.3	-593.0	0.0	-48.3	-856.8
30.0	-207.2	-8.3	-793.7	0.0	-48.3	-1057.5
40.0	-207.2	-8.3	-892.8	0.0	-48.3	-1156.6
50.0	-207.2	-8.3	-876.4	0.0	-48.3	-1140.3
60.0	-207.2	-8.3	-745.2	0.0	-48.3	-1009.1
70.0	-207.2	-8.3	-513.8	0.0	-48.3	-777.7
80.0	-207.2	-8.3	-209.2	0.0	-48.3	-473.1
90.0	-207.2	-8.3	132.4	0.0	-48.3	-131.4
100.0	-207.2	-8.3	470.0	0.0	48.3	302.8
110.0	-207.2	-8.3	762.6	0.0	48.3	595.4
120.0	-207.2	-8.3	974.5	0.0	48.3	807.3
130.0	-207.2	-8.3	1079.2	0.0	48.3	912.1
140.0	-207.2	-8.3	1063.0	0.0	48.3	895.8
150.0	-207.2	-8.3	926.1	0.0	48.3	758.9
160.0	-207.2	-8.3	683.5	0.0	48.3	516.3
170.0	-207.2	-8.3	362.6	0.0	48.3	195.4
180.0	-207.2	-8.3	0.0	0.0	-48.3	-263.8
190.0	-207.2	-8.3	-362.6	0.0	-48.3	-626.4
200.0	-207.2	-8.3	-683.5	0.0	-48.3	-947.4
210.0	-207.2	-8.3	-926.1	0.0	-48.3	-1189.9
220.0	-207.2	-8.3	-1063.0	0.0	-48.3	-1326.8
230.0	-207.2	-8.3	-1079.2	0.0	-48.3	-1343.1
240.0	-207.2	-8.3	-974.5	0.0	-48.3	-1238.4
250.0	-207.2	-8.3	-762.6	0.0	-48.3	-1026.5
260.0	-207.2	-8.3	-470.0	0.0	-48.3	-733.8
270.0	-207.2	-8.3	-132.4	0.0	-48.3	-396.2
280.0	-207.2	-8.3	209.2	0.0	-48.3	-54.6
290.0	-207.2	-8.3	513.8	0.0	48.3	346.6
300.0	-207.2	-8.3	745.2	0.0	48.3	578.0
310.0	-207.2	-8.3	876.4	0.0	48.3	709.2
320.0	-207.2	-8.3	892.8	0.0	48.3	725.6
330.0	-207.2	-8.3	793.7	0.0	48.3	626.5
340.0	-207.2	-8.3	593.0	0.0	48.3	425.8
350.0	-207.2	-8.3	316.6	0.0	48.3	149.4
360.0	-207.2	-8.3	0.0	0.0	-48.3	-263.8

6.29.4 Thruster use

Case 29 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	95.6	5.9	92.9	165.7	25.7	90.0	58.6	85.1
10.0	95.0	7.9	90.8	172.0	25.4	90.0	51.2	85.3
20.0	93.8	6.2	90.3	173.9	25.5	90.0	45.3	85.7
30.0	91.0	9.4	87.0	180.0	25.7	90.0	40.6	86.0
40.0	90.1	8.2	86.8	180.0	26.1	90.0	39.0	86.5
50.0	89.8	8.6	86.6	180.0	26.7	90.0	40.2	87.0
60.0	90.0	10.7	86.4	180.0	27.4	90.0	44.2	87.4
70.0	90.6	13.7	86.3	180.0	27.1	90.0	48.5	87.9
80.0	92.0	17.5	86.2	180.0	26.8	90.0	54.5	88.3
90.0	94.2	21.7	86.2	180.0	26.5	90.0	61.4	88.7
100.0	96.3	27.0	84.7	180.0	26.6	90.0	70.3	89.1
110.0	96.0	31.1	83.3	180.0	26.7	90.0	76.2	90.8
120.0	96.7	33.8	82.0	180.0	26.9	90.0	80.8	91.2
130.0	96.5	35.3	80.9	180.0	26.9	90.0	82.7	91.5
140.0	95.0	35.5	80.0	180.0	27.1	90.0	82.3	91.8
150.0	92.4	34.4	79.3	180.0	27.3	90.0	79.5	92.1
160.0	89.1	31.9	78.8	180.0	27.6	90.0	74.8	92.4
170.0	85.6	28.2	78.4	180.0	28.1	90.0	68.6	92.5
180.0	81.7	22.3	78.3	180.0	28.6	90.0	59.1	92.6
190.0	79.3	17.0	78.4	180.0	28.6	90.0	51.9	92.9
200.0	78.1	12.2	78.8	180.0	28.6	90.0	45.2	93.1
210.0	77.9	8.5	79.3	180.0	28.3	90.0	40.3	93.2
220.0	78.4	6.5	80.0	180.0	29.0	90.0	38.0	93.2
230.0	79.3	6.5	80.3	180.0	29.3	90.0	38.3	93.1
240.0	80.8	8.3	82.0	180.0	29.6	90.0	41.3	92.8
250.0	69.0	6.1	80.4	175.0	29.6	90.0	43.1	92.1
260.0	30.7	7.3	28.6	170.3	29.6	90.0	39.9	87.2
270.0	9.6	35.7	7.4	133.5	27.8	90.0	38.9	86.0
280.0	11.3	47.4	8.5	119.8	24.1	90.0	40.0	84.9
290.0	16.4	54.3	10.5	119.8	20.6	90.0	43.3	84.2
300.0	20.2	56.3	12.4	119.8	20.3	90.0	48.2	83.9
310.0	23.3	56.7	14.2	119.8	22.0	90.0	54.1	83.9
320.0	25.2	56.0	15.8	119.8	25.4	90.0	60.3	84.1
330.0	42.5	27.3	36.7	147.8	27.1	90.0	66.4	84.2
340.0	87.9	15.0	81.2	163.8	26.4	90.0	72.1	84.5
350.0	95.7	9.2	92.1	163.5	25.9	90.0	67.6	84.8
360.0	96.0	0.3	96.5	160.4	25.7	90.0	58.9	85.0

6.29.5 Thruster loss

Case 29 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.85	0.81
10.0	0.85	0.82	0.80
20.0	0.85	0.81	0.80
30.0	0.85	0.78	0.81
40.0	0.86	0.77	0.82
50.0	0.87	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.88	0.77	0.85
80.0	0.89	0.77	0.84
90.0	0.89	0.77	0.83
100.0	0.90	0.75	0.84
110.0	0.91	0.74	0.84
120.0	0.92	0.73	0.85
130.0	0.92	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.93	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.94	0.70	0.90
200.0	0.94	0.70	0.90
210.0	0.94	0.71	0.90
220.0	0.94	0.71	0.91
230.0	0.94	0.72	0.92
240.0	0.94	0.73	0.93
250.0	0.94	0.78	0.93
260.0	0.93	0.82	0.93
270.0	0.93	0.89	0.93
280.0	0.93	0.89	0.94
290.0	0.93	0.89	0.94
300.0	0.93	0.89	0.95
310.0	0.92	0.89	0.91
320.0	0.92	0.89	0.88
330.0	0.88	0.88	0.85
340.0	0.86	0.86	0.83
350.0	0.85	0.86	0.81
360.0	0.86	0.86	0.81

Preliminary Design, @IDR5

6.30 Case 30 - Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 5

6.30.1 Environment and thrust utilisation

Case 30 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	100.0	100.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	100.0	100.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	100.0	100.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	100.0	100.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	100.0	100.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	100.0	100.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	100.0	100.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	100.0	100.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	100.0	100.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	100.0	100.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	100.0	100.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	100.0	100.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	100.0	100.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	100.0	100.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	100.0	100.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	100.0	100.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	100.0	100.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	100.0	100.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	100.0	100.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	100.0	100.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	100.0	100.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	100.0	100.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	100.0	100.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	100.0	100.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	100.0	100.0	240.0	35.0	4.0	6.7	9.4	2.00	97.4
250.0	100.0	100.0	250.0	35.0	4.0	6.7	9.4	2.00	83.3
260.0	100.0	100.0	260.0	35.0	4.0	6.7	9.4	2.00	69.1
270.0	100.0	100.0	270.0	35.0	4.0	6.7	9.4	2.00	56.5
280.0	100.0	100.0	280.0	35.0	4.0	6.7	9.4	2.00	43.8
290.0	100.0	100.0	290.0	35.0	4.0	6.7	9.4	2.00	37.9
300.0	100.0	100.0	300.0	35.0	4.0	6.7	9.4	2.00	37.5
310.0	100.0	100.0	310.0	35.0	4.0	6.7	9.4	2.00	42.8
320.0	100.0	100.0	320.0	35.0	4.0	6.7	9.4	2.00	52.4
330.0	100.0	100.0	330.0	35.0	4.0	6.7	9.4	2.00	65.6
340.0	100.0	100.0	340.0	35.0	4.0	6.7	9.4	2.00	81.8
350.0	100.0	100.0	350.0	35.0	4.0	6.7	9.4	2.00	99.9
360.0	100.0	100.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.30.2 Relative contributions of force components

Case 30 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	38.5	36.6	0.1	0.0	24.8	100.0
10.0	36.2	34.4	6.0	0.0	23.4	100.0
20.0	34.1	32.4	11.5	0.0	22.0	100.0
30.0	32.0	30.4	16.9	0.0	20.7	100.0
40.0	30.0	28.6	22.0	0.0	19.4	100.0
50.0	28.3	26.9	26.6	0.0	18.2	100.0
60.0	26.8	25.5	30.4	0.0	17.3	100.0
70.0	25.7	24.4	33.3	0.0	16.6	100.0
80.0	25.0	23.7	35.1	0.0	16.1	100.0
90.0	24.8	23.5	35.7	0.0	16.0	100.0
100.0	25.0	23.7	35.2	0.0	16.1	100.0
110.0	25.7	24.4	33.4	0.0	16.5	100.0
120.0	26.8	25.4	30.5	0.0	17.3	100.0
130.0	28.3	26.8	26.7	0.0	18.2	100.0
140.0	30.0	28.5	22.1	0.0	19.3	100.0
150.0	32.0	30.3	17.1	0.0	20.5	100.0
160.0	34.0	32.3	11.8	0.0	21.9	100.0
170.0	36.1	34.3	6.3	0.0	23.3	100.0
180.0	38.4	36.4	0.5	0.0	24.7	100.0
190.0	40.9	38.7	-6.0	0.0	26.3	100.0
200.0	43.9	41.7	-13.9	0.0	28.3	100.0
210.0	47.9	45.4	-24.2	0.0	30.9	100.0
220.0	53.4	50.1	-37.6	0.0	34.2	100.0
230.0	59.7	56.6	-54.8	0.0	38.5	100.0
240.0	67.7	64.1	-75.5	0.0	43.6	100.0
250.0	76.2	72.2	-97.5	0.0	49.1	100.0
260.0	83.2	78.9	-115.7	0.0	53.7	100.0
270.0	86.3	81.8	-123.7	0.0	55.6	100.0
280.0	83.9	79.6	-117.5	0.0	54.1	100.0
290.0	77.2	73.2	-100.1	0.0	49.7	100.0
300.0	68.6	65.2	-78.1	0.0	44.2	100.0
310.0	60.4	57.4	-56.7	0.0	39.0	100.0
320.0	53.5	50.9	-39.0	0.0	34.6	100.0
330.0	48.2	45.8	-25.2	0.0	31.2	100.0
340.0	44.1	42.0	-14.7	0.0	28.5	100.0
350.0	41.0	39.0	-6.5	0.0	26.5	100.0
360.0	38.5	36.6	0.1	0.0	24.8	100.0

6.30.3 Environment forces

Case 30 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	1.4	0.8	-3.6	0.0	-1.0	-2.4
10.0	1.4	0.8	-3.6	0.0	-1.0	-2.4
20.0	1.4	0.8	-3.5	0.0	-1.0	-2.3
30.0	1.4	0.8	-3.2	0.0	-1.0	-2.0
40.0	1.4	0.8	-2.8	0.0	-1.0	-1.6
50.0	1.4	0.8	-2.3	0.0	-1.0	-1.1
60.0	1.4	0.8	-1.6	0.0	1.0	1.6
70.0	1.4	0.8	-0.9	0.0	1.0	2.4
80.0	1.4	0.8	-0.1	0.0	1.0	3.2
90.0	1.4	0.8	0.7	0.0	1.0	4.0
100.0	1.4	0.8	1.5	0.0	1.0	4.8
110.0	1.4	0.8	2.3	0.0	1.0	5.5
120.0	1.4	0.8	3.0	0.0	1.0	6.2
130.0	1.4	0.8	3.5	0.0	1.0	6.8
140.0	1.4	0.8	4.0	0.0	1.0	7.2
150.0	1.4	0.8	4.3	0.0	1.0	7.5
160.0	1.4	0.8	4.4	0.0	1.0	7.7
170.0	1.4	0.8	4.4	0.0	1.0	7.7
180.0	1.4	0.8	4.3	0.0	1.0	7.6
190.0	1.4	0.8	4.4	0.0	1.0	7.7
200.0	1.4	0.8	4.4	0.0	1.0	7.7
210.0	1.4	0.8	4.3	0.0	1.0	7.5
220.0	1.4	0.8	4.0	0.0	1.0	7.2
230.0	1.4	0.8	3.5	0.0	1.0	6.8
240.0	1.4	0.8	3.0	0.0	1.0	6.2
250.0	1.4	0.8	2.3	0.0	1.0	5.5
260.0	1.4	0.8	1.5	0.0	1.0	4.8
270.0	1.4	0.8	0.7	0.0	1.0	4.0
280.0	1.4	0.8	-0.1	0.0	1.0	3.2
290.0	1.4	0.8	-0.9	0.0	1.0	2.4
300.0	1.4	0.8	-1.6	0.0	1.0	1.6
310.0	1.4	0.8	-2.3	0.0	-1.0	-1.1
320.0	1.4	0.8	-2.8	0.0	-1.0	-1.6
330.0	1.4	0.8	-3.2	0.0	-1.0	-2.0
340.0	1.4	0.8	-3.5	0.0	-1.0	-2.3
350.0	1.4	0.8	-3.6	0.0	-1.0	-2.4
360.0	1.4	0.8	-3.6	0.0	-1.0	-2.4

Case 30 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.8	-28.3	0.0	0.0	-19.2	-77.2
10.0	-29.8	-28.3	-4.8	0.0	-19.2	-82.1
20.0	-29.8	-28.3	-10.0	0.0	-19.2	-87.2
30.0	-29.8	-28.3	-15.6	0.0	-19.2	-92.9
40.0	-29.8	-28.3	-21.7	0.0	-19.2	-99.0
50.0	-29.8	-28.3	-28.0	0.0	-19.2	-105.2
60.0	-29.8	-28.3	-33.8	0.0	-19.2	-111.1
70.0	-29.8	-28.3	-38.7	0.0	-19.2	-115.9
80.0	-29.8	-28.3	-41.9	0.0	-19.2	-119.1
90.0	-29.8	-28.3	-43.0	0.0	-19.2	-120.2
100.0	-29.8	-28.3	-41.9	0.0	-19.2	-119.1
110.0	-29.8	-28.3	-38.7	0.0	-19.2	-115.9
120.0	-29.8	-28.3	-33.8	0.0	-19.2	-111.1
130.0	-29.8	-28.3	-28.0	0.0	-19.2	-105.2
140.0	-29.8	-28.3	-21.7	0.0	-19.2	-99.0
150.0	-29.8	-28.3	-15.6	0.0	-19.2	-92.9
160.0	-29.8	-28.3	-10.0	0.0	-19.2	-87.2
170.0	-29.8	-28.3	-4.8	0.0	-19.2	-82.1
180.0	-29.8	-28.3	0.0	0.0	-19.2	-77.2
190.0	-29.8	-28.3	4.8	0.0	-19.2	-72.4
200.0	-29.8	-28.3	10.0	0.0	-19.2	-67.2
210.0	-29.8	-28.3	15.6	0.0	-19.2	-61.6
220.0	-29.8	-28.3	21.7	0.0	-19.2	-55.5
230.0	-29.8	-28.3	28.0	0.0	-19.2	-49.2
240.0	-29.8	-28.3	33.8	0.0	-19.2	-43.4
250.0	-29.8	-28.3	38.7	0.0	-19.2	-38.5
260.0	-29.8	-28.3	41.9	0.0	-19.2	-35.3
270.0	-29.8	-28.3	43.0	0.0	-19.2	-34.2
280.0	-29.8	-28.3	41.9	0.0	-19.2	-35.3
290.0	-29.8	-28.3	38.7	0.0	-19.2	-38.5
300.0	-29.8	-28.3	33.8	0.0	-19.2	-43.4
310.0	-29.8	-28.3	28.0	0.0	-19.2	-49.2
320.0	-29.8	-28.3	21.7	0.0	-19.2	-55.5
330.0	-29.8	-28.3	15.6	0.0	-19.2	-61.6
340.0	-29.8	-28.3	10.0	0.0	-19.2	-67.2
350.0	-29.8	-28.3	4.8	0.0	-19.2	-72.4
360.0	-29.8	-28.3	0.0	0.0	-19.2	-77.2

Case 30 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-105.5	60.1	0.0	0.0	-54.2	-99.6
10.0	-105.5	60.1	-316.6	0.0	-54.2	-416.2
20.0	-105.5	60.1	-593.0	0.0	-54.2	-692.6
30.0	-105.5	60.1	-793.7	0.0	-54.2	-893.3
40.0	-105.5	60.1	-892.8	0.0	-54.2	-992.4
50.0	-105.5	60.1	-876.4	0.0	-54.2	-976.0
60.0	-105.5	60.1	-745.2	0.0	-54.2	-844.8
70.0	-105.5	60.1	-513.8	0.0	-54.2	-613.4
80.0	-105.5	60.1	-209.2	0.0	-54.2	-308.8
90.0	-105.5	60.1	132.4	0.0	54.2	141.1
100.0	-105.5	60.1	470.0	0.0	54.2	478.7
110.0	-105.5	60.1	762.6	0.0	54.2	771.4
120.0	-105.5	60.1	974.5	0.0	54.2	983.3
130.0	-105.5	60.1	1079.2	0.0	54.2	1088.0
140.0	-105.5	60.1	1063.0	0.0	54.2	1071.7
150.0	-105.5	60.1	926.1	0.0	54.2	934.8
160.0	-105.5	60.1	683.5	0.0	54.2	692.3
170.0	-105.5	60.1	362.6	0.0	54.2	371.3
180.0	-105.5	60.1	0.0	0.0	-54.2	-99.6
190.0	-105.5	60.1	-362.6	0.0	-54.2	-462.2
200.0	-105.5	60.1	-683.5	0.0	-54.2	-783.1
210.0	-105.5	60.1	-926.1	0.0	-54.2	-1025.7
220.0	-105.5	60.1	-1063.0	0.0	-54.2	-1162.6
230.0	-105.5	60.1	-1079.2	0.0	-54.2	-1178.9
240.0	-105.5	60.1	-974.5	0.0	-54.2	-1074.1
250.0	-105.5	60.1	-762.6	0.0	-54.2	-862.2
260.0	-105.5	60.1	-470.0	0.0	-54.2	-569.6
270.0	-105.5	60.1	-132.4	0.0	-54.2	-232.0
280.0	-105.5	60.1	209.2	0.0	54.2	218.0
290.0	-105.5	60.1	513.8	0.0	54.2	522.6
300.0	-105.5	60.1	745.2	0.0	54.2	754.0
310.0	-105.5	60.1	876.4	0.0	54.2	885.2
320.0	-105.5	60.1	892.8	0.0	54.2	901.5
330.0	-105.5	60.1	793.7	0.0	54.2	802.4
340.0	-105.5	60.1	593.0	0.0	54.2	601.7
350.0	-105.5	60.1	316.6	0.0	54.2	325.4
360.0	-105.5	60.1	0.0	0.0	-54.2	-99.6

6.30.4 Thruster use

Case 30 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	93.5	11.1	91.6	168.8	25.7	90.0	61.6	88.2
10.0	93.6	9.0	92.0	171.0	25.4	90.0	54.5	88.3
20.0	91.2	14.2	87.2	180.0	25.5	90.0	47.8	88.5
30.0	89.8	11.6	87.0	180.0	25.7	90.0	43.8	88.7
40.0	89.0	10.5	86.8	180.0	26.1	90.0	42.2	89.1
50.0	88.7	10.9	86.6	180.0	26.7	90.0	43.5	89.4
60.0	88.0	13.1	86.4	180.0	27.5	90.0	47.4	90.9
70.0	88.7	16.1	86.3	180.0	27.1	90.0	51.7	91.2
80.0	90.1	20.0	86.2	180.0	26.8	90.0	57.6	91.6
90.0	93.0	25.6	86.2	180.0	26.5	90.0	66.8	91.9
100.0	94.2	29.9	84.6	180.0	26.6	90.0	73.7	92.3
110.0	95.4	33.7	83.3	180.0	26.7	90.0	79.8	92.8
120.0	96.1	36.5	82.0	180.0	26.9	90.0	84.3	93.3
130.0	95.7	38.1	80.9	180.0	26.9	90.0	86.3	93.7
140.0	94.1	38.5	80.0	180.0	27.1	90.0	85.8	94.2
150.0	91.3	37.5	79.3	180.0	27.3	90.0	83.1	94.7
160.0	87.7	35.1	78.8	180.0	27.6	90.0	78.3	95.1
170.0	83.9	31.5	78.4	180.0	28.1	90.0	72.2	95.5
180.0	79.8	25.3	78.3	180.0	28.6	90.0	63.7	95.7
190.0	77.1	20.0	78.4	180.0	28.6	90.0	55.3	96.2
200.0	75.7	15.0	78.8	180.0	28.6	90.0	48.6	96.6
210.0	75.3	11.2	79.3	180.0	28.3	90.0	43.8	97.1
220.0	75.5	9.2	80.0	180.0	29.0	90.0	41.4	97.6
230.0	76.1	9.1	80.3	180.0	29.3	90.0	41.7	98.0
240.0	72.4	6.1	79.1	175.5	29.6	90.0	43.8	98.2
250.0	32.8	8.5	86.2	173.9	29.6	90.0	38.9	98.2
260.0	5.6	4.7	9.5	158.1	28.0	90.0	35.7	97.7
270.0	6.6	60.8	9.0	143.0	23.1	90.0	34.5	96.6
280.0	9.1	76.0	10.0	122.5	18.1	90.0	35.5	95.1
290.0	12.9	74.7	11.7	119.8	16.0	90.0	38.6	93.5
300.0	16.7	72.4	13.5	119.8	15.7	90.0	43.4	92.2
310.0	20.9	66.2	14.9	119.8	17.3	90.0	49.2	88.8
320.0	22.8	64.7	16.4	119.8	20.7	90.0	55.5	88.4
330.0	23.4	62.8	17.5	119.8	25.6	90.0	61.6	88.1
340.0	51.5	23.2	49.6	155.5	26.4	90.0	67.3	88.1
350.0	95.7	12.6	94.2	164.9	25.9	90.0	71.3	88.1
360.0	93.5	11.1	91.6	168.8	25.7	90.0	61.6	88.2

6.30.5 Thruster loss

Case 30 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.84	0.81
10.0	0.85	0.83	0.80
20.0	0.85	0.78	0.80
30.0	0.85	0.78	0.81
40.0	0.86	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.88	0.77	0.85
80.0	0.88	0.77	0.84
90.0	0.89	0.77	0.83
100.0	0.89	0.75	0.84
110.0	0.90	0.74	0.84
120.0	0.91	0.73	0.85
130.0	0.92	0.72	0.85
140.0	0.92	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.93	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.94	0.70	0.90
200.0	0.94	0.70	0.91
210.0	0.94	0.71	0.90
220.0	0.94	0.71	0.91
230.0	0.94	0.72	0.92
240.0	0.94	0.76	0.93
250.0	0.94	0.78	0.93
260.0	0.93	0.86	0.93
270.0	0.93	0.88	0.93
280.0	0.93	0.89	0.94
290.0	0.93	0.89	0.94
300.0	0.93	0.89	0.95
310.0	0.93	0.89	0.91
320.0	0.92	0.89	0.88
330.0	0.92	0.89	0.85
340.0	0.86	0.87	0.83
350.0	0.85	0.85	0.81
360.0	0.85	0.84	0.81

Preliminary Design, @IDR5

6.31 Case 31 - Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 5

6.31.1 Environment and thrust utilisation

Case 31 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	110.0	110.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	110.0	110.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	110.0	110.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	110.0	110.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	110.0	110.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	110.0	110.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	110.0	110.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	110.0	110.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	110.0	110.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	110.0	110.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	110.0	110.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	110.0	110.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	110.0	110.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	110.0	110.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	110.0	110.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	110.0	110.0	150.0	35.0	4.0	6.7	9.4	2.00	99.3
160.0	110.0	110.0	160.0	35.0	4.0	6.7	9.4	2.00	97.6
170.0	110.0	110.0	170.0	35.0	4.0	6.7	9.4	2.00	99.3
180.0	110.0	110.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	110.0	110.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	110.0	110.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	110.0	110.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	110.0	110.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	110.0	110.0	230.0	35.0	4.0	6.7	9.4	2.00	97.8
240.0	110.0	110.0	240.0	35.0	4.0	6.7	9.4	2.00	84.8
250.0	110.0	110.0	250.0	35.0	4.0	6.7	9.4	2.00	70.8
260.0	110.0	110.0	260.0	35.0	4.0	6.7	9.4	2.00	56.6
270.0	110.0	110.0	270.0	35.0	4.0	6.7	9.4	2.00	44.1
280.0	110.0	110.0	280.0	35.0	4.0	6.7	9.4	2.00	30.6
290.0	110.0	110.0	290.0	35.0	4.0	6.7	9.4	2.00	25.0
300.0	110.0	110.0	300.0	35.0	4.0	6.7	9.4	2.00	24.7
310.0	110.0	110.0	310.0	35.0	4.0	6.7	9.4	2.00	29.7
320.0	110.0	110.0	320.0	35.0	4.0	6.7	9.4	2.00	38.7
330.0	110.0	110.0	330.0	35.0	4.0	6.7	9.4	2.00	51.7
340.0	110.0	110.0	340.0	35.0	4.0	6.7	9.4	2.00	67.6
350.0	110.0	110.0	350.0	35.0	4.0	6.7	9.4	2.00	85.3
360.0	110.0	110.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.31.2 Relative contributions of force components

Case 31 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	43.0	34.0	-0.4	0.0	23.4	100.0
10.0	40.2	31.9	6.0	0.0	21.9	100.0
20.0	37.7	29.8	12.0	0.0	20.5	100.0
30.0	35.2	27.9	17.7	0.0	19.2	100.0
40.0	32.9	26.1	23.1	0.0	17.9	100.0
50.0	30.8	24.4	28.0	0.0	16.8	100.0
60.0	29.1	23.0	32.0	0.0	15.9	100.0
70.0	27.8	22.0	35.0	0.0	15.2	100.0
80.0	27.0	21.4	36.8	0.0	14.7	100.0
90.0	26.8	21.2	37.5	0.0	14.6	100.0
100.0	27.0	21.4	36.9	0.0	14.7	100.0
110.0	27.8	22.0	35.1	0.0	15.2	100.0
120.0	29.0	23.0	32.2	0.0	15.8	100.0
130.0	30.7	24.3	28.2	0.0	16.8	100.0
140.0	32.7	25.9	23.6	0.0	17.9	100.0
150.0	34.9	27.7	18.4	0.0	19.1	100.0
160.0	37.2	29.5	12.9	0.0	20.4	100.0
170.0	39.6	31.5	7.2	0.0	21.7	100.0
180.0	42.2	33.5	1.1	0.0	23.2	100.0
190.0	45.1	35.8	-5.7	0.0	24.8	100.0
200.0	48.6	38.7	-14.0	0.0	26.7	100.0
210.0	53.2	42.4	-24.3	0.0	29.3	100.0
220.0	59.2	47.1	-39.2	0.0	32.7	100.0
230.0	67.0	53.5	-57.6	0.0	37.1	100.0
240.0	76.5	61.1	-79.9	0.0	42.4	100.0
250.0	86.7	69.3	-104.1	0.0	48.1	100.0
260.0	95.5	76.4	-124.9	0.0	53.1	100.0
270.0	100.1	80.0	-135.6	0.0	55.5	100.0
280.0	98.2	78.4	-131.0	0.0	54.4	100.0
290.0	90.6	72.2	-112.8	0.0	50.0	100.0
300.0	80.3	63.8	-88.2	0.0	44.1	100.0
310.0	70.1	55.7	-64.2	0.0	38.4	100.0
320.0	61.6	48.8	-44.1	0.0	33.7	100.0
330.0	54.9	43.6	-28.5	0.0	30.0	100.0
340.0	49.9	39.6	-16.7	0.0	27.2	100.0
350.0	46.1	36.5	-7.7	0.0	25.1	100.0
360.0	43.0	34.0	-0.4	0.0	23.4	100.0

6.31.3 Environment forces

Case 31 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	3.0	3.3	-3.6	0.0	2.9	5.5
10.0	3.0	3.3	-3.6	0.0	2.9	5.5
20.0	3.0	3.3	-3.5	0.0	2.9	5.6
30.0	3.0	3.3	-3.2	0.0	2.9	5.9
40.0	3.0	3.3	-2.8	0.0	2.9	6.3
50.0	3.0	3.3	-2.3	0.0	2.9	6.8
60.0	3.0	3.3	-1.6	0.0	2.9	7.5
70.0	3.0	3.3	-0.9	0.0	2.9	8.2
80.0	3.0	3.3	-0.1	0.0	2.9	9.0
90.0	3.0	3.3	0.7	0.0	2.9	9.8
100.0	3.0	3.3	1.5	0.0	2.9	10.6
110.0	3.0	3.3	2.3	0.0	2.9	11.4
120.0	3.0	3.3	3.0	0.0	2.9	12.1
130.0	3.0	3.3	3.5	0.0	2.9	12.6
140.0	3.0	3.3	4.0	0.0	2.9	13.1
150.0	3.0	3.3	4.3	0.0	2.9	13.4
160.0	3.0	3.3	4.4	0.0	2.9	13.5
170.0	3.0	3.3	4.4	0.0	2.9	13.5
180.0	3.0	3.3	4.3	0.0	2.9	13.4
190.0	3.0	3.3	4.4	0.0	2.9	13.5
200.0	3.0	3.3	4.4	0.0	2.9	13.5
210.0	3.0	3.3	4.3	0.0	2.9	13.4
220.0	3.0	3.3	4.0	0.0	2.9	13.1
230.0	3.0	3.3	3.5	0.0	2.9	12.6
240.0	3.0	3.3	3.0	0.0	2.9	12.1
250.0	3.0	3.3	2.3	0.0	2.9	11.4
260.0	3.0	3.3	1.5	0.0	2.9	10.6
270.0	3.0	3.3	0.7	0.0	2.9	9.8
280.0	3.0	3.3	-0.1	0.0	2.9	9.0
290.0	3.0	3.3	-0.9	0.0	2.9	8.2
300.0	3.0	3.3	-1.6	0.0	2.9	7.5
310.0	3.0	3.3	-2.3	0.0	2.9	6.8
320.0	3.0	3.3	-2.8	0.0	2.9	6.3
330.0	3.0	3.3	-3.2	0.0	2.9	5.9
340.0	3.0	3.3	-3.5	0.0	2.9	5.6
350.0	3.0	3.3	-3.6	0.0	2.9	5.5
360.0	3.0	3.3	-3.6	0.0	2.9	5.5

Case 31 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.5	-24.1	0.0	0.0	-16.5	-71.1
10.0	-30.5	-24.1	-4.8	0.0	-16.5	-75.9
20.0	-30.5	-24.1	-10.0	0.0	-16.5	-81.1
30.0	-30.5	-24.1	-15.6	0.0	-16.5	-86.7
40.0	-30.5	-24.1	-21.7	0.0	-16.5	-92.8
50.0	-30.5	-24.1	-28.0	0.0	-16.5	-99.1
60.0	-30.5	-24.1	-33.8	0.0	-16.5	-104.9
70.0	-30.5	-24.1	-38.7	0.0	-16.5	-109.8
80.0	-30.5	-24.1	-41.9	0.0	-16.5	-112.9
90.0	-30.5	-24.1	-43.0	0.0	-16.5	-114.1
100.0	-30.5	-24.1	-41.9	0.0	-16.5	-112.9
110.0	-30.5	-24.1	-38.7	0.0	-16.5	-109.8
120.0	-30.5	-24.1	-33.8	0.0	-16.5	-104.9
130.0	-30.5	-24.1	-28.0	0.0	-16.5	-99.1
140.0	-30.5	-24.1	-21.7	0.0	-16.5	-92.8
150.0	-30.5	-24.1	-15.6	0.0	-16.5	-86.7
160.0	-30.5	-24.1	-10.0	0.0	-16.5	-81.1
170.0	-30.5	-24.1	-4.8	0.0	-16.5	-75.9
180.0	-30.5	-24.1	0.0	0.0	-16.5	-71.1
190.0	-30.5	-24.1	4.8	0.0	-16.5	-66.2
200.0	-30.5	-24.1	10.0	0.0	-16.5	-61.1
210.0	-30.5	-24.1	15.6	0.0	-16.5	-55.4
220.0	-30.5	-24.1	21.7	0.0	-16.5	-49.3
230.0	-30.5	-24.1	28.0	0.0	-16.5	-43.1
240.0	-30.5	-24.1	33.8	0.0	-16.5	-37.2
250.0	-30.5	-24.1	38.7	0.0	-16.5	-32.4
260.0	-30.5	-24.1	41.9	0.0	-16.5	-29.2
270.0	-30.5	-24.1	43.0	0.0	-16.5	-28.1
280.0	-30.5	-24.1	41.9	0.0	-16.5	-29.2
290.0	-30.5	-24.1	38.7	0.0	-16.5	-32.4
300.0	-30.5	-24.1	33.8	0.0	-16.5	-37.2
310.0	-30.5	-24.1	28.0	0.0	-16.5	-43.1
320.0	-30.5	-24.1	21.7	0.0	-16.5	-49.3
330.0	-30.5	-24.1	15.6	0.0	-16.5	-55.4
340.0	-30.5	-24.1	10.0	0.0	-16.5	-61.1
350.0	-30.5	-24.1	4.8	0.0	-16.5	-66.2
360.0	-30.5	-24.1	0.0	0.0	-16.5	-71.1

Case 31 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-1.5	119.1	0.0	0.0	66.3	184.0
10.0	-1.5	119.1	-316.6	0.0	-66.3	-265.3
20.0	-1.5	119.1	-593.0	0.0	-66.3	-541.7
30.0	-1.5	119.1	-793.7	0.0	-66.3	-742.4
40.0	-1.5	119.1	-892.8	0.0	-66.3	-841.5
50.0	-1.5	119.1	-876.4	0.0	-66.3	-825.1
60.0	-1.5	119.1	-745.2	0.0	-66.3	-693.9
70.0	-1.5	119.1	-513.8	0.0	-66.3	-462.5
80.0	-1.5	119.1	-209.2	0.0	-66.3	-157.9
90.0	-1.5	119.1	132.4	0.0	66.3	316.4
100.0	-1.5	119.1	470.0	0.0	66.3	654.0
110.0	-1.5	119.1	762.6	0.0	66.3	946.6
120.0	-1.5	119.1	974.5	0.0	66.3	1158.5
130.0	-1.5	119.1	1079.2	0.0	66.3	1265.2
140.0	-1.5	119.1	1063.0	0.0	66.3	1247.0
150.0	-1.5	119.1	926.1	0.0	66.3	1110.1
160.0	-1.5	119.1	683.5	0.0	66.3	867.5
170.0	-1.5	119.1	362.6	0.0	66.3	546.6
180.0	-1.5	119.1	0.0	0.0	66.3	184.0
190.0	-1.5	119.1	-362.6	0.0	-66.3	-311.3
200.0	-1.5	119.1	-683.5	0.0	-66.3	-632.2
210.0	-1.5	119.1	-926.1	0.0	-66.3	-874.8
220.0	-1.5	119.1	-1063.0	0.0	-66.3	-1011.6
230.0	-1.5	119.1	-1079.2	0.0	-66.3	-1027.9
240.0	-1.5	119.1	-974.5	0.0	-66.3	-923.2
250.0	-1.5	119.1	-762.6	0.0	-66.3	-711.3
260.0	-1.5	119.1	-470.0	0.0	-66.3	-418.7
270.0	-1.5	119.1	-132.4	0.0	-66.3	-81.1
280.0	-1.5	119.1	209.2	0.0	66.3	393.2
290.0	-1.5	119.1	513.8	0.0	66.3	697.8
300.0	-1.5	119.1	745.2	0.0	66.3	929.2
310.0	-1.5	119.1	876.4	0.0	66.3	1060.4
320.0	-1.5	119.1	892.8	0.0	66.3	1076.8
330.0	-1.5	119.1	793.7	0.0	66.3	977.7
340.0	-1.5	119.1	593.0	0.0	66.3	777.0
350.0	-1.5	119.1	316.6	0.0	66.3	500.6
360.0	-1.5	119.1	0.0	0.0	66.3	184.0

6.31.4 Thruster use

Case 31 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	91.5	26.3	87.3	180.0	25.7	90.0	66.4	94.5
10.0	88.6	20.3	87.2	180.0	25.4	90.0	56.4	94.2
20.0	87.2	16.6	87.1	180.0	25.5	90.0	50.6	94.0
30.0	86.3	14.0	87.0	180.0	25.7	90.0	46.6	94.0
40.0	85.8	12.7	86.8	180.0	26.1	90.0	45.1	94.0
50.0	85.6	13.2	86.6	180.0	26.7	90.0	46.4	94.0
60.0	85.8	15.4	86.4	180.0	27.5	90.0	50.4	94.2
70.0	86.5	18.5	86.2	180.0	27.1	90.0	54.7	94.3
80.0	87.9	22.5	86.1	180.0	26.8	90.0	60.6	94.6
90.0	91.0	28.5	86.1	180.0	26.5	90.0	70.3	95.0
100.0	92.2	33.1	84.6	180.0	26.6	90.0	77.2	95.5
110.0	93.2	37.0	83.2	180.0	26.7	90.0	83.3	96.0
120.0	82.4	31.6	81.9	168.2	26.9	90.0	87.5	96.6
130.0	86.4	37.1	80.8	173.0	27.0	90.0	89.7	97.3
140.0	83.7	37.1	79.9	172.2	27.1	90.0	89.3	98.0
150.0	88.1	41.6	79.2	180.0	27.3	90.0	86.8	98.9
160.0	84.2	39.3	78.7	180.0	27.6	90.0	82.1	99.5
170.0	79.9	35.8	78.4	180.0	28.1	90.0	76.1	100.3
180.0	76.2	31.1	78.3	180.0	28.6	90.0	69.2	100.8
190.0	72.4	23.5	78.4	180.0	28.6	90.0	58.7	101.8
200.0	70.8	18.2	78.7	180.0	28.6	90.0	52.1	102.7
210.0	70.1	14.2	79.2	180.0	28.3	90.0	47.3	103.8
220.0	69.7	12.0	79.9	180.0	29.0	90.0	45.1	105.1
230.0	66.0	6.7	78.4	175.5	29.3	90.0	44.9	106.4
240.0	29.5	8.2	47.1	175.2	29.6	90.0	39.1	108.0
250.0	2.3	81.3	17.9	170.3	28.1	90.0	34.3	109.4
260.0	3.6	97.5	10.7	162.6	22.5	90.0	31.1	110.0
270.0	5.6	102.0	10.1	149.7	17.6	90.0	29.8	109.3
280.0	9.0	104.3	10.7	129.6	12.3	90.0	30.6	107.2
290.0	11.7	100.7	12.2	119.8	10.3	90.0	33.4	104.2
300.0	15.0	92.0	14.0	119.8	10.1	90.0	38.0	101.4
310.0	17.6	86.7	15.8	119.8	11.7	90.0	43.6	99.0
320.0	19.2	83.1	17.4	119.8	15.2	90.0	49.7	97.3
330.0	19.6	80.4	18.5	119.8	20.1	90.0	55.8	96.1
340.0	18.8	78.1	19.2	119.8	26.0	90.0	61.4	95.3
350.0	55.9	21.0	61.1	160.6	25.9	90.0	66.5	94.8
360.0	91.5	26.3	87.3	180.0	25.7	90.0	66.4	94.5

6.31.5 Thruster loss

Case 31 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.78	0.81
10.0	0.84	0.78	0.80
20.0	0.85	0.78	0.80
30.0	0.85	0.78	0.81
40.0	0.86	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.88	0.77	0.84
90.0	0.88	0.77	0.83
100.0	0.89	0.75	0.84
110.0	0.90	0.74	0.84
120.0	0.92	0.78	0.85
130.0	0.92	0.75	0.85
140.0	0.93	0.75	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.93	0.70	0.88
180.0	0.93	0.70	0.90
190.0	0.94	0.70	0.90
200.0	0.94	0.70	0.91
210.0	0.94	0.71	0.90
220.0	0.94	0.71	0.91
230.0	0.94	0.75	0.92
240.0	0.94	0.76	0.93
250.0	0.94	0.81	0.93
260.0	0.94	0.85	0.93
270.0	0.94	0.87	0.93
280.0	0.94	0.89	0.94
290.0	0.94	0.89	0.94
300.0	0.93	0.89	0.95
310.0	0.93	0.89	0.91
320.0	0.93	0.89	0.88
330.0	0.93	0.89	0.85
340.0	0.92	0.89	0.83
350.0	0.85	0.86	0.81
360.0	0.85	0.78	0.81

Preliminary Design, @IDR5

6.32 Case 32 - Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 5

6.32.1 Environment and thrust utilisation

Case 32 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	120.0	120.0	0.0	35.0	4.0	6.7	9.4	2.00	86.6
10.0	120.0	120.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	120.0	120.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	120.0	120.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	120.0	120.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	120.0	120.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	120.0	120.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	120.0	120.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	120.0	120.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	120.0	120.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	120.0	120.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	120.0	120.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	120.0	120.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	120.0	120.0	130.0	35.0	4.0	6.7	9.4	2.00	93.6
140.0	120.0	120.0	140.0	35.0	4.0	6.7	9.4	2.00	83.8
150.0	120.0	120.0	150.0	35.0	4.0	6.7	9.4	2.00	78.2
160.0	120.0	120.0	160.0	35.0	4.0	6.7	9.4	2.00	78.8
170.0	120.0	120.0	170.0	35.0	4.0	6.7	9.4	2.00	80.8
180.0	120.0	120.0	180.0	35.0	4.0	6.7	9.4	2.00	84.4
190.0	120.0	120.0	190.0	35.0	4.0	6.7	9.4	2.00	95.5
200.0	120.0	120.0	200.0	35.0	4.0	6.7	9.4	2.00	98.1
210.0	120.0	120.0	210.0	35.0	4.0	6.7	9.4	2.00	97.1
220.0	120.0	120.0	220.0	35.0	4.0	6.7	9.4	2.00	91.7
230.0	120.0	120.0	230.0	35.0	4.0	6.7	9.4	2.00	82.1
240.0	120.0	120.0	240.0	35.0	4.0	6.7	9.4	2.00	69.3
250.0	120.0	120.0	250.0	35.0	4.0	6.7	9.4	2.00	55.2
260.0	120.0	120.0	260.0	35.0	4.0	6.7	9.4	2.00	41.1
270.0	120.0	120.0	270.0	35.0	4.0	6.7	9.4	2.00	22.5
280.0	120.0	120.0	280.0	35.0	4.0	6.7	9.4	2.00	13.1
290.0	120.0	120.0	290.0	35.0	4.0	6.7	9.4	2.00	12.5
300.0	120.0	120.0	300.0	35.0	4.0	6.7	9.4	2.00	14.3
310.0	120.0	120.0	310.0	35.0	4.0	6.7	9.4	2.00	16.7
320.0	120.0	120.0	320.0	35.0	4.0	6.7	9.4	2.00	21.7
330.0	120.0	120.0	330.0	35.0	4.0	6.7	9.4	2.00	33.4
340.0	120.0	120.0	340.0	35.0	4.0	6.7	9.4	2.00	49.4
350.0	120.0	120.0	350.0	35.0	4.0	6.7	9.4	2.00	67.1
360.0	120.0	120.0	360.0	35.0	4.0	6.7	9.4	2.00	86.6

6.32.2 Relative contributions of force components

Case 32 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	49.1	30.3	-1.0	0.0	21.6	100.0
10.0	45.6	28.1	6.2	0.0	20.1	100.0
20.0	42.4	26.1	12.8	0.0	18.7	100.0
30.0	39.4	24.2	19.1	0.0	17.3	100.0
40.0	36.6	22.5	24.9	0.0	16.0	100.0
50.0	34.1	20.9	30.1	0.0	14.9	100.0
60.0	32.0	19.6	34.4	0.0	14.0	100.0
70.0	30.5	18.7	37.5	0.0	13.3	100.0
80.0	29.5	18.1	39.4	0.0	12.9	100.0
90.0	29.2	17.9	40.1	0.0	12.8	100.0
100.0	29.4	18.1	39.5	0.0	12.9	100.0
110.0	30.3	18.7	37.6	0.0	13.4	100.0
120.0	31.7	19.6	34.6	0.0	14.0	100.0
130.0	33.7	20.9	30.6	0.0	14.9	100.0
140.0	36.0	22.3	25.7	0.0	16.0	100.0
150.0	38.6	24.0	20.2	0.0	17.3	100.0
160.0	41.3	25.8	14.4	0.0	18.5	100.0
170.0	44.2	27.6	8.4	0.0	19.8	100.0
180.0	47.2	29.6	1.9	0.0	21.3	100.0
190.0	50.6	31.8	-5.3	0.0	22.9	100.0
200.0	54.7	34.5	-14.1	0.0	24.9	100.0
210.0	60.1	38.1	-25.5	0.0	27.5	100.0
220.0	67.0	42.1	-40.6	0.0	30.9	100.0
230.0	75.7	48.6	-59.6	0.0	35.3	100.0
240.0	85.7	55.5	-81.6	0.0	40.5	100.0
250.0	95.7	62.6	-104.1	0.0	45.8	100.0
260.0	104.1	68.5	-123.0	0.0	50.3	100.0
270.0	109.8	72.3	-135.2	0.0	53.1	100.0
280.0	111.1	72.6	-136.8	0.0	53.2	100.0
290.0	106.1	68.4	-124.3	0.0	49.8	100.0
300.0	95.7	60.9	-100.7	0.0	44.1	100.0
310.0	83.6	52.7	-74.4	0.0	38.0	100.0
320.0	72.9	45.6	-51.3	0.0	32.8	100.0
330.0	64.4	40.1	-33.2	0.0	28.7	100.0
340.0	58.0	35.9	-19.6	0.0	25.7	100.0
350.0	53.0	32.8	-9.3	0.0	23.5	100.0
360.0	49.1	30.3	-1.0	0.0	21.6	100.0

6.32.3 Environment forces

Case 32 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	4.8	5.3	-3.6	0.0	4.5	11.0
10.0	4.8	5.3	-3.6	0.0	4.5	11.0
20.0	4.8	5.3	-3.5	0.0	4.5	11.1
30.0	4.8	5.3	-3.2	0.0	4.5	11.4
40.0	4.8	5.3	-2.8	0.0	4.5	11.8
50.0	4.8	5.3	-2.3	0.0	4.5	12.3
60.0	4.8	5.3	-1.6	0.0	4.5	12.9
70.0	4.8	5.3	-0.9	0.0	4.5	13.7
80.0	4.8	5.3	-0.1	0.0	4.5	14.5
90.0	4.8	5.3	0.7	0.0	4.5	15.3
100.0	4.8	5.3	1.5	0.0	4.5	16.1
110.0	4.8	5.3	2.3	0.0	4.5	16.8
120.0	4.8	5.3	3.0	0.0	4.5	17.5
130.0	4.8	5.3	3.5	0.0	4.5	18.1
140.0	4.8	5.3	4.0	0.0	4.5	18.5
150.0	4.8	5.3	4.3	0.0	4.5	18.8
160.0	4.8	5.3	4.4	0.0	4.5	19.0
170.0	4.8	5.3	4.4	0.0	4.5	19.0
180.0	4.8	5.3	4.3	0.0	4.5	18.9
190.0	4.8	5.3	4.4	0.0	4.5	19.0
200.0	4.8	5.3	4.4	0.0	4.5	19.0
210.0	4.8	5.3	4.3	0.0	4.5	18.8
220.0	4.8	5.3	4.0	0.0	4.5	18.5
230.0	4.8	5.3	3.5	0.0	4.5	18.1
240.0	4.8	5.3	3.0	0.0	4.5	17.5
250.0	4.8	5.3	2.3	0.0	4.5	16.8
260.0	4.8	5.3	1.5	0.0	4.5	16.1
270.0	4.8	5.3	0.7	0.0	4.5	15.3
280.0	4.8	5.3	-0.1	0.0	4.5	14.5
290.0	4.8	5.3	-0.9	0.0	4.5	13.7
300.0	4.8	5.3	-1.6	0.0	4.5	12.9
310.0	4.8	5.3	-2.3	0.0	4.5	12.3
320.0	4.8	5.3	-2.8	0.0	4.5	11.8
330.0	4.8	5.3	-3.2	0.0	4.5	11.4
340.0	4.8	5.3	-3.5	0.0	4.5	11.1
350.0	4.8	5.3	-3.6	0.0	4.5	11.0
360.0	4.8	5.3	-3.6	0.0	4.5	11.0

Case 32 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.7	-18.5	0.0	0.0	-13.1	-62.3
10.0	-30.7	-18.5	-4.8	0.0	-13.1	-67.1
20.0	-30.7	-18.5	-10.0	0.0	-13.1	-72.3
30.0	-30.7	-18.5	-15.6	0.0	-13.1	-77.9
40.0	-30.7	-18.5	-21.7	0.0	-13.1	-84.0
50.0	-30.7	-18.5	-28.0	0.0	-13.1	-90.3
60.0	-30.7	-18.5	-33.8	0.0	-13.1	-96.1
70.0	-30.7	-18.5	-38.7	0.0	-13.1	-101.0
80.0	-30.7	-18.5	-41.9	0.0	-13.1	-104.2
90.0	-30.7	-18.5	-43.0	0.0	-13.1	-105.3
100.0	-30.7	-18.5	-41.9	0.0	-13.1	-104.2
110.0	-30.7	-18.5	-38.7	0.0	-13.1	-101.0
120.0	-30.7	-18.5	-33.8	0.0	-13.1	-96.1
130.0	-30.7	-18.5	-28.0	0.0	-13.1	-90.3
140.0	-30.7	-18.5	-21.7	0.0	-13.1	-84.0
150.0	-30.7	-18.5	-15.6	0.0	-13.1	-77.9
160.0	-30.7	-18.5	-10.0	0.0	-13.1	-72.3
170.0	-30.7	-18.5	-4.8	0.0	-13.1	-67.1
180.0	-30.7	-18.5	0.0	0.0	-13.1	-62.3
190.0	-30.7	-18.5	4.8	0.0	-13.1	-57.5
200.0	-30.7	-18.5	10.0	0.0	-13.1	-52.3
210.0	-30.7	-18.5	15.6	0.0	-13.1	-46.7
220.0	-30.7	-18.5	21.7	0.0	-13.1	-40.6
230.0	-30.7	-18.5	28.0	0.0	-13.1	-34.3
240.0	-30.7	-18.5	33.8	0.0	-13.1	-28.4
250.0	-30.7	-18.5	38.7	0.0	-13.1	-23.6
260.0	-30.7	-18.5	41.9	0.0	-13.1	-20.4
270.0	-30.7	-18.5	43.0	0.0	-13.1	-19.3
280.0	-30.7	-18.5	41.9	0.0	-13.1	-20.4
290.0	-30.7	-18.5	38.7	0.0	-13.1	-23.6
300.0	-30.7	-18.5	33.8	0.0	-13.1	-28.4
310.0	-30.7	-18.5	28.0	0.0	-13.1	-34.3
320.0	-30.7	-18.5	21.7	0.0	-13.1	-40.6
330.0	-30.7	-18.5	15.6	0.0	-13.1	-46.7
340.0	-30.7	-18.5	10.0	0.0	-13.1	-52.3
350.0	-30.7	-18.5	4.8	0.0	-13.1	-57.5
360.0	-30.7	-18.5	0.0	0.0	-13.1	-62.3

Case 32 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	105.7	168.9	0.0	0.0	99.8	374.4
10.0	105.7	168.9	-316.6	0.0	-99.8	-141.9
20.0	105.7	168.9	-593.0	0.0	-99.8	-418.2
30.0	105.7	168.9	-793.7	0.0	-99.8	-618.9
40.0	105.7	168.9	-892.8	0.0	-99.8	-718.0
50.0	105.7	168.9	-876.4	0.0	-99.8	-701.7
60.0	105.7	168.9	-745.2	0.0	-99.8	-570.5
70.0	105.7	168.9	-513.8	0.0	-99.8	-339.1
80.0	105.7	168.9	-209.2	0.0	99.8	165.2
90.0	105.7	168.9	132.4	0.0	99.8	506.8
100.0	105.7	168.9	470.0	0.0	99.8	844.4
110.0	105.7	168.9	762.6	0.0	99.8	1137.1
120.0	105.7	168.9	974.5	0.0	99.8	1349.0
130.0	105.7	168.9	1079.2	0.0	99.8	1457.7
140.0	105.7	168.9	1063.0	0.0	99.8	1437.4
150.0	105.7	168.9	926.1	0.0	99.8	1300.3
160.0	105.7	168.9	683.5	0.0	99.8	1058.0
170.0	105.7	168.9	362.6	0.0	99.8	737.0
180.0	105.7	168.9	0.0	0.0	99.8	374.4
190.0	105.7	168.9	-362.6	0.0	-99.8	-187.8
200.0	105.7	168.9	-683.5	0.0	-99.8	-508.8
210.0	105.7	168.9	-926.1	0.0	-99.8	-751.3
220.0	105.7	168.9	-1063.0	0.0	-99.8	-888.2
230.0	105.7	168.9	-1079.2	0.0	-99.8	-904.5
240.0	105.7	168.9	-974.5	0.0	-99.8	-799.8
250.0	105.7	168.9	-762.6	0.0	-99.8	-587.9
260.0	105.7	168.9	-470.0	0.0	-99.8	-295.2
270.0	105.7	168.9	-132.4	0.0	99.8	242.0
280.0	105.7	168.9	209.2	0.0	99.8	583.7
290.0	105.7	168.9	513.8	0.0	99.8	888.3
300.0	105.7	168.9	745.2	0.0	99.8	1119.7
310.0	105.7	168.9	876.4	0.0	99.8	1250.9
320.0	105.7	168.9	892.8	0.0	99.8	1267.2
330.0	105.7	168.9	793.7	0.0	99.8	1168.1
340.0	105.7	168.9	593.0	0.0	99.8	967.4
350.0	105.7	168.9	316.6	0.0	99.8	691.0
360.0	105.7	168.9	0.0	0.0	99.8	374.4

6.32.4 Thruster use

Case 32 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	48.9	21.9	59.3	161.9	25.7	90.0	63.2	100.0
10.0	83.9	23.0	86.9	180.0	25.4	90.0	58.9	99.4
20.0	83.2	18.9	86.8	180.0	25.5	90.0	53.1	98.9
30.0	82.8	16.1	86.7	180.0	25.7	90.0	49.2	98.4
40.0	82.5	14.8	86.5	180.0	26.1	90.0	47.6	98.1
50.0	82.5	15.3	86.3	180.0	26.7	90.0	48.9	97.9
60.0	82.8	17.6	86.1	180.0	27.5	90.0	52.9	97.8
70.0	83.6	20.7	86.0	180.0	27.1	90.0	57.2	97.8
80.0	86.2	27.6	85.9	180.0	26.8	90.0	67.4	98.0
90.0	93.1	31.1	85.8	180.0	26.5	90.0	74.9	94.6
100.0	89.6	36.8	84.3	180.0	26.6	90.0	81.2	98.9
110.0	82.8	31.1	87.1	168.5	26.7	90.0	88.0	99.5
120.0	80.3	34.0	85.3	167.1	26.9	90.0	92.4	100.3
130.0	63.6	32.5	77.4	157.9	27.0	90.0	92.1	101.3
140.0	41.3	48.1	53.0	150.3	27.1	90.0	86.0	102.4
150.0	29.8	65.3	39.1	143.1	27.3	90.0	80.2	103.6
160.0	25.3	71.4	34.1	142.6	27.6	90.0	74.7	104.7
170.0	24.2	60.1	35.9	149.9	28.1	90.0	69.8	105.8
180.0	27.9	41.0	42.8	158.9	28.6	90.0	65.2	106.8
190.0	54.0	17.3	71.7	169.7	28.6	90.0	60.5	108.3
200.0	60.2	12.7	78.4	172.4	28.6	90.0	55.6	109.9
210.0	56.8	10.2	75.1	174.0	28.3	90.0	50.3	112.0
220.0	41.5	9.0	59.8	175.1	29.0	90.0	44.6	114.5
230.0	14.6	11.2	32.4	175.1	29.3	90.0	38.8	117.8
240.0	3.6	167.2	14.0	177.1	26.9	90.0	33.4	121.6
250.0	4.4	164.5	12.6	175.2	21.4	90.0	29.0	125.5
260.0	5.4	157.6	11.4	168.8	15.8	90.0	26.0	128.2
270.0	3.4	157.8	10.5	149.6	8.4	90.0	24.6	128.3
280.0	10.5	130.3	10.8	135.0	4.8	90.0	25.0	125.3
290.0	12.8	123.5	12.1	123.1	2.8	90.0	27.3	120.1
300.0	15.0	113.7	13.9	119.8	2.7	90.0	31.2	114.4
310.0	17.0	105.4	15.6	119.8	4.3	90.0	36.4	109.7
320.0	18.2	100.3	17.1	119.8	7.8	90.0	42.2	106.2
330.0	18.3	97.2	18.2	119.8	12.7	90.0	48.0	103.7
340.0	17.3	95.6	18.9	119.8	18.6	90.0	53.5	102.0
350.0	16.6	89.1	19.4	125.4	25.1	90.0	58.5	100.8
360.0	48.9	21.9	59.3	161.9	25.7	90.0	63.2	100.0

6.32.5 Thruster loss

Case 32 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.86	0.81
10.0	0.84	0.77	0.80
20.0	0.84	0.77	0.80
30.0	0.85	0.77	0.81
40.0	0.85	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.86	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.87	0.77	0.84
90.0	0.88	0.76	0.83
100.0	0.88	0.75	0.84
110.0	0.91	0.78	0.84
120.0	0.92	0.78	0.85
130.0	0.93	0.79	0.85
140.0	0.92	0.79	0.85
150.0	0.92	0.79	0.86
160.0	0.92	0.80	0.87
170.0	0.93	0.79	0.88
180.0	0.93	0.78	0.90
190.0	0.94	0.75	0.90
200.0	0.94	0.74	0.90
210.0	0.94	0.74	0.90
220.0	0.94	0.74	0.91
230.0	0.94	0.74	0.92
240.0	0.83	0.75	0.93
250.0	0.86	0.77	0.93
260.0	0.80	0.83	0.93
270.0	0.93	0.87	0.93
280.0	0.93	0.88	0.94
290.0	0.93	0.89	0.94
300.0	0.94	0.89	0.95
310.0	0.93	0.89	0.91
320.0	0.93	0.89	0.88
330.0	0.93	0.89	0.85
340.0	0.93	0.88	0.83
350.0	0.92	0.88	0.81
360.0	0.85	0.86	0.81

Preliminary Design, @IDR5

6.33 Case 33 - Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 5

6.33.1 Environment and thrust utilisation

Case 33 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	130.0	130.0	0.0	35.0	4.0	6.7	9.4	2.00	69.5
10.0	130.0	130.0	10.0	35.0	4.0	6.7	9.4	2.00	88.5
20.0	130.0	130.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	130.0	130.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	130.0	130.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	130.0	130.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	130.0	130.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	130.0	130.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	130.0	130.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	130.0	130.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	130.0	130.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	130.0	130.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	130.0	130.0	120.0	35.0	4.0	6.7	9.4	2.00	87.7
130.0	130.0	130.0	130.0	35.0	4.0	6.7	9.4	2.00	77.0
140.0	130.0	130.0	140.0	35.0	4.0	6.7	9.4	2.00	67.0
150.0	130.0	130.0	150.0	35.0	4.0	6.7	9.4	2.00	61.8
160.0	130.0	130.0	160.0	35.0	4.0	6.7	9.4	2.00	61.1
170.0	130.0	130.0	170.0	35.0	4.0	6.7	9.4	2.00	64.2
180.0	130.0	130.0	180.0	35.0	4.0	6.7	9.4	2.00	68.0
190.0	130.0	130.0	190.0	35.0	4.0	6.7	9.4	2.00	72.7
200.0	130.0	130.0	200.0	35.0	4.0	6.7	9.4	2.00	83.0
210.0	130.0	130.0	210.0	35.0	4.0	6.7	9.4	2.00	82.0
220.0	130.0	130.0	220.0	35.0	4.0	6.7	9.4	2.00	76.6
230.0	130.0	130.0	230.0	35.0	4.0	6.7	9.4	2.00	67.2
240.0	130.0	130.0	240.0	35.0	4.0	6.7	9.4	2.00	54.6
250.0	130.0	130.0	250.0	35.0	4.0	6.7	9.4	2.00	40.6
260.0	130.0	130.0	260.0	35.0	4.0	6.7	9.4	2.00	26.6
270.0	130.0	130.0	270.0	35.0	4.0	6.7	9.4	2.00	9.6
280.0	130.0	130.0	280.0	35.0	4.0	6.7	9.4	2.00	10.8
290.0	130.0	130.0	290.0	35.0	4.0	6.7	9.4	2.00	13.2
300.0	130.0	130.0	300.0	35.0	4.0	6.7	9.4	2.00	13.8
310.0	130.0	130.0	310.0	35.0	4.0	6.7	9.4	2.00	15.7
320.0	130.0	130.0	320.0	35.0	4.0	6.7	9.4	2.00	17.2
330.0	130.0	130.0	330.0	35.0	4.0	6.7	9.4	2.00	19.6
340.0	130.0	130.0	340.0	35.0	4.0	6.7	9.4	2.00	32.5
350.0	130.0	130.0	350.0	35.0	4.0	6.7	9.4	2.00	49.8
360.0	130.0	130.0	360.0	35.0	4.0	6.7	9.4	2.00	69.5

6.33.2 Relative contributions of force components

Case 33 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	53.5	27.7	-1.5	0.0	20.4	100.0
10.0	49.3	25.4	6.6	0.0	18.7	100.0
20.0	45.4	23.4	14.0	0.0	17.2	100.0
30.0	41.8	21.5	20.9	0.0	15.8	100.0
40.0	38.5	19.8	27.2	0.0	14.5	100.0
50.0	35.6	18.3	32.8	0.0	13.4	100.0
60.0	33.2	17.0	37.2	0.0	12.5	100.0
70.0	31.5	16.1	40.5	0.0	11.9	100.0
80.0	30.4	15.6	42.5	0.0	11.5	100.0
90.0	30.0	15.4	43.2	0.0	11.3	100.0
100.0	30.4	15.6	42.6	0.0	11.5	100.0
110.0	31.3	16.1	40.7	0.0	11.9	100.0
120.0	32.9	17.0	37.5	0.0	12.5	100.0
130.0	35.1	18.2	33.3	0.0	13.4	100.0
140.0	37.8	19.6	28.1	0.0	14.5	100.0
150.0	40.7	21.2	22.4	0.0	15.7	100.0
160.0	43.9	23.0	16.2	0.0	16.9	100.0
170.0	47.2	24.8	9.7	0.0	18.3	100.0
180.0	50.8	26.8	2.7	0.0	19.8	100.0
190.0	54.7	29.0	-5.1	0.0	21.4	100.0
200.0	59.5	31.7	-12.7	0.0	23.5	100.0
210.0	65.6	35.2	-20.0	0.0	26.2	100.0
220.0	73.3	39.1	-27.7	0.0	29.6	100.0
230.0	82.8	45.2	-35.3	0.0	33.8	100.0
240.0	93.9	50.9	-42.8	0.0	38.2	100.0
250.0	96.7	55.4	-49.4	0.0	41.8	100.0
260.0	99.6	58.2	-55.2	0.0	44.1	100.0
270.0	103.5	60.8	-60.8	0.0	46.2	100.0
280.0	110.6	64.0	-66.6	0.0	48.4	100.0
290.0	114.6	64.5	-71.5	0.0	48.5	100.0
300.0	109.1	59.8	-76.5	0.0	44.6	100.0
310.0	96.6	51.9	-81.6	0.0	38.6	100.0
320.0	83.6	44.3	-86.7	0.0	32.8	100.0
330.0	72.8	38.2	-91.2	0.0	28.2	100.0
340.0	64.6	33.7	-95.7	0.0	24.8	100.0
350.0	58.4	30.3	-100.3	0.0	22.3	100.0
360.0	53.5	27.7	-105.0	0.0	20.4	100.0

6.33.3 Environment forces

Case 33 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	6.5	5.4	-3.6	0.0	4.4	12.8
10.0	6.5	5.4	-3.6	0.0	4.4	12.8
20.0	6.5	5.4	-3.5	0.0	4.4	12.9
30.0	6.5	5.4	-3.2	0.0	4.4	13.2
40.0	6.5	5.4	-2.8	0.0	4.4	13.6
50.0	6.5	5.4	-2.3	0.0	4.4	14.1
60.0	6.5	5.4	-1.6	0.0	4.4	14.8
70.0	6.5	5.4	-0.9	0.0	4.4	15.5
80.0	6.5	5.4	-0.1	0.0	4.4	16.3
90.0	6.5	5.4	0.7	0.0	4.4	17.1
100.0	6.5	5.4	1.5	0.0	4.4	17.9
110.0	6.5	5.4	2.3	0.0	4.4	18.7
120.0	6.5	5.4	3.0	0.0	4.4	19.3
130.0	6.5	5.4	3.5	0.0	4.4	19.9
140.0	6.5	5.4	4.0	0.0	4.4	20.4
150.0	6.5	5.4	4.3	0.0	4.4	20.7
160.0	6.5	5.4	4.4	0.0	4.4	20.8
170.0	6.5	5.4	4.4	0.0	4.4	20.8
180.0	6.5	5.4	4.3	0.0	4.4	20.7
190.0	6.5	5.4	4.4	0.0	4.4	20.8
200.0	6.5	5.4	4.4	0.0	4.4	20.8
210.0	6.5	5.4	4.3	0.0	4.4	20.7
220.0	6.5	5.4	4.0	0.0	4.4	20.4
230.0	6.5	5.4	3.5	0.0	4.4	19.9
240.0	6.5	5.4	3.0	0.0	4.4	19.3
250.0	6.5	5.4	2.3	0.0	4.4	18.7
260.0	6.5	5.4	1.5	0.0	4.4	17.9
270.0	6.5	5.4	0.7	0.0	4.4	17.1
280.0	6.5	5.4	-0.1	0.0	4.4	16.3
290.0	6.5	5.4	-0.9	0.0	4.4	15.5
300.0	6.5	5.4	-1.6	0.0	4.4	14.8
310.0	6.5	5.4	-2.3	0.0	4.4	14.1
320.0	6.5	5.4	-2.8	0.0	4.4	13.6
330.0	6.5	5.4	-3.2	0.0	4.4	13.2
340.0	6.5	5.4	-3.5	0.0	4.4	12.9
350.0	6.5	5.4	-3.6	0.0	4.4	12.8
360.0	6.5	5.4	-3.6	0.0	4.4	12.8

Case 33 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-28.8	-14.4	0.0	0.0	-10.5	-53.8
10.0	-28.8	-14.4	-4.8	0.0	-10.5	-58.6
20.0	-28.8	-14.4	-10.0	0.0	-10.5	-63.8
30.0	-28.8	-14.4	-15.6	0.0	-10.5	-69.4
40.0	-28.8	-14.4	-21.7	0.0	-10.5	-75.5
50.0	-28.8	-14.4	-28.0	0.0	-10.5	-81.8
60.0	-28.8	-14.4	-33.8	0.0	-10.5	-87.6
70.0	-28.8	-14.4	-38.7	0.0	-10.5	-92.5
80.0	-28.8	-14.4	-41.9	0.0	-10.5	-95.7
90.0	-28.8	-14.4	-43.0	0.0	-10.5	-96.8
100.0	-28.8	-14.4	-41.9	0.0	-10.5	-95.7
110.0	-28.8	-14.4	-38.7	0.0	-10.5	-92.5
120.0	-28.8	-14.4	-33.8	0.0	-10.5	-87.6
130.0	-28.8	-14.4	-28.0	0.0	-10.5	-81.8
140.0	-28.8	-14.4	-21.7	0.0	-10.5	-75.5
150.0	-28.8	-14.4	-15.6	0.0	-10.5	-69.4
160.0	-28.8	-14.4	-10.0	0.0	-10.5	-63.8
170.0	-28.8	-14.4	-4.8	0.0	-10.5	-58.6
180.0	-28.8	-14.4	0.0	0.0	-10.5	-53.8
190.0	-28.8	-14.4	4.8	0.0	-10.5	-49.0
200.0	-28.8	-14.4	10.0	0.0	-10.5	-43.8
210.0	-28.8	-14.4	15.6	0.0	-10.5	-38.2
220.0	-28.8	-14.4	21.7	0.0	-10.5	-32.1
230.0	-28.8	-14.4	28.0	0.0	-10.5	-25.8
240.0	-28.8	-14.4	33.8	0.0	-10.5	-20.0
250.0	-28.8	-14.4	38.7	0.0	-10.5	-15.1
260.0	-28.8	-14.4	41.9	0.0	-10.5	-11.9
270.0	-28.8	-14.4	43.0	0.0	-10.5	-10.8
280.0	-28.8	-14.4	41.9	0.0	-10.5	-11.9
290.0	-28.8	-14.4	38.7	0.0	-10.5	-15.1
300.0	-28.8	-14.4	33.8	0.0	-10.5	-20.0
310.0	-28.8	-14.4	28.0	0.0	-10.5	-25.8
320.0	-28.8	-14.4	21.7	0.0	-10.5	-32.1
330.0	-28.8	-14.4	15.6	0.0	-10.5	-38.2
340.0	-28.8	-14.4	10.0	0.0	-10.5	-43.8
350.0	-28.8	-14.4	4.8	0.0	-10.5	-49.0
360.0	-28.8	-14.4	0.0	0.0	-10.5	-53.8

Case 33 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	200.3	178.7	0.0	0.0	116.8	495.8
10.0	200.3	178.7	-316.6	0.0	116.8	179.2
20.0	200.3	178.7	-593.0	0.0	-116.8	-330.8
30.0	200.3	178.7	-793.7	0.0	-116.8	-531.5
40.0	200.3	178.7	-892.8	0.0	-116.8	-630.6
50.0	200.3	178.7	-876.4	0.0	-116.8	-614.2
60.0	200.3	178.7	-745.2	0.0	-116.8	-483.0
70.0	200.3	178.7	-513.8	0.0	-116.8	-251.7
80.0	200.3	178.7	-209.2	0.0	116.8	286.6
90.0	200.3	178.7	132.4	0.0	116.8	628.2
100.0	200.3	178.7	470.0	0.0	116.8	965.8
110.0	200.3	178.7	762.6	0.0	116.8	1258.5
120.0	200.3	178.7	974.5	0.0	116.8	1470.4
130.0	200.3	178.7	1079.2	0.0	116.8	1575.1
140.0	200.3	178.7	1063.0	0.0	116.8	1553.8
150.0	200.3	178.7	926.1	0.0	116.8	1421.9
160.0	200.3	178.7	683.5	0.0	116.8	1179.4
170.0	200.3	178.7	362.6	0.0	116.8	858.4
180.0	200.3	178.7	0.0	0.0	116.8	495.8
190.0	200.3	178.7	-362.6	0.0	116.8	133.2
200.0	200.3	178.7	-683.5	0.0	-116.8	-421.4
210.0	200.3	178.7	-926.1	0.0	-116.8	-663.9
220.0	200.3	178.7	-1063.0	0.0	-116.8	-800.8
230.0	200.3	178.7	-1079.2	0.0	-116.8	-817.1
240.0	200.3	178.7	-974.5	0.0	-116.8	-712.3
250.0	200.3	178.7	-762.6	0.0	-116.8	-500.5
260.0	200.3	178.7	-470.0	0.0	-116.8	-207.8
270.0	200.3	178.7	-132.4	0.0	116.8	363.4
280.0	200.3	178.7	209.2	0.0	116.8	705.1
290.0	200.3	178.7	513.8	0.0	116.8	1009.7
300.0	200.3	178.7	745.2	0.0	116.8	1241.1
310.0	200.3	178.7	876.4	0.0	116.8	1372.3
320.0	200.3	178.7	892.8	0.0	116.8	1388.6
330.0	200.3	178.7	793.7	0.0	116.8	1289.5
340.0	200.3	178.7	593.0	0.0	116.8	1088.8
350.0	200.3	178.7	316.6	0.0	116.8	812.4
360.0	200.3	178.7	0.0	0.0	116.8	495.8

6.33.4 Thruster use

Case 33 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	14.6	91.6	18.6	131.7	25.4	90.0	55.3	103.4
10.0	51.4	18.8	63.7	164.9	25.4	90.0	60.0	102.3
20.0	80.9	20.6	86.8	180.0	25.5	90.0	55.1	101.6
30.0	80.8	17.7	86.6	180.0	25.7	90.0	51.1	100.9
40.0	80.8	16.3	86.5	180.0	26.1	90.0	49.6	100.4
50.0	80.9	16.8	86.3	180.0	26.7	90.0	50.8	99.9
60.0	81.3	19.1	86.1	180.0	27.5	90.0	54.8	99.7
70.0	82.1	22.3	85.9	180.0	27.1	90.0	59.1	99.7
80.0	85.1	29.8	85.8	180.0	26.8	90.0	70.1	99.8
90.0	87.3	34.3	85.8	180.0	26.5	90.0	77.0	100.2
100.0	79.0	26.3	88.9	166.1	26.6	90.0	84.4	100.6
110.0	89.4	43.6	82.9	180.0	26.7	90.0	90.2	101.6
120.0	51.8	38.7	66.1	154.7	26.9	90.0	89.8	102.4
130.0	29.2	78.8	36.6	134.3	27.0	90.0	84.2	103.7
140.0	26.8	103.3	28.3	120.1	25.0	90.0	78.2	105.1
150.0	24.8	105.6	26.4	122.0	23.2	90.0	72.4	106.6
160.0	22.2	107.5	24.3	125.6	22.9	90.0	67.1	108.1
170.0	19.2	109.2	22.1	131.0	23.9	90.0	62.2	109.6
180.0	15.8	111.2	20.1	138.0	25.6	90.0	57.5	111.0
190.0	12.6	114.5	18.7	146.6	27.3	90.0	53.2	113.0
200.0	16.1	31.3	35.3	168.9	28.6	90.0	48.5	115.4
210.0	12.2	25.4	31.9	172.5	28.3	90.0	43.4	118.4
220.0	4.2	156.9	16.5	175.0	29.0	90.0	38.0	122.4
230.0	4.9	178.7	15.0	179.6	25.6	90.0	32.6	127.6
240.0	5.5	184.3	12.3	181.7	20.8	90.0	27.8	134.1
250.0	6.3	186.5	12.4	180.3	15.3	90.0	24.0	141.0
260.0	7.2	177.8	10.8	174.2	9.7	90.0	21.5	146.3
270.0	9.8	152.0	9.5	152.7	1.9	90.0	20.2	147.7
280.0	11.0	143.0	9.7	136.3	-1.8	90.0	20.2	143.8
290.0	13.6	134.9	10.9	122.7	-3.7	90.0	21.7	135.7
300.0	15.4	123.4	12.7	119.8	-3.9	90.0	24.8	126.5
310.0	17.0	114.2	14.4	119.8	-2.2	90.0	29.4	118.7
320.0	17.9	108.5	15.9	119.8	1.3	90.0	34.8	113.0
330.0	17.9	105.4	17.0	119.8	6.1	90.0	40.4	109.1
340.0	16.9	104.2	17.6	119.8	12.1	90.0	45.7	106.4
350.0	15.7	98.8	18.1	125.0	18.6	90.0	50.6	104.6
360.0	14.6	91.6	18.6	131.7	25.4	90.0	55.3	103.4

6.33.5 Thruster loss

Case 33 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.92	0.88	0.81
10.0	0.84	0.85	0.80
20.0	0.84	0.77	0.80
30.0	0.85	0.77	0.81
40.0	0.85	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.86	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.87	0.76	0.84
90.0	0.88	0.76	0.83
100.0	0.90	0.80	0.84
110.0	0.89	0.74	0.84
120.0	0.91	0.79	0.85
130.0	0.87	0.80	0.85
140.0	0.85	0.80	0.85
150.0	0.86	0.81	0.86
160.0	0.87	0.81	0.87
170.0	0.88	0.81	0.88
180.0	0.89	0.81	0.90
190.0	0.90	0.81	0.90
200.0	0.94	0.76	0.90
210.0	0.94	0.75	0.90
220.0	0.86	0.74	0.91
230.0	0.73	0.73	0.92
240.0	0.75	0.74	0.93
250.0	0.74	0.74	0.93
260.0	0.74	0.79	0.93
270.0	0.71	0.87	0.93
280.0	0.92	0.88	0.84
290.0	0.93	0.89	0.85
300.0	0.94	0.89	0.86
310.0	0.93	0.89	0.84
320.0	0.93	0.89	0.88
330.0	0.93	0.89	0.85
340.0	0.93	0.88	0.83
350.0	0.92	0.88	0.81
360.0	0.92	0.88	0.81

Preliminary Design, @IDR5

6.34 Case 34 - Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 5

6.34.1 Environment and thrust utilisation

Case 34 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	140.0	140.0	0.0	35.0	4.0	6.7	9.4	2.00	50.3
10.0	140.0	140.0	10.0	35.0	4.0	6.7	9.4	2.00	69.2
20.0	140.0	140.0	20.0	35.0	4.0	6.7	9.4	2.00	95.4
30.0	140.0	140.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	140.0	140.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	140.0	140.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	140.0	140.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	140.0	140.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	140.0	140.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	140.0	140.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	140.0	140.0	100.0	35.0	4.0	6.7	9.4	2.00	98.8
110.0	140.0	140.0	110.0	35.0	4.0	6.7	9.4	2.00	84.7
120.0	140.0	140.0	120.0	35.0	4.0	6.7	9.4	2.00	70.1
130.0	140.0	140.0	130.0	35.0	4.0	6.7	9.4	2.00	57.1
140.0	140.0	140.0	140.0	35.0	4.0	6.7	9.4	2.00	48.3
150.0	140.0	140.0	150.0	35.0	4.0	6.7	9.4	2.00	43.3
160.0	140.0	140.0	160.0	35.0	4.0	6.7	9.4	2.00	43.1
170.0	140.0	140.0	170.0	35.0	4.0	6.7	9.4	2.00	44.9
180.0	140.0	140.0	180.0	35.0	4.0	6.7	9.4	2.00	49.7
190.0	140.0	140.0	190.0	35.0	4.0	6.7	9.4	2.00	54.3
200.0	140.0	140.0	200.0	35.0	4.0	6.7	9.4	2.00	65.3
210.0	140.0	140.0	210.0	35.0	4.0	6.7	9.4	2.00	64.4
220.0	140.0	140.0	220.0	35.0	4.0	6.7	9.4	2.00	59.2
230.0	140.0	140.0	230.0	35.0	4.0	6.7	9.4	2.00	50.0
240.0	140.0	140.0	240.0	35.0	4.0	6.7	9.4	2.00	37.4
250.0	140.0	140.0	250.0	35.0	4.0	6.7	9.4	2.00	12.2
260.0	140.0	140.0	260.0	35.0	4.0	6.7	9.4	2.00	21.2
270.0	140.0	140.0	270.0	35.0	4.0	6.7	9.4	2.00	42.5
280.0	140.0	140.0	280.0	35.0	4.0	6.7	9.4	2.00	51.7
290.0	140.0	140.0	290.0	35.0	4.0	6.7	9.4	2.00	56.2
300.0	140.0	140.0	300.0	35.0	4.0	6.7	9.4	2.00	31.1
310.0	140.0	140.0	310.0	35.0	4.0	6.7	9.4	2.00	27.2
320.0	140.0	140.0	320.0	35.0	4.0	6.7	9.4	2.00	21.3
330.0	140.0	140.0	330.0	35.0	4.0	6.7	9.4	2.00	16.4
340.0	140.0	140.0	340.0	35.0	4.0	6.7	9.4	2.00	16.7
350.0	140.0	140.0	350.0	35.0	4.0	6.7	9.4	2.00	31.2
360.0	140.0	140.0	360.0	35.0	4.0	6.7	9.4	2.00	50.1

6.34.2 Relative contributions of force components

Case 34 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	56.4	26.3	-2.5	0.0	19.8	100.0
10.0	51.2	23.7	7.2	0.0	17.9	100.0
20.0	46.5	21.4	16.0	0.0	16.1	100.0
30.0	42.2	19.4	23.9	0.0	14.6	100.0
40.0	38.3	17.5	31.0	0.0	13.2	100.0
50.0	34.9	16.0	37.1	0.0	12.0	100.0
60.0	32.3	14.7	41.9	0.0	11.1	100.0
70.0	30.4	13.9	45.3	0.0	10.4	100.0
80.0	29.2	13.3	47.4	0.0	10.0	100.0
90.0	28.8	13.2	48.1	0.0	9.9	100.0
100.0	29.2	13.4	47.4	0.0	10.0	100.0
110.0	30.2	13.9	45.4	0.0	10.4	100.0
120.0	32.0	14.8	42.1	0.0	11.1	100.0
130.0	34.4	16.0	37.6	0.0	12.0	100.0
140.0	37.3	17.4	32.1	0.0	13.1	100.0
150.0	40.7	19.1	25.8	0.0	14.1	100.0
160.0	44.2	20.9	19.1	0.0	15.3	100.0
170.0	48.0	22.9	11.9	0.0	17.2	100.0
180.0	52.1	25.0	4.1	0.0	18.8	100.0
190.0	56.4	27.3	-4.4	0.0	20.6	100.0
200.0	61.6	30.2	-14.5	0.0	22.8	100.0
210.0	67.7	33.3	-26.3	0.0	25.5	100.0
220.0	73.9	37.1	-40.3	0.0	28.5	100.0
230.0	77.6	41.2	-49.9	0.0	31.1	100.0
240.0	77.7	41.6	-46.7	0.0	31.4	100.0
250.0	-23.7	-1.9	92.3	0.0	33.3	100.0
260.0	-35.3	-8.1	109.5	0.0	33.9	100.0
270.0	-40.6	-10.7	116.8	0.0	34.5	100.0
280.0	-41.6	-10.7	115.9	0.0	36.3	100.0
290.0	-36.0	-6.6	103.4	0.0	39.2	100.0
300.0	99.7	54.5	-95.4	0.0	41.2	100.0
310.0	103.8	53.2	-97.2	0.0	40.2	100.0
320.0	93.7	46.2	-74.6	0.0	34.8	100.0
330.0	81.1	39.0	-49.6	0.0	29.4	100.0
340.0	70.7	33.5	-29.4	0.0	25.2	100.0
350.0	62.7	29.4	-14.3	0.0	22.2	100.0
360.0	56.4	26.3	-2.5	0.0	19.8	100.0

6.34.3 Environment forces

Case 34 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	7.8	5.7	-3.6	0.0	4.3	14.3
10.0	7.8	5.7	-3.6	0.0	4.3	14.3
20.0	7.8	5.7	-3.5	0.0	4.3	14.4
30.0	7.8	5.7	-3.2	0.0	4.3	14.7
40.0	7.8	5.7	-2.8	0.0	4.3	15.1
50.0	7.8	5.7	-2.3	0.0	4.3	15.6
60.0	7.8	5.7	-1.6	0.0	4.3	16.2
70.0	7.8	5.7	-0.9	0.0	4.3	17.0
80.0	7.8	5.7	-0.1	0.0	4.3	17.8
90.0	7.8	5.7	0.7	0.0	4.3	18.6
100.0	7.8	5.7	1.5	0.0	4.3	19.4
110.0	7.8	5.7	2.3	0.0	4.3	20.1
120.0	7.8	5.7	3.0	0.0	4.3	20.8
130.0	7.8	5.7	3.5	0.0	4.3	21.4
140.0	7.8	5.7	4.0	0.0	4.3	21.8
150.0	7.8	5.7	4.3	0.0	4.3	22.1
160.0	7.8	5.7	4.4	0.0	4.3	22.3
170.0	7.8	5.7	4.4	0.0	4.3	22.3
180.0	7.8	5.7	4.3	0.0	4.3	22.2
190.0	7.8	5.7	4.4	0.0	4.3	22.3
200.0	7.8	5.7	4.4	0.0	4.3	22.3
210.0	7.8	5.7	4.3	0.0	4.3	22.1
220.0	7.8	5.7	4.0	0.0	4.3	21.8
230.0	7.8	5.7	3.5	0.0	4.3	21.4
240.0	7.8	5.7	3.0	0.0	4.3	20.8
250.0	7.8	5.7	2.3	0.0	4.3	20.1
260.0	7.8	5.7	1.5	0.0	4.3	19.4
270.0	7.8	5.7	0.7	0.0	4.3	18.6
280.0	7.8	5.7	-0.1	0.0	4.3	17.8
290.0	7.8	5.7	-0.9	0.0	4.3	17.0
300.0	7.8	5.7	-1.6	0.0	4.3	16.2
310.0	7.8	5.7	-2.3	0.0	4.3	15.6
320.0	7.8	5.7	-2.8	0.0	4.3	15.1
330.0	7.8	5.7	-3.2	0.0	4.3	14.7
340.0	7.8	5.7	-3.5	0.0	4.3	14.4
350.0	7.8	5.7	-3.6	0.0	4.3	14.3
360.0	7.8	5.7	-3.6	0.0	4.3	14.3

Case 34 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-24.2	-10.6	0.0	0.0	-8.0	-42.7
10.0	-24.2	-10.6	-4.8	0.0	-8.0	-47.6
20.0	-24.2	-10.6	-10.0	0.0	-8.0	-52.7
30.0	-24.2	-10.6	-15.6	0.0	-8.0	-58.4
40.0	-24.2	-10.6	-21.7	0.0	-8.0	-64.5
50.0	-24.2	-10.6	-28.0	0.0	-8.0	-70.7
60.0	-24.2	-10.6	-33.8	0.0	-8.0	-76.6
70.0	-24.2	-10.6	-38.7	0.0	-8.0	-81.4
80.0	-24.2	-10.6	-41.9	0.0	-8.0	-84.6
90.0	-24.2	-10.6	-43.0	0.0	-8.0	-85.7
100.0	-24.2	-10.6	-41.9	0.0	-8.0	-84.6
110.0	-24.2	-10.6	-38.7	0.0	-8.0	-81.4
120.0	-24.2	-10.6	-33.8	0.0	-8.0	-76.6
130.0	-24.2	-10.6	-28.0	0.0	-8.0	-70.7
140.0	-24.2	-10.6	-21.7	0.0	-8.0	-64.5
150.0	-24.2	-10.6	-15.6	0.0	-8.0	-58.4
160.0	-24.2	-10.6	-10.0	0.0	-8.0	-52.7
170.0	-24.2	-10.6	-4.8	0.0	-8.0	-47.6
180.0	-24.2	-10.6	0.0	0.0	-8.0	-42.7
190.0	-24.2	-10.6	4.8	0.0	-8.0	-37.9
200.0	-24.2	-10.6	10.0	0.0	-8.0	-32.7
210.0	-24.2	-10.6	15.6	0.0	-8.0	-27.1
220.0	-24.2	-10.6	21.7	0.0	-8.0	-21.0
230.0	-24.2	-10.6	28.0	0.0	-8.0	-14.7
240.0	-24.2	-10.6	33.8	0.0	-8.0	-8.9
250.0	-24.2	-10.6	38.7	0.0	8.0	11.8
260.0	-24.2	-10.6	41.9	0.0	8.0	15.0
270.0	-24.2	-10.6	43.0	0.0	8.0	16.2
280.0	-24.2	-10.6	41.9	0.0	8.0	15.0
290.0	-24.2	-10.6	38.7	0.0	8.0	11.8
300.0	-24.2	-10.6	33.8	0.0	-8.0	-8.9
310.0	-24.2	-10.6	28.0	0.0	-8.0	-14.7
320.0	-24.2	-10.6	21.7	0.0	-8.0	-21.0
330.0	-24.2	-10.6	15.6	0.0	-8.0	-27.1
340.0	-24.2	-10.6	10.0	0.0	-8.0	-32.7
350.0	-24.2	-10.6	4.8	0.0	-8.0	-37.9
360.0	-24.2	-10.6	0.0	0.0	-8.0	-42.7

Case 34 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	252.6	180.3	0.0	0.0	127.5	560.4
10.0	252.6	180.3	-316.6	0.0	127.5	243.8
20.0	252.6	180.3	-593.0	0.0	-127.5	-287.6
30.0	252.6	180.3	-793.7	0.0	-127.5	-488.3
40.0	252.6	180.3	-892.8	0.0	-127.5	-587.4
50.0	252.6	180.3	-876.4	0.0	-127.5	-571.0
60.0	252.6	180.3	-745.2	0.0	-127.5	-439.8
70.0	252.6	180.3	-513.8	0.0	-127.5	-208.4
80.0	252.6	180.3	-209.2	0.0	127.5	351.2
90.0	252.6	180.3	132.4	0.0	127.5	692.8
100.0	252.6	180.3	470.0	0.0	127.5	1030.4
110.0	252.6	180.3	762.6	0.0	127.5	1323.0
120.0	252.6	180.3	974.5	0.0	127.5	1534.9
130.0	252.6	180.3	1079.2	0.0	127.5	1629.6
140.0	252.6	180.3	1063.0	0.0	127.5	1623.4
150.0	252.6	180.3	926.1	0.0	127.5	1436.3
160.0	252.6	180.3	683.5	0.0	127.5	1243.9
170.0	252.6	180.3	362.6	0.0	127.5	923.0
180.0	252.6	180.3	0.0	0.0	127.5	560.4
190.0	252.6	180.3	-362.6	0.0	127.5	197.8
200.0	252.6	180.3	-683.5	0.0	-127.5	-378.1
210.0	252.6	180.3	-926.1	0.0	-127.5	-620.7
220.0	252.6	180.3	-1063.0	0.0	-127.5	-757.6
230.0	252.6	180.3	-1079.2	0.0	-127.5	-773.9
240.0	252.6	180.3	-974.5	0.0	-127.5	-669.1
250.0	252.6	180.3	-762.6	0.0	-127.5	-457.2
260.0	252.6	180.3	-470.0	0.0	-127.5	-164.6
270.0	252.6	180.3	-132.4	0.0	127.5	428.0
280.0	252.6	180.3	209.2	0.0	127.5	769.6
290.0	252.6	180.3	513.8	0.0	127.5	1074.2
300.0	252.6	180.3	745.2	0.0	127.5	1305.6
310.0	252.6	180.3	876.4	0.0	127.5	1436.8
320.0	252.6	180.3	892.8	0.0	127.5	1453.2
330.0	252.6	180.3	793.7	0.0	127.5	1354.1
340.0	252.6	180.3	593.0	0.0	127.5	1153.4
350.0	252.6	180.3	316.6	0.0	127.5	877.0
360.0	252.6	180.3	0.0	0.0	127.5	560.4

6.34.4 Thruster use

Case 34 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	13.0	103.8	16.4	132.9	18.1	90.0	45.1	108.5
10.0	11.6	95.2	17.3	139.9	24.8	90.0	49.7	106.7
20.0	66.1	12.0	80.2	170.3	25.5	90.0	54.6	105.3
30.0	77.8	18.8	86.6	180.0	25.7	90.0	52.3	104.3
40.0	78.2	17.3	86.4	180.0	26.1	90.0	50.7	103.4
50.0	78.5	17.8	86.2	180.0	26.7	90.0	51.9	102.7
60.0	79.0	20.1	86.0	180.0	27.5	90.0	55.9	102.2
70.0	80.0	23.4	85.8	180.0	27.1	90.0	60.2	101.9
80.0	82.9	31.4	85.7	180.0	26.8	90.0	71.6	102.1
90.0	85.2	36.1	85.7	180.0	26.5	90.0	78.6	102.4
100.0	79.9	32.8	87.6	170.7	26.6	90.0	86.1	102.9
110.0	40.4	45.2	55.1	151.8	26.7	90.0	83.9	103.9
120.0	26.8	103.4	28.6	120.7	25.9	90.0	79.4	105.2
130.0	26.6	106.6	27.7	119.8	21.2	90.0	73.9	106.8
140.0	25.6	109.6	26.3	120.3	17.7	90.0	68.1	108.7
150.0	23.7	112.5	24.4	122.4	15.8	90.0	62.4	110.8
160.0	21.2	115.3	22.3	126.3	15.5	90.0	57.2	112.9
170.0	18.3	118.4	20.2	132.3	16.5	90.0	52.5	115.1
180.0	15.1	122.4	18.4	140.1	18.2	90.0	48.7	117.4
190.0	12.1	129.0	17.0	149.7	19.9	90.0	44.0	120.5
200.0	8.0	145.3	16.2	165.5	24.2	90.0	39.6	124.2
210.0	6.8	165.6	15.7	174.4	23.9	90.0	35.0	129.2
220.0	6.6	184.3	15.3	181.8	22.0	90.0	30.3	136.1
230.0	7.0	195.5	14.7	187.2	18.5	90.0	26.0	145.4
240.0	7.7	198.1	12.7	190.0	13.7	90.0	22.6	156.9
250.0	11.1	207.3	7.6	207.5	-1.3	90.0	23.4	210.5
260.0	11.6	201.3	9.4	206.3	-6.8	90.0	24.5	217.8
270.0	12.7	182.8	5.9	186.2	-14.9	90.0	24.6	221.0
280.0	13.0	172.9	4.6	157.7	-18.5	90.0	23.3	220.3
290.0	14.7	163.2	5.2	124.1	-20.4	90.0	20.7	214.9
300.0	15.5	135.3	10.6	119.8	-11.2	90.0	18.5	151.3
310.0	16.6	125.0	12.3	119.8	-9.5	90.0	21.5	136.6
320.0	17.2	118.6	13.7	119.8	-6.0	90.0	25.8	125.7
330.0	17.1	115.4	14.8	119.8	-1.2	90.0	30.8	118.4
340.0	16.0	114.8	15.4	119.8	4.8	90.0	35.8	113.7
350.0	14.5	110.5	15.9	125.3	11.3	90.0	40.5	110.6
360.0	13.0	103.8	16.4	132.9	18.1	90.0	45.1	108.5

6.34.5 Thruster loss

Case 34 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.92	0.88	0.81
10.0	0.92	0.88	0.80
20.0	0.85	0.83	0.80
30.0	0.85	0.77	0.81
40.0	0.85	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.86	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.87	0.76	0.84
90.0	0.87	0.76	0.83
100.0	0.89	0.79	0.84
110.0	0.89	0.80	0.84
120.0	0.84	0.80	0.85
130.0	0.85	0.80	0.85
140.0	0.85	0.80	0.85
150.0	0.86	0.80	0.86
160.0	0.86	0.81	0.87
170.0	0.87	0.81	0.88
180.0	0.88	0.81	0.90
190.0	0.88	0.80	0.90
200.0	0.86	0.77	0.90
210.0	0.81	0.74	0.90
220.0	0.73	0.72	0.91
230.0	0.78	0.76	0.92
240.0	0.79	0.79	0.93
250.0	0.81	0.84	0.84
260.0	0.81	0.85	0.84
270.0	0.78	0.80	0.83
280.0	0.82	0.86	0.84
290.0	0.88	0.89	0.85
300.0	0.93	0.89	0.86
310.0	0.93	0.89	0.84
320.0	0.93	0.89	0.82
330.0	0.93	0.88	0.81
340.0	0.93	0.88	0.83
350.0	0.93	0.88	0.81
360.0	0.92	0.88	0.81

Preliminary Design, @IDR5

6.35 Case 35 - Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 5

6.35.1 Environment and thrust utilisation

Case 35 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	150.0	150.0	0.0	35.0	4.0	6.7	9.4	2.00	30.6
10.0	150.0	150.0	10.0	35.0	4.0	6.7	9.4	2.00	50.0
20.0	150.0	150.0	20.0	35.0	4.0	6.7	9.4	2.00	76.2
30.0	150.0	150.0	30.0	35.0	4.0	6.7	9.4	2.00	91.6
40.0	150.0	150.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	150.0	150.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	150.0	150.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	150.0	150.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	150.0	150.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	150.0	150.0	90.0	35.0	4.0	6.7	9.4	2.00	93.0
100.0	150.0	150.0	100.0	35.0	4.0	6.7	9.4	2.00	79.3
110.0	150.0	150.0	110.0	35.0	4.0	6.7	9.4	2.00	65.5
120.0	150.0	150.0	120.0	35.0	4.0	6.7	9.4	2.00	50.8
130.0	150.0	150.0	130.0	35.0	4.0	6.7	9.4	2.00	39.1
140.0	150.0	150.0	140.0	35.0	4.0	6.7	9.4	2.00	30.6
150.0	150.0	150.0	150.0	35.0	4.0	6.7	9.4	2.00	26.0
160.0	150.0	150.0	160.0	35.0	4.0	6.7	9.4	2.00	24.6
170.0	150.0	150.0	170.0	35.0	4.0	6.7	9.4	2.00	26.5
180.0	150.0	150.0	180.0	35.0	4.0	6.7	9.4	2.00	31.5
190.0	150.0	150.0	190.0	35.0	4.0	6.7	9.4	2.00	36.0
200.0	150.0	150.0	200.0	35.0	4.0	6.7	9.4	2.00	47.0
210.0	150.0	150.0	210.0	35.0	4.0	6.7	9.4	2.00	46.2
220.0	150.0	150.0	220.0	35.0	4.0	6.7	9.4	2.00	41.1
230.0	150.0	150.0	230.0	35.0	4.0	6.7	9.4	2.00	15.5
240.0	150.0	150.0	240.0	35.0	4.0	6.7	9.4	2.00	14.1
250.0	150.0	150.0	250.0	35.0	4.0	6.7	9.4	2.00	17.8
260.0	150.0	150.0	260.0	35.0	4.0	6.7	9.4	2.00	32.7
270.0	150.0	150.0	270.0	35.0	4.0	6.7	9.4	2.00	53.9
280.0	150.0	150.0	280.0	35.0	4.0	6.7	9.4	2.00	63.1
290.0	150.0	150.0	290.0	35.0	4.0	6.7	9.4	2.00	67.6
300.0	150.0	150.0	300.0	35.0	4.0	6.7	9.4	2.00	67.1
310.0	150.0	150.0	310.0	35.0	4.0	6.7	9.4	2.00	63.7
320.0	150.0	150.0	320.0	35.0	4.0	6.7	9.4	2.00	37.1
330.0	150.0	150.0	330.0	35.0	4.0	6.7	9.4	2.00	24.7
340.0	150.0	150.0	340.0	35.0	4.0	6.7	9.4	2.00	13.5
350.0	150.0	150.0	350.0	35.0	4.0	6.7	9.4	2.00	13.5
360.0	150.0	150.0	360.0	35.0	4.0	6.7	9.4	2.00	30.9

6.35.2 Relative contributions of force components

Case 35 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	57.9	26.6	-4.8	0.0	20.3	100.0
10.0	51.3	23.1	7.9	0.0	17.7	100.0
20.0	45.4	20.2	18.9	0.0	15.5	100.0
30.0	40.2	17.7	28.5	0.0	13.6	100.0
40.0	35.7	15.6	36.8	0.0	12.0	100.0
50.0	31.9	13.8	43.5	0.0	10.7	100.0
60.0	29.0	12.5	48.7	0.0	9.7	100.0
70.0	27.0	11.6	52.3	0.0	9.0	100.0
80.0	25.8	11.1	54.5	0.0	8.6	100.0
90.0	25.4	11.0	55.1	0.0	8.5	100.0
100.0	25.8	11.2	54.4	0.0	8.6	100.0
110.0	26.9	11.7	52.3	0.0	9.1	100.0
120.0	28.7	12.7	48.8	0.0	9.8	100.0
130.0	31.3	14.0	44.0	0.0	10.7	100.0
140.0	34.5	15.6	38.0	0.0	11.9	100.0
150.0	38.1	17.5	31.0	0.0	13.4	100.0
160.0	42.0	19.6	23.4	0.0	14.9	100.0
170.0	46.1	21.9	15.4	0.0	16.6	100.0
180.0	50.3	24.3	6.9	0.0	18.4	100.0
190.0	54.4	27.0	-1.7	0.0	20.3	100.0
200.0	58.3	29.9	-10.5	0.0	22.4	100.0
210.0	60.6	32.0	-17.1	0.0	24.2	100.0
220.0	57.6	33.1	-15.9	0.0	24.7	100.0
230.0	53.0	32.9	-12.9	0.0	25.3	100.0
240.0	49.0	32.0	-11.7	0.0	25.5	100.0
250.0	45.7	30.3	-10.8	0.0	25.8	100.0
260.0	43.0	28.1	-10.0	0.0	26.1	100.0
270.0	40.7	25.6	-9.3	0.0	26.4	100.0
280.0	38.9	23.0	-8.7	0.0	26.8	100.0
290.0	37.5	20.4	-8.2	0.0	27.3	100.0
300.0	36.4	17.9	-7.8	0.0	27.7	100.0
310.0	35.6	15.5	-7.5	0.0	28.1	100.0
320.0	35.0	13.2	-7.3	0.0	28.5	100.0
330.0	34.6	11.0	-7.2	0.0	28.9	100.0
340.0	34.3	9.0	-7.2	0.0	29.3	100.0
350.0	34.1	7.2	-7.3	0.0	29.7	100.0
360.0	34.0	5.6	-7.4	0.0	30.1	100.0

6.35.3 Environment forces

Case 35 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.3	6.1	-3.6	0.0	4.3	15.1
10.0	8.3	6.1	-3.6	0.0	4.3	15.1
20.0	8.3	6.1	-3.5	0.0	4.3	15.2
30.0	8.3	6.1	-3.2	0.0	4.3	15.5
40.0	8.3	6.1	-2.8	0.0	4.3	15.9
50.0	8.3	6.1	-2.3	0.0	4.3	16.4
60.0	8.3	6.1	-1.6	0.0	4.3	17.1
70.0	8.3	6.1	-0.9	0.0	4.3	17.8
80.0	8.3	6.1	-0.1	0.0	4.3	18.6
90.0	8.3	6.1	0.7	0.0	4.3	19.4
100.0	8.3	6.1	1.5	0.0	4.3	20.2
110.0	8.3	6.1	2.3	0.0	4.3	21.0
120.0	8.3	6.1	3.0	0.0	4.3	21.7
130.0	8.3	6.1	3.5	0.0	4.3	22.2
140.0	8.3	6.1	4.0	0.0	4.3	22.7
150.0	8.3	6.1	4.3	0.0	4.3	23.0
160.0	8.3	6.1	4.4	0.0	4.3	23.1
170.0	8.3	6.1	4.4	0.0	4.3	23.1
180.0	8.3	6.1	4.3	0.0	4.3	23.0
190.0	8.3	6.1	4.4	0.0	4.3	23.1
200.0	8.3	6.1	4.4	0.0	4.3	23.1
210.0	8.3	6.1	4.3	0.0	4.3	23.0
220.0	8.3	6.1	4.0	0.0	4.3	22.7
230.0	8.3	6.1	3.5	0.0	4.3	22.2
240.0	8.3	6.1	3.0	0.0	4.3	21.7
250.0	8.3	6.1	2.3	0.0	4.3	21.0
260.0	8.3	6.1	1.5	0.0	4.3	20.2
270.0	8.3	6.1	0.7	0.0	4.3	19.4
280.0	8.3	6.1	-0.1	0.0	4.3	18.6
290.0	8.3	6.1	-0.9	0.0	4.3	17.8
300.0	8.3	6.1	-1.6	0.0	4.3	17.1
310.0	8.3	6.1	-2.3	0.0	4.3	16.4
320.0	8.3	6.1	-2.8	0.0	4.3	15.9
330.0	8.3	6.1	-3.2	0.0	4.3	15.5
340.0	8.3	6.1	-3.5	0.0	4.3	15.2
350.0	8.3	6.1	-3.6	0.0	4.3	15.1
360.0	8.3	6.1	-3.6	0.0	4.3	15.1

Case 35 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-17.7	-7.0	0.0	0.0	-5.5	-30.2
10.0	-17.7	-7.0	-4.8	0.0	-5.5	-35.0
20.0	-17.7	-7.0	-10.0	0.0	-5.5	-40.2
30.0	-17.7	-7.0	-15.6	0.0	-5.5	-45.8
40.0	-17.7	-7.0	-21.7	0.0	-5.5	-51.9
50.0	-17.7	-7.0	-28.0	0.0	-5.5	-58.2
60.0	-17.7	-7.0	-33.8	0.0	-5.5	-64.0
70.0	-17.7	-7.0	-38.7	0.0	-5.5	-68.8
80.0	-17.7	-7.0	-41.9	0.0	-5.5	-72.0
90.0	-17.7	-7.0	-43.0	0.0	-5.5	-73.2
100.0	-17.7	-7.0	-41.9	0.0	-5.5	-72.0
110.0	-17.7	-7.0	-38.7	0.0	-5.5	-68.8
120.0	-17.7	-7.0	-33.8	0.0	-5.5	-64.0
130.0	-17.7	-7.0	-28.0	0.0	-5.5	-58.2
140.0	-17.7	-7.0	-21.7	0.0	-5.5	-51.9
150.0	-17.7	-7.0	-15.6	0.0	-5.5	-45.8
160.0	-17.7	-7.0	-10.0	0.0	-5.5	-40.2
170.0	-17.7	-7.0	-4.8	0.0	-5.5	-35.0
180.0	-17.7	-7.0	0.0	0.0	-5.5	-30.2
190.0	-17.7	-7.0	4.8	0.0	-5.5	-25.3
200.0	-17.7	-7.0	10.0	0.0	-5.5	-20.2
210.0	-17.7	-7.0	15.6	0.0	-5.5	-14.5
220.0	-17.7	-7.0	21.7	0.0	-5.5	-8.4
230.0	-17.7	-7.0	28.0	0.0	5.5	8.8
240.0	-17.7	-7.0	33.8	0.0	5.5	14.7
250.0	-17.7	-7.0	38.7	0.0	5.5	19.5
260.0	-17.7	-7.0	41.9	0.0	5.5	22.7
270.0	-17.7	-7.0	43.0	0.0	5.5	23.8
280.0	-17.7	-7.0	41.9	0.0	5.5	22.7
290.0	-17.7	-7.0	38.7	0.0	5.5	19.5
300.0	-17.7	-7.0	33.8	0.0	5.5	14.7
310.0	-17.7	-7.0	28.0	0.0	5.5	8.8
320.0	-17.7	-7.0	21.7	0.0	-5.5	-8.4
330.0	-17.7	-7.0	15.6	0.0	-5.5	-14.5
340.0	-17.7	-7.0	10.0	0.0	-5.5	-20.2
350.0	-17.7	-7.0	4.8	0.0	-5.5	-25.3
360.0	-17.7	-7.0	0.0	0.0	-5.5	-30.2

Case 35 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	246.7	173.4	0.0	0.0	126.3	546.4
10.0	246.7	173.4	-316.6	0.0	126.3	229.8
20.0	246.7	173.4	-593.0	0.0	-126.3	-299.1
30.0	246.7	173.4	-793.7	0.0	-126.3	-499.9
40.0	246.7	173.4	-892.8	0.0	-126.3	-599.0
50.0	246.7	173.4	-876.4	0.0	-126.3	-582.6
60.0	246.7	173.4	-745.2	0.0	-126.3	-451.4
70.0	246.7	173.4	-513.8	0.0	-126.3	-220.0
80.0	246.7	173.4	-209.2	0.0	126.3	337.2
90.0	246.7	173.4	132.4	0.0	126.3	678.8
100.0	246.7	173.4	470.0	0.0	126.3	1016.4
110.0	246.7	173.4	762.6	0.0	126.3	1309.0
120.0	246.7	173.4	974.5	0.0	126.3	1520.9
130.0	246.7	173.4	1079.2	0.0	126.3	1635.7
140.0	246.7	173.4	1063.0	0.0	126.3	1602.4
150.0	246.7	173.4	926.1	0.0	126.3	1472.3
160.0	246.7	173.4	683.5	0.0	126.3	1229.9
170.0	246.7	173.4	362.6	0.0	126.3	909.0
180.0	246.7	173.4	0.0	0.0	126.3	546.4
190.0	246.7	173.4	-362.6	0.0	126.3	183.8
200.0	246.7	173.4	-683.5	0.0	-126.3	-389.7
210.0	246.7	173.4	-926.1	0.0	-126.3	-632.3
220.0	246.7	173.4	-1063.0	0.0	-126.3	-769.1
230.0	246.7	173.4	-1079.2	0.0	-126.3	-785.4
240.0	246.7	173.4	-974.5	0.0	-126.3	-680.7
250.0	246.7	173.4	-762.6	0.0	-126.3	-468.8
260.0	246.7	173.4	-470.0	0.0	-126.3	-176.2
270.0	246.7	173.4	-132.4	0.0	126.3	414.0
280.0	246.7	173.4	209.2	0.0	126.3	755.6
290.0	246.7	173.4	513.8	0.0	126.3	1060.2
300.0	246.7	173.4	745.2	0.0	126.3	1291.6
310.0	246.7	173.4	876.4	0.0	126.3	1422.8
320.0	246.7	173.4	892.8	0.0	126.3	1439.2
330.0	246.7	173.4	793.7	0.0	126.3	1340.1
340.0	246.7	173.4	593.0	0.0	126.3	1139.4
350.0	246.7	173.4	316.6	0.0	126.3	863.0
360.0	246.7	173.4	0.0	0.0	126.3	546.4

6.35.4 Thruster use

Case 35 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	11.2	118.5	13.5	136.1	10.9	90.0	33.7	116.6
10.0	9.5	110.7	14.5	144.3	17.7	90.0	38.1	113.3
20.0	14.1	31.5	28.2	164.9	25.5	90.0	42.9	110.8
30.0	53.5	11.0	68.8	171.8	25.7	90.0	48.4	108.7
40.0	74.7	17.6	86.4	180.0	26.1	90.0	51.0	107.3
50.0	75.5	18.0	86.2	180.0	26.7	90.0	52.1	106.0
60.0	76.1	20.5	86.0	180.0	27.5	90.0	56.0	105.2
70.0	77.2	23.9	85.9	180.0	27.1	90.0	60.3	104.7
80.0	79.9	32.2	85.8	180.0	26.8	90.0	71.7	104.7
90.0	58.9	24.4	76.4	163.0	26.5	90.0	75.7	104.9
100.0	29.2	53.3	43.7	149.7	26.6	90.0	74.8	105.7
110.0	23.8	105.6	26.2	123.8	24.2	90.0	72.0	107.0
120.0	24.6	109.4	25.8	121.5	18.7	90.0	67.6	108.7
130.0	24.6	112.9	24.9	120.5	14.0	90.0	62.3	110.9
140.0	23.8	116.4	23.5	121.0	10.5	90.0	56.6	113.6
150.0	22.1	120.0	21.7	123.4	8.6	90.0	51.2	116.6
160.0	19.7	124.0	19.7	128.0	8.3	90.0	46.3	120.0
170.0	17.0	128.8	17.7	135.1	9.3	90.0	42.0	123.5
180.0	14.1	135.3	16.0	144.5	11.0	90.0	37.1	127.3
190.0	11.6	145.5	14.9	155.9	12.7	90.0	34.3	132.4
200.0	8.7	168.6	14.7	173.8	16.5	90.0	30.7	138.9
210.0	8.2	187.2	14.9	183.9	16.5	90.0	27.2	147.7
220.0	8.5	201.3	15.0	191.9	14.6	90.0	24.2	159.6
230.0	11.5	215.0	14.5	205.0	4.6	90.0	23.9	201.6
240.0	12.4	215.1	12.7	212.7	-0.2	90.0	26.2	214.1
250.0	13.1	211.2	12.1	215.8	-5.6	90.0	28.6	222.9
260.0	13.5	201.6	9.9	216.5	-11.2	90.0	30.4	228.3
270.0	14.2	189.0	5.9	203.8	-19.2	90.0	30.7	230.8
280.0	14.5	179.7	4.0	178.9	-22.8	90.0	29.3	230.6
290.0	15.4	170.5	3.7	134.2	-24.7	90.0	26.4	227.6
300.0	15.6	158.6	5.2	119.8	-24.8	90.0	22.5	220.6
310.0	15.7	146.9	6.7	119.8	-23.1	90.0	18.7	208.2
320.0	16.2	130.6	10.7	119.8	-13.2	90.0	18.0	152.1
330.0	15.9	127.4	11.8	119.8	-8.3	90.0	21.3	136.9
340.0	14.8	127.7	12.5	119.8	-2.4	90.0	25.3	127.1
350.0	13.1	124.0	12.9	126.9	4.1	90.0	29.5	120.8
360.0	11.2	118.5	13.5	136.1	10.9	90.0	33.7	116.6

6.35.5 Thruster loss

Case 35 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.93	0.88	0.81
10.0	0.92	0.88	0.80
20.0	0.84	0.84	0.80
30.0	0.85	0.82	0.81
40.0	0.85	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.86	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.87	0.76	0.84
90.0	0.89	0.82	0.83
100.0	0.86	0.81	0.84
110.0	0.84	0.80	0.84
120.0	0.84	0.80	0.85
130.0	0.84	0.80	0.85
140.0	0.85	0.80	0.85
150.0	0.85	0.80	0.86
160.0	0.85	0.81	0.87
170.0	0.86	0.81	0.88
180.0	0.86	0.80	0.90
190.0	0.85	0.79	0.90
200.0	0.78	0.73	0.90
210.0	0.74	0.73	0.90
220.0	0.78	0.78	0.91
230.0	0.80	0.83	0.92
240.0	0.80	0.83	0.85
250.0	0.81	0.84	0.84
260.0	0.82	0.85	0.84
270.0	0.81	0.86	0.83
280.0	0.77	0.77	0.84
290.0	0.85	0.88	0.85
300.0	0.90	0.89	0.86
310.0	0.92	0.89	0.84
320.0	0.93	0.89	0.82
330.0	0.93	0.89	0.81
340.0	0.93	0.88	0.80
350.0	0.93	0.88	0.81
360.0	0.93	0.88	0.81

Preliminary Design, @IDR5

6.36 Case 36 - Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 5

6.36.1 Environment and thrust utilisation

Case 36 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	160.0	160.0	0.0	35.0	4.0	6.7	9.4	2.00	17.4
10.0	160.0	160.0	10.0	35.0	4.0	6.7	9.4	2.00	36.4
20.0	160.0	160.0	20.0	35.0	4.0	6.7	9.4	2.00	60.5
30.0	160.0	160.0	30.0	35.0	4.0	6.7	9.4	2.00	76.0
40.0	160.0	160.0	40.0	35.0	4.0	6.7	9.4	2.00	88.1
50.0	160.0	160.0	50.0	35.0	4.0	6.7	9.4	2.00	95.9
60.0	160.0	160.0	60.0	35.0	4.0	6.7	9.4	2.00	98.7
70.0	160.0	160.0	70.0	35.0	4.0	6.7	9.4	2.00	99.4
80.0	160.0	160.0	80.0	35.0	4.0	6.7	9.4	2.00	88.8
90.0	160.0	160.0	90.0	35.0	4.0	6.7	9.4	2.00	79.7
100.0	160.0	160.0	100.0	35.0	4.0	6.7	9.4	2.00	66.7
110.0	160.0	160.0	110.0	35.0	4.0	6.7	9.4	2.00	51.7
120.0	160.0	160.0	120.0	35.0	4.0	6.7	9.4	2.00	37.7
130.0	160.0	160.0	130.0	35.0	4.0	6.7	9.4	2.00	26.7
140.0	160.0	160.0	140.0	35.0	4.0	6.7	9.4	2.00	22.3
150.0	160.0	160.0	150.0	35.0	4.0	6.7	9.4	2.00	20.8
160.0	160.0	160.0	160.0	35.0	4.0	6.7	9.4	2.00	18.6
170.0	160.0	160.0	170.0	35.0	4.0	6.7	9.4	2.00	16.2
180.0	160.0	160.0	180.0	35.0	4.0	6.7	9.4	2.00	18.1
190.0	160.0	160.0	190.0	35.0	4.0	6.7	9.4	2.00	29.3
200.0	160.0	160.0	200.0	35.0	4.0	6.7	9.4	2.00	32.0
210.0	160.0	160.0	210.0	35.0	4.0	6.7	9.4	2.00	20.5
220.0	160.0	160.0	220.0	35.0	4.0	6.7	9.4	2.00	15.6
230.0	160.0	160.0	230.0	35.0	4.0	6.7	9.4	2.00	15.5
240.0	160.0	160.0	240.0	35.0	4.0	6.7	9.4	2.00	15.3
250.0	160.0	160.0	250.0	35.0	4.0	6.7	9.4	2.00	27.0
260.0	160.0	160.0	260.0	35.0	4.0	6.7	9.4	2.00	42.0
270.0	160.0	160.0	270.0	35.0	4.0	6.7	9.4	2.00	61.1
280.0	160.0	160.0	280.0	35.0	4.0	6.7	9.4	2.00	70.2
290.0	160.0	160.0	290.0	35.0	4.0	6.7	9.4	2.00	74.7
300.0	160.0	160.0	300.0	35.0	4.0	6.7	9.4	2.00	74.3
310.0	160.0	160.0	310.0	35.0	4.0	6.7	9.4	2.00	70.9
320.0	160.0	160.0	320.0	35.0	4.0	6.7	9.4	2.00	62.8
330.0	160.0	160.0	330.0	35.0	4.0	6.7	9.4	2.00	49.8
340.0	160.0	160.0	340.0	35.0	4.0	6.7	9.4	2.00	23.0
350.0	160.0	160.0	350.0	35.0	4.0	6.7	9.4	2.00	11.1
360.0	160.0	160.0	360.0	35.0	4.0	6.7	9.4	2.00	17.4

6.36.2 Relative contributions of force components

Case 36 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	56.9	30.0	-9.4	0.0	22.5	100.0
10.0	49.0	24.8	7.4	0.0	18.8	100.0
20.0	41.9	20.6	21.8	0.0	15.7	100.0
30.0	35.8	17.1	34.0	0.0	13.1	100.0
40.0	30.7	14.4	43.9	0.0	11.1	100.0
50.0	26.7	12.3	51.5	0.0	9.5	100.0
60.0	23.7	10.8	57.1	0.0	8.4	100.0
70.0	21.7	9.8	60.8	0.0	7.7	100.0
80.0	20.6	9.3	62.9	0.0	7.2	100.0
90.0	20.2	9.2	63.5	0.0	7.1	100.0
100.0	20.6	9.4	62.7	0.0	7.3	100.0
110.0	21.7	10.0	60.5	0.0	7.8	100.0
120.0	23.6	11.1	56.8	0.0	8.6	100.0
130.0	26.2	12.6	51.5	0.0	9.7	100.0
140.0	29.5	14.6	44.8	0.0	11.1	100.0
150.0	33.3	17.0	36.9	0.0	12.8	100.0
160.0	37.3	19.6	28.4	0.0	14.7	100.0
170.0	41.1	22.4	19.7	0.0	16.7	100.0
180.0	44.7	25.4	11.2	0.0	18.7	100.0
190.0	46.8	27.9	5.0	0.0	20.3	100.0
200.0	46.4	29.7	2.7	0.0	21.3	100.0
210.0	26.9	23.5	28.5	0.0	20.8	100.0
220.0	12.3	6.1	48.9	0.0	21.6	100.0
230.0	3.9	9.9	69.0	0.0	20.2	100.0
240.0	-1.5	5.0	83.7	0.0	17.9	100.0
250.0	-10.4	2.0	92.5	0.0	15.9	100.0
260.0	-12.4	0.4	97.3	0.0	14.7	100.0
270.0	-13.4	-0.3	99.5	0.0	14.3	100.0
280.0	-14.0	-0.4	99.6	0.0	14.8	100.0
290.0	-14.1	0.3	97.4	0.0	16.4	100.0
300.0	-12.8	2.4	91.0	0.0	19.4	100.0
310.0	-7.5	7.2	76.4	0.0	23.9	100.0
320.0	6.7	17.2	46.9	0.0	29.2	100.0
330.0	33.4	32.1	3.2	0.0	31.3	100.0
340.0	70.7	42.6	-44.3	0.0	31.0	100.0
350.0	65.3	36.3	-28.4	0.0	26.9	100.0
360.0	56.9	30.0	-9.4	0.0	22.5	100.0

6.36.3 Environment forces

Case 36 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.2	6.4	-3.6	0.0	4.4	15.4
10.0	8.2	6.4	-3.6	0.0	4.4	15.4
20.0	8.2	6.4	-3.5	0.0	4.4	15.6
30.0	8.2	6.4	-3.2	0.0	4.4	15.8
40.0	8.2	6.4	-2.8	0.0	4.4	16.2
50.0	8.2	6.4	-2.3	0.0	4.4	16.8
60.0	8.2	6.4	-1.6	0.0	4.4	17.4
70.0	8.2	6.4	-0.9	0.0	4.4	18.1
80.0	8.2	6.4	-0.1	0.0	4.4	18.9
90.0	8.2	6.4	0.7	0.0	4.4	19.7
100.0	8.2	6.4	1.5	0.0	4.4	20.6
110.0	8.2	6.4	2.3	0.0	4.4	21.3
120.0	8.2	6.4	3.0	0.0	4.4	22.0
130.0	8.2	6.4	3.5	0.0	4.4	22.6
140.0	8.2	6.4	4.0	0.0	4.4	23.0
150.0	8.2	6.4	4.3	0.0	4.4	23.3
160.0	8.2	6.4	4.4	0.0	4.4	23.5
170.0	8.2	6.4	4.4	0.0	4.4	23.5
180.0	8.2	6.4	4.3	0.0	4.4	23.3
190.0	8.2	6.4	4.4	0.0	4.4	23.5
200.0	8.2	6.4	4.4	0.0	4.4	23.5
210.0	8.2	6.4	4.3	0.0	4.4	23.3
220.0	8.2	6.4	4.0	0.0	4.4	23.0
230.0	8.2	6.4	3.5	0.0	4.4	22.6
240.0	8.2	6.4	3.0	0.0	4.4	22.0
250.0	8.2	6.4	2.3	0.0	4.4	21.3
260.0	8.2	6.4	1.5	0.0	4.4	20.6
270.0	8.2	6.4	0.7	0.0	4.4	19.7
280.0	8.2	6.4	-0.1	0.0	4.4	18.9
290.0	8.2	6.4	-0.9	0.0	4.4	18.1
300.0	8.2	6.4	-1.6	0.0	4.4	17.4
310.0	8.2	6.4	-2.3	0.0	4.4	16.8
320.0	8.2	6.4	-2.8	0.0	4.4	16.2
330.0	8.2	6.4	-3.2	0.0	4.4	15.8
340.0	8.2	6.4	-3.5	0.0	4.4	15.6
350.0	8.2	6.4	-3.6	0.0	4.4	15.4
360.0	8.2	6.4	-3.6	0.0	4.4	15.4

Case 36 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-11.1	-4.2	0.0	0.0	-3.4	-18.7
10.0	-11.1	-4.2	-4.8	0.0	-3.4	-23.6
20.0	-11.1	-4.2	-10.0	0.0	-3.4	-28.7
30.0	-11.1	-4.2	-15.6	0.0	-3.4	-34.4
40.0	-11.1	-4.2	-21.7	0.0	-3.4	-40.5
50.0	-11.1	-4.2	-28.0	0.0	-3.4	-46.7
60.0	-11.1	-4.2	-33.8	0.0	-3.4	-52.6
70.0	-11.1	-4.2	-38.7	0.0	-3.4	-57.4
80.0	-11.1	-4.2	-41.9	0.0	-3.4	-60.6
90.0	-11.1	-4.2	-43.0	0.0	-3.4	-61.7
100.0	-11.1	-4.2	-41.9	0.0	-3.4	-60.6
110.0	-11.1	-4.2	-38.7	0.0	-3.4	-57.4
120.0	-11.1	-4.2	-33.8	0.0	-3.4	-52.6
130.0	-11.1	-4.2	-28.0	0.0	-3.4	-46.7
140.0	-11.1	-4.2	-21.7	0.0	-3.4	-40.5
150.0	-11.1	-4.2	-15.6	0.0	-3.4	-34.4
160.0	-11.1	-4.2	-10.0	0.0	-3.4	-28.7
170.0	-11.1	-4.2	-4.8	0.0	-3.4	-23.6
180.0	-11.1	-4.2	0.0	0.0	-3.4	-18.7
190.0	-11.1	-4.2	4.8	0.0	-3.4	-13.9
200.0	-11.1	-4.2	10.0	0.0	-3.4	-8.7
210.0	-11.1	-4.2	15.6	0.0	3.4	3.8
220.0	-11.1	-4.2	21.7	0.0	3.4	9.9
230.0	-11.1	-4.2	28.0	0.0	3.4	16.1
240.0	-11.1	-4.2	33.8	0.0	3.4	22.0
250.0	-11.1	-4.2	38.7	0.0	3.4	26.8
260.0	-11.1	-4.2	41.9	0.0	3.4	30.0
270.0	-11.1	-4.2	43.0	0.0	3.4	31.1
280.0	-11.1	-4.2	41.9	0.0	3.4	30.0
290.0	-11.1	-4.2	38.7	0.0	3.4	26.8
300.0	-11.1	-4.2	33.8	0.0	3.4	22.0
310.0	-11.1	-4.2	28.0	0.0	3.4	16.1
320.0	-11.1	-4.2	21.7	0.0	3.4	9.9
330.0	-11.1	-4.2	15.6	0.0	3.4	3.8
340.0	-11.1	-4.2	10.0	0.0	-3.4	-8.7
350.0	-11.1	-4.2	4.8	0.0	-3.4	-13.9
360.0	-11.1	-4.2	0.0	0.0	-3.4	-18.7

Case 36 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	193.5	133.0	0.0	0.0	95.6	422.1
10.0	193.5	133.0	-316.6	0.0	95.6	105.5
20.0	193.5	133.0	-593.0	0.0	-95.6	-362.1
30.0	193.5	133.0	-793.7	0.0	-95.6	-562.8
40.0	193.5	133.0	-892.8	0.0	-95.6	-661.9
50.0	193.5	133.0	-876.4	0.0	-95.6	-645.6
60.0	193.5	133.0	-745.2	0.0	-95.6	-514.4
70.0	193.5	133.0	-513.8	0.0	-95.6	-283.0
80.0	193.5	133.0	-209.2	0.0	95.6	212.9
90.0	193.5	133.0	132.4	0.0	95.6	554.5
100.0	193.5	133.0	470.0	0.0	95.6	892.1
110.0	193.5	133.0	762.6	0.0	95.6	1184.7
120.0	193.5	133.0	974.5	0.0	95.6	1396.6
130.0	193.5	133.0	1079.2	0.0	95.6	1591.3
140.0	193.5	133.0	1063.0	0.0	95.6	1485.1
150.0	193.5	133.0	926.1	0.0	95.6	1318.2
160.0	193.5	133.0	683.5	0.0	95.6	1105.6
170.0	193.5	133.0	362.6	0.0	95.6	784.7
180.0	193.5	133.0	0.0	0.0	95.6	422.1
190.0	193.5	133.0	-362.6	0.0	-95.6	-131.7
200.0	193.5	133.0	-683.5	0.0	-95.6	-452.7
210.0	193.5	133.0	-926.1	0.0	-95.6	-695.2
220.0	193.5	133.0	-1063.0	0.0	-95.6	-832.1
230.0	193.5	133.0	-1079.2	0.0	-95.6	-848.4
240.0	193.5	133.0	-974.5	0.0	-95.6	-743.7
250.0	193.5	133.0	-762.6	0.0	-95.6	-531.8
260.0	193.5	133.0	-470.0	0.0	-95.6	-239.1
270.0	193.5	133.0	-132.4	0.0	95.6	289.7
280.0	193.5	133.0	209.2	0.0	95.6	631.3
290.0	193.5	133.0	513.8	0.0	95.6	935.9
300.0	193.5	133.0	745.2	0.0	95.6	1167.3
310.0	193.5	133.0	876.4	0.0	95.6	1298.5
320.0	193.5	133.0	892.8	0.0	95.6	1314.9
330.0	193.5	133.0	793.7	0.0	95.6	1215.8
340.0	193.5	133.0	593.0	0.0	95.6	1015.1
350.0	193.5	133.0	316.6	0.0	95.6	738.7
360.0	193.5	133.0	0.0	0.0	95.6	422.1

6.36.4 Thruster use

Case 36 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	9.5	135.4	10.7	143.9	5.7	90.0	24.3	129.5
10.0	7.4	130.2	11.9	153.3	12.5	90.0	28.2	123.2
20.0	4.5	122.6	13.6	165.0	21.4	90.0	32.7	118.5
30.0	10.5	24.6	25.8	170.4	25.7	90.0	37.8	114.7
40.0	42.3	10.1	58.3	173.1	26.1	90.0	43.6	111.9
50.0	63.1	9.5	79.6	173.0	26.7	90.0	49.6	109.7
60.0	73.0	20.0	86.0	180.0	27.4	90.0	55.2	108.4
70.0	73.9	23.6	85.9	180.0	27.1	90.0	59.5	107.8
80.0	44.8	22.8	62.5	164.7	26.8	90.0	63.5	107.4
90.0	24.2	47.9	39.9	154.4	26.5	90.0	64.8	107.7
100.0	19.2	107.2	23.1	130.1	24.5	90.0	64.0	108.7
110.0	21.1	111.2	23.2	126.2	19.0	90.0	61.2	110.4
120.0	22.1	115.1	22.8	123.6	13.5	90.0	57.0	112.7
130.0	22.2	119.0	21.9	122.5	8.8	90.0	51.9	115.8
140.0	21.5	123.1	20.5	123.3	5.3	90.0	46.5	119.6
150.0	20.0	127.6	18.7	126.3	3.4	90.0	41.5	124.1
160.0	17.9	132.9	16.8	132.1	3.1	90.0	37.1	129.3
170.0	15.4	139.7	15.1	141.0	4.1	90.0	33.3	134.9
180.0	13.0	149.2	13.7	152.8	5.8	90.0	29.1	141.3
190.0	10.3	168.5	13.6	171.8	9.9	90.0	27.3	149.4
200.0	9.5	186.4	14.0	184.3	10.9	90.0	25.0	159.6
210.0	10.9	207.5	14.6	200.9	6.5	90.0	23.6	189.2
220.0	12.1	216.0	15.2	209.0	4.6	90.0	25.0	203.3
230.0	13.2	219.6	15.2	215.4	1.1	90.0	27.7	215.6
240.0	14.2	219.2	14.1	220.4	-3.7	90.0	31.1	225.0
250.0	14.8	215.5	12.9	224.3	-9.2	90.0	34.3	231.5
260.0	15.2	207.6	10.7	226.8	-14.7	90.0	36.4	235.6
270.0	15.6	196.8	6.7	224.0	-22.0	90.0	36.9	237.6
280.0	15.3	187.9	4.2	213.2	-25.6	90.0	35.5	237.8
290.0	18.7	179.6	0.6	13.3	-27.1	90.0	32.4	235.9
300.0	16.7	167.6	2.2	119.8	-27.4	90.0	28.1	231.6
310.0	15.5	158.7	4.7	119.8	-25.8	90.0	23.3	223.9
320.0	15.2	151.2	5.9	119.8	-22.4	90.0	19.0	211.3
330.0	14.6	148.3	7.0	119.8	-17.5	90.0	16.3	193.5
340.0	13.5	142.1	9.3	121.7	-7.5	90.0	17.9	150.7
350.0	11.6	138.8	9.9	132.7	-1.0	90.0	20.8	138.0
360.0	9.5	135.4	10.7	143.9	5.7	90.0	24.3	129.5

6.36.5 Thruster loss

Case 36 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.93	0.88	0.81
10.0	0.92	0.87	0.80
20.0	0.92	0.84	0.80
30.0	0.84	0.83	0.81
40.0	0.86	0.81	0.82
50.0	0.87	0.81	0.84
60.0	0.86	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.88	0.83	0.84
90.0	0.86	0.82	0.83
100.0	0.84	0.81	0.84
110.0	0.84	0.80	0.84
120.0	0.84	0.80	0.85
130.0	0.84	0.80	0.85
140.0	0.84	0.80	0.85
150.0	0.84	0.80	0.86
160.0	0.84	0.80	0.87
170.0	0.84	0.80	0.88
180.0	0.84	0.79	0.90
190.0	0.78	0.74	0.90
200.0	0.73	0.73	0.90
210.0	0.79	0.81	0.90
220.0	0.79	0.82	0.91
230.0	0.80	0.83	0.92
240.0	0.80	0.84	0.85
250.0	0.81	0.84	0.84
260.0	0.82	0.85	0.84
270.0	0.82	0.86	0.83
280.0	0.81	0.87	0.84
290.0	0.77	0.89	0.85
300.0	0.86	0.89	0.86
310.0	0.90	0.89	0.84
320.0	0.92	0.89	0.82
330.0	0.92	0.89	0.81
340.0	0.93	0.88	0.80
350.0	0.93	0.88	0.80
360.0	0.93	0.88	0.81

Preliminary Design, @IDR5

6.37 Case 37 - Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 5

6.37.1 Environment and thrust utilisation

Case 37 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	170.0	170.0	0.0	35.0	4.0	6.7	9.4	2.00	8.3
10.0	170.0	170.0	10.0	35.0	4.0	6.7	9.4	2.00	30.6
20.0	170.0	170.0	20.0	35.0	4.0	6.7	9.4	2.00	48.2
30.0	170.0	170.0	30.0	35.0	4.0	6.7	9.4	2.00	63.7
40.0	170.0	170.0	40.0	35.0	4.0	6.7	9.4	2.00	76.0
50.0	170.0	170.0	50.0	35.0	4.0	6.7	9.4	2.00	84.0
60.0	170.0	170.0	60.0	35.0	4.0	6.7	9.4	2.00	87.0
70.0	170.0	170.0	70.0	35.0	4.0	6.7	9.4	2.00	87.6
80.0	170.0	170.0	80.0	35.0	4.0	6.7	9.4	2.00	83.2
90.0	170.0	170.0	90.0	35.0	4.0	6.7	9.4	2.00	70.6
100.0	170.0	170.0	100.0	35.0	4.0	6.7	9.4	2.00	57.4
110.0	170.0	170.0	110.0	35.0	4.0	6.7	9.4	2.00	42.8
120.0	170.0	170.0	120.0	35.0	4.0	6.7	9.4	2.00	28.7
130.0	170.0	170.0	130.0	35.0	4.0	6.7	9.4	2.00	20.9
140.0	170.0	170.0	140.0	35.0	4.0	6.7	9.4	2.00	19.8
150.0	170.0	170.0	150.0	35.0	4.0	6.7	9.4	2.00	18.3
160.0	170.0	170.0	160.0	35.0	4.0	6.7	9.4	2.00	16.5
170.0	170.0	170.0	170.0	35.0	4.0	6.7	9.4	2.00	14.7
180.0	170.0	170.0	180.0	35.0	4.0	6.7	9.4	2.00	13.6
190.0	170.0	170.0	190.0	35.0	4.0	6.7	9.4	2.00	17.6
200.0	170.0	170.0	200.0	35.0	4.0	6.7	9.4	2.00	14.9
210.0	170.0	170.0	210.0	35.0	4.0	6.7	9.4	2.00	15.2
220.0	170.0	170.0	220.0	35.0	4.0	6.7	9.4	2.00	15.9
230.0	170.0	170.0	230.0	35.0	4.0	6.7	9.4	2.00	16.8
240.0	170.0	170.0	240.0	35.0	4.0	6.7	9.4	2.00	19.4
250.0	170.0	170.0	250.0	35.0	4.0	6.7	9.4	2.00	33.1
260.0	170.0	170.0	260.0	35.0	4.0	6.7	9.4	2.00	48.4
270.0	170.0	170.0	270.0	35.0	4.0	6.7	9.4	2.00	64.7
280.0	170.0	170.0	280.0	35.0	4.0	6.7	9.4	2.00	73.9
290.0	170.0	170.0	290.0	35.0	4.0	6.7	9.4	2.00	78.3
300.0	170.0	170.0	300.0	35.0	4.0	6.7	9.4	2.00	77.8
310.0	170.0	170.0	310.0	35.0	4.0	6.7	9.4	2.00	74.6
320.0	170.0	170.0	320.0	35.0	4.0	6.7	9.4	2.00	66.4
330.0	170.0	170.0	330.0	35.0	4.0	6.7	9.4	2.00	53.9
340.0	170.0	170.0	340.0	35.0	4.0	6.7	9.4	2.00	38.2
350.0	170.0	170.0	350.0	35.0	4.0	6.7	9.4	2.00	15.6
360.0	170.0	170.0	360.0	35.0	4.0	6.7	9.4	2.00	8.3

6.37.2 Relative contributions of force components

Case 37 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	54.0	37.2	-17.6	0.0	26.4	100.0
10.0	46.2	29.9	2.4	0.0	21.5	100.0
20.0	37.7	23.1	22.4	0.0	16.9	100.0
30.0	30.2	17.6	39.1	0.0	13.1	100.0
40.0	24.4	13.7	51.7	0.0	10.2	100.0
50.0	20.1	10.9	60.7	0.0	8.3	100.0
60.0	17.2	9.1	66.7	0.0	7.0	100.0
70.0	15.3	8.0	70.5	0.0	6.1	100.0
80.0	14.3	7.5	72.5	0.0	5.7	100.0
90.0	14.0	7.4	73.0	0.0	5.6	100.0
100.0	14.5	7.7	72.0	0.0	5.8	100.0
110.0	15.6	8.4	69.6	0.0	6.4	100.0
120.0	17.4	9.7	65.5	0.0	7.3	100.0
130.0	20.2	11.6	59.6	0.0	8.6	100.0
140.0	23.7	14.2	51.7	0.0	10.4	100.0
150.0	27.7	17.4	42.2	0.0	12.5	100.0
160.0	31.9	20.9	32.2	0.0	15.0	100.0
170.0	35.4	24.3	23.1	0.0	17.2	100.0
180.0	37.6	27.2	16.2	0.0	19.0	100.0
190.0	37.0	28.4	15.1	0.0	19.6	100.0
200.0	28.9	25.4	20.0	0.0	19.6	100.0
210.0	20.8	20.0	39.3	0.0	18.6	100.0
220.0	12.6	5.0	56.0	0.0	16.3	100.0
230.0	3.3	10.4	69.8	0.0	13.5	100.0
240.0	-2.2	7.1	79.5	0.0	11.2	100.0
250.0	-0.2	5.0	85.6	0.0	9.6	100.0
260.0	-1.4	3.8	89.0	0.0	8.6	100.0
270.0	-2.1	3.3	90.5	0.0	8.3	100.0
280.0	-2.3	3.3	90.4	0.0	8.5	100.0
290.0	-1.9	4.0	88.5	0.0	9.4	100.0
300.0	-0.8	5.5	84.1	0.0	11.2	100.0
310.0	2.2	8.6	75.1	0.0	14.2	100.0
320.0	8.6	14.4	58.2	0.0	18.7	100.0
330.0	21.0	23.9	30.5	0.0	24.6	100.0
340.0	38.7	35.5	-3.5	0.0	29.2	100.0
350.0	57.0	42.6	-29.3	0.0	29.6	100.0
360.0	54.0	37.2	-17.6	0.0	26.4	100.0

6.37.3 Environment forces

Case 37 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.1	6.5	-3.6	0.0	4.5	15.5
10.0	8.1	6.5	-3.6	0.0	4.5	15.5
20.0	8.1	6.5	-3.5	0.0	4.5	15.6
30.0	8.1	6.5	-3.2	0.0	4.5	15.9
40.0	8.1	6.5	-2.8	0.0	4.5	16.3
50.0	8.1	6.5	-2.3	0.0	4.5	16.8
60.0	8.1	6.5	-1.6	0.0	4.5	17.4
70.0	8.1	6.5	-0.9	0.0	4.5	18.2
80.0	8.1	6.5	-0.1	0.0	4.5	19.0
90.0	8.1	6.5	0.7	0.0	4.5	19.8
100.0	8.1	6.5	1.5	0.0	4.5	20.6
110.0	8.1	6.5	2.3	0.0	4.5	21.3
120.0	8.1	6.5	3.0	0.0	4.5	22.0
130.0	8.1	6.5	3.5	0.0	4.5	22.6
140.0	8.1	6.5	4.0	0.0	4.5	23.0
150.0	8.1	6.5	4.3	0.0	4.5	23.3
160.0	8.1	6.5	4.4	0.0	4.5	23.5
170.0	8.1	6.5	4.4	0.0	4.5	23.5
180.0	8.1	6.5	4.3	0.0	4.5	23.4
190.0	8.1	6.5	4.4	0.0	4.5	23.5
200.0	8.1	6.5	4.4	0.0	4.5	23.5
210.0	8.1	6.5	4.3	0.0	4.5	23.3
220.0	8.1	6.5	4.0	0.0	4.5	23.0
230.0	8.1	6.5	3.5	0.0	4.5	22.6
240.0	8.1	6.5	3.0	0.0	4.5	22.0
250.0	8.1	6.5	2.3	0.0	4.5	21.3
260.0	8.1	6.5	1.5	0.0	4.5	20.6
270.0	8.1	6.5	0.7	0.0	4.5	19.8
280.0	8.1	6.5	-0.1	0.0	4.5	19.0
290.0	8.1	6.5	-0.9	0.0	4.5	18.2
300.0	8.1	6.5	-1.6	0.0	4.5	17.4
310.0	8.1	6.5	-2.3	0.0	4.5	16.8
320.0	8.1	6.5	-2.8	0.0	4.5	16.3
330.0	8.1	6.5	-3.2	0.0	4.5	15.9
340.0	8.1	6.5	-3.5	0.0	4.5	15.6
350.0	8.1	6.5	-3.6	0.0	4.5	15.5
360.0	8.1	6.5	-3.6	0.0	4.5	15.5

Case 37 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.2	-1.9	0.0	0.0	-1.6	-8.7
10.0	-5.2	-1.9	-4.8	0.0	-1.6	-13.6
20.0	-5.2	-1.9	-10.0	0.0	-1.6	-18.7
30.0	-5.2	-1.9	-15.6	0.0	-1.6	-24.4
40.0	-5.2	-1.9	-21.7	0.0	-1.6	-30.5
50.0	-5.2	-1.9	-28.0	0.0	-1.6	-36.7
60.0	-5.2	-1.9	-33.8	0.0	-1.6	-42.6
70.0	-5.2	-1.9	-38.7	0.0	-1.6	-47.4
80.0	-5.2	-1.9	-41.9	0.0	-1.6	-50.6
90.0	-5.2	-1.9	-43.0	0.0	-1.6	-51.7
100.0	-5.2	-1.9	-41.9	0.0	-1.6	-50.6
110.0	-5.2	-1.9	-38.7	0.0	-1.6	-47.4
120.0	-5.2	-1.9	-33.8	0.0	-1.6	-42.6
130.0	-5.2	-1.9	-28.0	0.0	-1.6	-36.7
140.0	-5.2	-1.9	-21.7	0.0	-1.6	-30.5
150.0	-5.2	-1.9	-15.6	0.0	-1.6	-24.4
160.0	-5.2	-1.9	-10.0	0.0	-1.6	-18.7
170.0	-5.2	-1.9	-4.8	0.0	-1.6	-13.6
180.0	-5.2	-1.9	0.0	0.0	-1.6	-8.7
190.0	-5.2	-1.9	4.8	0.0	-1.6	-3.9
200.0	-5.2	-1.9	10.0	0.0	1.6	4.5
210.0	-5.2	-1.9	15.6	0.0	1.6	10.1
220.0	-5.2	-1.9	21.7	0.0	1.6	16.3
230.0	-5.2	-1.9	28.0	0.0	1.6	22.5
240.0	-5.2	-1.9	33.8	0.0	1.6	28.4
250.0	-5.2	-1.9	38.7	0.0	1.6	33.2
260.0	-5.2	-1.9	41.9	0.0	1.6	36.4
270.0	-5.2	-1.9	43.0	0.0	1.6	37.5
280.0	-5.2	-1.9	41.9	0.0	1.6	36.4
290.0	-5.2	-1.9	38.7	0.0	1.6	33.2
300.0	-5.2	-1.9	33.8	0.0	1.6	28.4
310.0	-5.2	-1.9	28.0	0.0	1.6	22.5
320.0	-5.2	-1.9	21.7	0.0	1.6	16.3
330.0	-5.2	-1.9	15.6	0.0	1.6	10.1
340.0	-5.2	-1.9	10.0	0.0	1.6	4.5
350.0	-5.2	-1.9	4.8	0.0	-1.6	-3.9
360.0	-5.2	-1.9	0.0	0.0	-1.6	-8.7

Case 37 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	109.9	75.2	0.0	0.0	53.6	238.7
10.0	109.9	75.2	-316.6	0.0	-53.6	-185.2
20.0	109.9	75.2	-593.0	0.0	-53.6	-461.5
30.0	109.9	75.2	-793.7	0.0	-53.6	-662.2
40.0	109.9	75.2	-892.8	0.0	-53.6	-761.3
50.0	109.9	75.2	-876.4	0.0	-53.6	-745.0
60.0	109.9	75.2	-745.2	0.0	-53.6	-613.8
70.0	109.9	75.2	-513.8	0.0	-53.6	-382.4
80.0	109.9	75.2	-209.2	0.0	-53.6	-77.8
90.0	109.9	75.2	132.4	0.0	53.6	371.1
100.0	109.9	75.2	470.0	0.0	53.6	708.7
110.0	109.9	75.2	762.6	0.0	53.6	1001.4
120.0	109.9	75.2	974.5	0.0	53.6	1213.2
130.0	109.9	75.2	1079.2	0.0	53.6	1315.0
140.0	109.9	75.2	1063.0	0.0	53.6	1300.7
150.0	109.9	75.2	926.1	0.0	53.6	1154.8
160.0	109.9	75.2	683.5	0.0	53.6	922.2
170.0	109.9	75.2	362.6	0.0	53.6	601.3
180.0	109.9	75.2	0.0	0.0	53.6	238.7
190.0	109.9	75.2	-362.6	0.0	-53.6	-231.2
200.0	109.9	75.2	-683.5	0.0	-53.6	-552.1
210.0	109.9	75.2	-926.1	0.0	-53.6	-794.6
220.0	109.9	75.2	-1063.0	0.0	-53.6	-931.5
230.0	109.9	75.2	-1079.2	0.0	-53.6	-947.8
240.0	109.9	75.2	-974.5	0.0	-53.6	-843.1
250.0	109.9	75.2	-762.6	0.0	-53.6	-631.2
260.0	109.9	75.2	-470.0	0.0	-53.6	-338.5
270.0	109.9	75.2	-132.4	0.0	53.6	106.3
280.0	109.9	75.2	209.2	0.0	53.6	447.9
290.0	109.9	75.2	513.8	0.0	53.6	752.6
300.0	109.9	75.2	745.2	0.0	53.6	983.9
310.0	109.9	75.2	876.4	0.0	53.6	1115.1
320.0	109.9	75.2	892.8	0.0	53.6	1131.5
330.0	109.9	75.2	793.7	0.0	53.6	1032.4
340.0	109.9	75.2	593.0	0.0	53.6	831.7
350.0	109.9	75.2	316.6	0.0	53.6	555.3
360.0	109.9	75.2	0.0	0.0	53.6	238.7

6.37.4 Thruster use

Case 37 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	8.3	156.0	8.5	158.0	2.2	90.0	17.8	150.5
10.0	5.6	162.4	10.2	171.2	10.3	90.0	20.6	138.7
20.0	3.9	165.2	11.8	175.5	16.8	90.0	24.4	129.8
30.0	2.7	160.0	13.4	176.5	22.6	90.0	29.1	123.0
40.0	8.6	15.4	24.7	175.0	26.1	90.0	34.5	118.1
50.0	29.4	10.2	46.0	173.9	26.7	90.0	40.4	114.6
60.0	36.9	12.3	54.0	172.2	27.4	90.0	46.0	112.3
70.0	39.1	15.6	56.7	170.0	27.1	90.0	50.8	111.0
80.0	28.2	25.7	45.8	165.3	26.8	90.0	54.0	110.5
90.0	13.9	108.7	20.0	140.1	25.8	90.0	55.4	110.9
100.0	16.4	112.7	20.4	134.4	21.0	90.0	54.6	112.1
110.0	18.3	116.8	20.4	129.9	15.4	90.0	52.0	114.2
120.0	19.5	120.9	19.9	127.0	9.9	90.0	47.9	117.3
130.0	19.8	125.3	19.0	125.9	5.2	90.0	43.1	121.6
140.0	19.3	130.1	17.6	127.1	1.7	90.0	38.2	127.1
150.0	18.0	135.7	15.9	131.2	-0.2	90.0	33.7	133.7
160.0	16.1	142.5	14.2	138.7	-0.5	90.0	30.0	141.4
170.0	14.0	151.6	12.9	150.2	0.5	90.0	27.1	150.0
180.0	12.1	164.0	12.1	164.7	2.2	90.0	25.7	159.5
190.0	10.7	183.5	12.9	182.9	5.2	90.0	23.8	170.5
200.0	11.2	202.7	13.9	198.6	4.2	90.0	23.9	190.8
210.0	12.2	214.5	15.1	208.4	3.9	90.0	25.4	203.5
220.0	13.6	221.4	15.9	215.0	2.1	90.0	28.2	215.2
230.0	14.8	224.1	16.5	225.0	-1.4	90.0	31.9	224.9
240.0	15.8	223.4	15.5	227.1	-6.2	90.0	35.9	232.2
250.0	16.4	226.0	17.1	231.4	-11.7	90.0	39.5	237.3
260.0	16.7	217.5	11.9	234.9	-17.2	90.0	41.8	240.5
270.0	16.7	204.6	8.5	237.2	-23.4	90.0	42.4	242.2
280.0	18.1	195.2	5.0	254.3	-26.8	90.0	41.0	242.5
290.0	29.3	185.7	11.4	343.7	-27.1	90.0	37.8	241.3
300.0	26.7	180.9	9.3	357.0	-27.4	90.0	33.3	238.4
310.0	19.1	174.0	3.1	44.8	-26.7	90.0	28.1	233.3
320.0	14.8	164.3	4.0	119.8	-23.7	90.0	23.0	225.0
330.0	14.1	161.9	4.9	119.8	-18.8	90.0	18.8	212.6
340.0	12.6	160.1	5.7	132.0	-13.0	90.0	16.2	196.1
350.0	10.4	155.4	7.3	145.1	-4.6	90.0	15.9	165.8
360.0	8.3	156.0	8.5	158.0	2.2	90.0	17.8	150.5

6.37.5 Thruster loss

Case 37 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.91	0.87	0.81
10.0	0.89	0.82	0.80
20.0	0.87	0.80	0.80
30.0	0.89	0.79	0.81
40.0	0.85	0.80	0.82
50.0	0.86	0.80	0.84
60.0	0.87	0.81	0.86
70.0	0.88	0.82	0.85
80.0	0.87	0.83	0.84
90.0	0.84	0.82	0.83
100.0	0.84	0.81	0.84
110.0	0.84	0.80	0.84
120.0	0.84	0.80	0.85
130.0	0.84	0.80	0.85
140.0	0.84	0.80	0.85
150.0	0.84	0.80	0.90
160.0	0.84	0.80	0.90
170.0	0.83	0.79	0.88
180.0	0.79	0.76	0.90
190.0	0.72	0.72	0.90
200.0	0.78	0.80	0.90
210.0	0.79	0.82	0.90
220.0	0.80	0.83	0.91
230.0	0.80	0.83	0.85
240.0	0.80	0.84	0.85
250.0	0.81	0.84	0.84
260.0	0.81	0.84	0.84
270.0	0.83	0.85	0.83
280.0	0.83	0.84	0.84
290.0	0.80	0.87	0.85
300.0	0.77	0.89	0.86
310.0	0.82	0.88	0.84
320.0	0.88	0.89	0.82
330.0	0.89	0.89	0.81
340.0	0.90	0.89	0.80
350.0	0.91	0.88	0.80
360.0	0.91	0.87	0.81

Preliminary Design, @IDR5

6.38 Case 38 - Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 5

6.38.1 Environment and thrust utilisation

Case 38 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	180.0	180.0	0.0	35.0	4.0	6.7	9.4	2.00	8.7
10.0	180.0	180.0	10.0	35.0	4.0	6.7	9.4	2.00	21.4
20.0	180.0	180.0	20.0	35.0	4.0	6.7	9.4	2.00	39.1
30.0	180.0	180.0	30.0	35.0	4.0	6.7	9.4	2.00	54.7
40.0	180.0	180.0	40.0	35.0	4.0	6.7	9.4	2.00	67.1
50.0	180.0	180.0	50.0	35.0	4.0	6.7	9.4	2.00	75.3
60.0	180.0	180.0	60.0	35.0	4.0	6.7	9.4	2.00	78.4
70.0	180.0	180.0	70.0	35.0	4.0	6.7	9.4	2.00	79.0
80.0	180.0	180.0	80.0	35.0	4.0	6.7	9.4	2.00	74.5
90.0	180.0	180.0	90.0	35.0	4.0	6.7	9.4	2.00	65.3
100.0	180.0	180.0	100.0	35.0	4.0	6.7	9.4	2.00	51.9
110.0	180.0	180.0	110.0	35.0	4.0	6.7	9.4	2.00	37.5
120.0	180.0	180.0	120.0	35.0	4.0	6.7	9.4	2.00	23.3
130.0	180.0	180.0	130.0	35.0	4.0	6.7	9.4	2.00	18.2
140.0	180.0	180.0	140.0	35.0	4.0	6.7	9.4	2.00	17.4
150.0	180.0	180.0	150.0	35.0	4.0	6.7	9.4	2.00	15.9
160.0	180.0	180.0	160.0	35.0	4.0	6.7	9.4	2.00	14.4
170.0	180.0	180.0	170.0	35.0	4.0	6.7	9.4	2.00	14.2
180.0	180.0	180.0	180.0	35.0	4.0	6.7	9.4	2.00	14.7
190.0	180.0	180.0	190.0	35.0	4.0	6.7	9.4	2.00	14.2
200.0	180.0	180.0	200.0	35.0	4.0	6.7	9.4	2.00	14.4
210.0	180.0	180.0	210.0	35.0	4.0	6.7	9.4	2.00	15.9
220.0	180.0	180.0	220.0	35.0	4.0	6.7	9.4	2.00	17.4
230.0	180.0	180.0	230.0	35.0	4.0	6.7	9.4	2.00	18.2
240.0	180.0	180.0	240.0	35.0	4.0	6.7	9.4	2.00	23.3
250.0	180.0	180.0	250.0	35.0	4.0	6.7	9.4	2.00	37.6
260.0	180.0	180.0	260.0	35.0	4.0	6.7	9.4	2.00	51.9
270.0	180.0	180.0	270.0	35.0	4.0	6.7	9.4	2.00	65.3
280.0	180.0	180.0	280.0	35.0	4.0	6.7	9.4	2.00	74.5
290.0	180.0	180.0	290.0	35.0	4.0	6.7	9.4	2.00	79.0
300.0	180.0	180.0	300.0	35.0	4.0	6.7	9.4	2.00	78.4
310.0	180.0	180.0	310.0	35.0	4.0	6.7	9.4	2.00	75.3
320.0	180.0	180.0	320.0	35.0	4.0	6.7	9.4	2.00	67.1
330.0	180.0	180.0	330.0	35.0	4.0	6.7	9.4	2.00	54.7
340.0	180.0	180.0	340.0	35.0	4.0	6.7	9.4	2.00	39.1
350.0	180.0	180.0	350.0	35.0	4.0	6.7	9.4	2.00	21.4
360.0	180.0	180.0	360.0	35.0	4.0	6.7	9.4	2.00	8.7

6.38.2 Relative contributions of force components

Case 38 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	51.6	42.7	-23.3	0.0	29.1	100.0
10.0	47.0	38.9	-12.3	0.0	26.5	100.0
20.0	36.2	30.0	13.4	0.0	20.4	100.0
30.0	25.5	21.1	39.1	0.0	14.3	100.0
40.0	17.6	14.5	58.0	0.0	9.9	100.0
50.0	12.5	10.4	70.0	0.0	7.1	100.0
60.0	9.6	7.9	77.1	0.0	5.4	100.0
70.0	7.9	6.6	81.1	0.0	4.5	100.0
80.0	7.1	5.9	82.9	0.0	4.0	100.0
90.0	7.0	5.8	83.2	0.0	4.0	100.0
100.0	7.5	6.2	82.0	0.0	4.2	100.0
110.0	8.7	7.2	79.2	0.0	4.9	100.0
120.0	10.7	8.9	74.3	0.0	6.1	100.0
130.0	13.9	11.5	66.8	0.0	7.8	100.0
140.0	18.3	15.1	56.3	0.0	10.3	100.0
150.0	23.6	19.5	43.7	0.0	13.3	100.0
160.0	28.7	23.8	31.3	0.0	16.2	100.0
170.0	32.5	26.9	22.2	0.0	18.3	100.0
180.0	34.1	28.2	18.5	0.0	19.2	100.0
190.0	32.5	26.9	22.2	0.0	18.3	100.0
200.0	28.7	23.8	31.3	0.0	16.2	100.0
210.0	23.6	19.5	43.7	0.0	13.3	100.0
220.0	18.3	15.1	56.3	0.0	10.3	100.0
230.0	13.9	11.5	66.8	0.0	7.8	100.0
240.0	10.7	8.9	74.3	0.0	6.1	100.0
250.0	8.7	7.2	79.2	0.0	4.9	100.0
260.0	7.5	6.2	82.0	0.0	4.2	100.0
270.0	7.0	5.8	83.2	0.0	4.0	100.0
280.0	7.1	5.9	82.9	0.0	4.0	100.0
290.0	7.9	6.6	81.1	0.0	4.5	100.0
300.0	9.6	7.9	77.1	0.0	5.4	100.0
310.0	12.5	10.4	70.0	0.0	7.1	100.0
320.0	17.6	14.5	58.0	0.0	9.9	100.0
330.0	25.5	21.1	39.1	0.0	14.3	100.0
340.0	36.2	30.0	13.4	0.0	20.4	100.0
350.0	47.0	38.9	-12.3	0.0	26.5	100.0
360.0	51.6	42.7	-23.3	0.0	29.1	100.0

6.38.3 Environment forces

Case 38 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.0	6.6	-3.6	0.0	4.5	15.4
10.0	8.0	6.6	-3.6	0.0	4.5	15.4
20.0	8.0	6.6	-3.5	0.0	4.5	15.6
30.0	8.0	6.6	-3.2	0.0	4.5	15.8
40.0	8.0	6.6	-2.8	0.0	4.5	16.2
50.0	8.0	6.6	-2.3	0.0	4.5	16.8
60.0	8.0	6.6	-1.6	0.0	4.5	17.4
70.0	8.0	6.6	-0.9	0.0	4.5	18.2
80.0	8.0	6.6	-0.1	0.0	4.5	18.9
90.0	8.0	6.6	0.7	0.0	4.5	19.8
100.0	8.0	6.6	1.5	0.0	4.5	20.6
110.0	8.0	6.6	2.3	0.0	4.5	21.3
120.0	8.0	6.6	3.0	0.0	4.5	22.0
130.0	8.0	6.6	3.5	0.0	4.5	22.6
140.0	8.0	6.6	4.0	0.0	4.5	23.0
150.0	8.0	6.6	4.3	0.0	4.5	23.3
160.0	8.0	6.6	4.4	0.0	4.5	23.5
170.0	8.0	6.6	4.4	0.0	4.5	23.5
180.0	8.0	6.6	4.3	0.0	4.5	23.4
190.0	8.0	6.6	4.4	0.0	4.5	23.5
200.0	8.0	6.6	4.4	0.0	4.5	23.5
210.0	8.0	6.6	4.3	0.0	4.5	23.3
220.0	8.0	6.6	4.0	0.0	4.5	23.0
230.0	8.0	6.6	3.5	0.0	4.5	22.6
240.0	8.0	6.6	3.0	0.0	4.5	22.0
250.0	8.0	6.6	2.3	0.0	4.5	21.3
260.0	8.0	6.6	1.5	0.0	4.5	20.6
270.0	8.0	6.6	0.7	0.0	4.5	19.8
280.0	8.0	6.6	-0.1	0.0	4.5	18.9
290.0	8.0	6.6	-0.9	0.0	4.5	18.2
300.0	8.0	6.6	-1.6	0.0	4.5	17.4
310.0	8.0	6.6	-2.3	0.0	4.5	16.8
320.0	8.0	6.6	-2.8	0.0	4.5	16.2
330.0	8.0	6.6	-3.2	0.0	4.5	15.8
340.0	8.0	6.6	-3.5	0.0	4.5	15.6
350.0	8.0	6.6	-3.6	0.0	4.5	15.4
360.0	8.0	6.6	-3.6	0.0	4.5	15.4

Case 38 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-4.8	0.0	0.0	-4.8
20.0	0.0	0.0	-10.0	0.0	0.0	-10.0
30.0	0.0	0.0	-15.6	0.0	0.0	-15.6
40.0	0.0	0.0	-21.7	0.0	0.0	-21.7
50.0	0.0	0.0	-28.0	0.0	0.0	-28.0
60.0	0.0	0.0	-33.8	0.0	0.0	-33.8
70.0	0.0	0.0	-38.7	0.0	0.0	-38.7
80.0	0.0	0.0	-41.9	0.0	0.0	-41.9
90.0	0.0	0.0	-43.0	0.0	0.0	-43.0
100.0	0.0	0.0	-41.9	0.0	0.0	-41.9
110.0	0.0	0.0	-38.7	0.0	0.0	-38.7
120.0	0.0	0.0	-33.8	0.0	0.0	-33.8
130.0	0.0	0.0	-28.0	0.0	0.0	-28.0
140.0	0.0	0.0	-21.7	0.0	0.0	-21.7
150.0	0.0	0.0	-15.6	0.0	0.0	-15.6
160.0	0.0	0.0	-10.0	0.0	0.0	-10.0
170.0	0.0	0.0	-4.8	0.0	0.0	-4.8
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	4.8	0.0	0.0	4.8
200.0	0.0	0.0	10.0	0.0	0.0	10.0
210.0	0.0	0.0	15.6	0.0	0.0	15.6
220.0	0.0	0.0	21.7	0.0	0.0	21.7
230.0	0.0	0.0	28.0	0.0	0.0	28.0
240.0	0.0	0.0	33.8	0.0	0.0	33.8
250.0	0.0	0.0	38.7	0.0	0.0	38.7
260.0	0.0	0.0	41.9	0.0	0.0	41.9
270.0	0.0	0.0	43.0	0.0	0.0	43.0
280.0	0.0	0.0	41.9	0.0	0.0	41.9
290.0	0.0	0.0	38.7	0.0	0.0	38.7
300.0	0.0	0.0	33.8	0.0	0.0	33.8
310.0	0.0	0.0	28.0	0.0	0.0	28.0
320.0	0.0	0.0	21.7	0.0	0.0	21.7
330.0	0.0	0.0	15.6	0.0	0.0	15.6
340.0	0.0	0.0	10.0	0.0	0.0	10.0
350.0	0.0	0.0	4.8	0.0	0.0	4.8
360.0	0.0	0.0	0.0	0.0	0.0	0.0

Case 38 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-316.6	0.0	0.0	-316.6
20.0	0.0	0.0	-593.0	0.0	0.0	-593.0
30.0	0.0	0.0	-793.7	0.0	0.0	-793.7
40.0	0.0	0.0	-892.8	0.0	0.0	-892.8
50.0	0.0	0.0	-876.4	0.0	0.0	-876.4
60.0	0.0	0.0	-745.2	0.0	0.0	-745.2
70.0	0.0	0.0	-513.8	0.0	0.0	-513.8
80.0	0.0	0.0	-209.2	0.0	0.0	-209.2
90.0	0.0	0.0	132.4	0.0	0.0	132.4
100.0	0.0	0.0	470.0	0.0	0.0	470.0
110.0	0.0	0.0	762.6	0.0	0.0	762.6
120.0	0.0	0.0	974.5	0.0	0.0	974.5
130.0	0.0	0.0	1079.2	0.0	0.0	1079.2
140.0	0.0	0.0	1063.0	0.0	0.0	1063.0
150.0	0.0	0.0	926.1	0.0	0.0	926.1
160.0	0.0	0.0	683.5	0.0	0.0	683.5
170.0	0.0	0.0	362.6	0.0	0.0	362.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	-362.6	0.0	0.0	-362.6
200.0	0.0	0.0	-683.5	0.0	0.0	-683.5
210.0	0.0	0.0	-926.1	0.0	0.0	-926.1
220.0	0.0	0.0	-1063.0	0.0	0.0	-1063.0
230.0	0.0	0.0	-1079.2	0.0	0.0	-1079.2
240.0	0.0	0.0	-974.5	0.0	0.0	-974.5
250.0	0.0	0.0	-762.6	0.0	0.0	-762.6
260.0	0.0	0.0	-470.0	0.0	0.0	-470.0
270.0	0.0	0.0	-132.4	0.0	0.0	-132.4
280.0	0.0	0.0	209.2	0.0	0.0	209.2
290.0	0.0	0.0	513.8	0.0	0.0	513.8
300.0	0.0	0.0	745.2	0.0	0.0	745.2
310.0	0.0	0.0	876.4	0.0	0.0	876.4
320.0	0.0	0.0	892.8	0.0	0.0	892.8
330.0	0.0	0.0	793.7	0.0	0.0	793.7
340.0	0.0	0.0	593.0	0.0	0.0	593.0
350.0	0.0	0.0	316.6	0.0	0.0	316.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.38.4 Thruster use

Case 38 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	7.7	180.0	7.7	180.0	0.0	90.0	15.4	180.0
10.0	6.0	189.5	9.6	185.8	6.8	90.0	16.2	162.6
20.0	4.5	201.6	11.5	188.1	13.3	90.0	18.5	147.3
30.0	3.4	211.6	13.1	187.4	19.1	90.0	22.3	135.4
40.0	2.5	208.2	14.1	184.3	24.0	90.0	27.1	126.8
50.0	4.6	9.5	21.3	178.2	26.5	90.0	32.6	120.9
60.0	12.2	16.1	29.3	173.8	27.3	90.0	38.1	117.2
70.0	14.6	24.2	32.0	169.7	27.0	90.0	42.7	115.1
80.0	7.7	82.4	21.4	159.1	26.6	90.0	46.0	114.3
90.0	10.9	115.6	17.8	147.6	23.6	90.0	47.3	114.7
100.0	13.5	119.3	18.0	141.0	18.8	90.0	46.6	116.2
110.0	15.5	123.3	17.8	135.8	13.3	90.0	44.2	118.9
120.0	16.8	127.6	17.3	132.6	7.8	90.0	40.4	123.0
130.0	17.3	132.5	16.3	131.7	3.0	90.0	36.0	128.9
140.0	17.0	138.1	15.0	133.7	-0.5	90.0	31.7	136.6
150.0	16.0	144.9	13.5	139.3	-2.3	90.0	28.1	146.2
160.0	14.5	153.7	12.2	149.4	-2.6	90.0	25.5	157.0
170.0	12.9	165.2	11.4	163.7	-1.7	90.0	24.0	168.4
180.0	11.7	180.0	11.7	180.0	0.0	90.0	23.4	180.0
190.0	11.4	196.3	12.9	194.8	1.7	90.0	24.0	191.6
200.0	12.2	210.6	14.5	206.3	2.6	90.0	25.5	203.0
210.0	13.5	220.7	16.0	215.1	2.3	90.0	28.1	213.8
220.0	15.0	226.3	17.0	221.9	0.5	90.0	31.7	223.4
230.0	16.3	228.3	17.5	227.5	-3.0	90.0	36.0	231.1
240.0	17.3	227.4	16.3	232.4	-7.8	90.0	40.4	237.0
250.0	17.8	224.2	15.5	236.7	-13.3	90.0	44.2	241.1
260.0	18.0	217.0	13.5	240.7	-18.8	90.0	46.6	243.8
270.0	17.8	212.4	10.9	244.4	-23.6	90.0	47.3	245.3
280.0	17.1	200.9	7.7	277.6	-26.6	90.0	46.0	245.7
290.0	32.0	190.3	14.6	335.8	-27.0	90.0	42.7	244.9
300.0	29.3	186.2	12.2	343.9	-27.3	90.0	38.1	242.8
310.0	21.3	181.8	4.6	350.5	-26.5	90.0	32.6	239.1
320.0	14.1	175.7	2.5	151.8	-24.0	90.0	27.1	233.2
330.0	13.1	172.6	3.4	148.4	-19.1	90.0	22.3	224.6
340.0	11.5	171.9	4.5	158.4	-13.3	90.0	18.5	212.7
350.0	9.6	174.2	6.0	170.5	-6.8	90.0	16.2	197.4
360.0	7.7	180.0	7.7	180.0	0.0	90.0	15.4	180.0

6.38.5 Thruster loss

Case 38 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.78	0.78	1.00
10.0	0.83	0.82	0.79
20.0	0.87	0.84	0.80
30.0	0.88	0.83	0.80
40.0	0.88	0.81	0.82
50.0	0.86	0.78	0.83
60.0	0.86	0.80	0.86
70.0	0.86	0.82	0.85
80.0	0.84	0.84	0.84
90.0	0.84	0.82	0.83
100.0	0.84	0.81	0.83
110.0	0.84	0.80	0.84
120.0	0.84	0.80	0.84
130.0	0.84	0.80	0.84
140.0	0.83	0.80	0.91
150.0	0.83	0.80	0.90
160.0	0.82	0.79	0.90
170.0	0.79	0.77	0.90
180.0	0.70	0.70	1.00
190.0	0.77	0.79	0.90
200.0	0.79	0.82	0.90
210.0	0.80	0.83	0.90
220.0	0.80	0.83	0.91
230.0	0.80	0.84	0.84
240.0	0.80	0.84	0.84
250.0	0.80	0.84	0.84
260.0	0.81	0.84	0.83
270.0	0.82	0.84	0.83
280.0	0.84	0.84	0.84
290.0	0.82	0.86	0.85
300.0	0.80	0.86	0.86
310.0	0.78	0.86	0.83
320.0	0.81	0.88	0.82
330.0	0.83	0.88	0.80
340.0	0.84	0.87	0.80
350.0	0.82	0.83	0.79
360.0	0.78	0.78	1.00

Preliminary Design, @IDR5

6.39 Case 39 - Thrust Utilization: 35 knots wind. 0 current, 0 waves

6.39.1 Environment and thrust utilisation

Case 39 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	0.0	0.0	360.0	35.0	0.0	0.0	0.0	0.00	3.2
10.0	10.0	10.0	360.0	35.0	0.0	0.0	0.0	0.00	13.8
20.0	20.0	20.0	360.0	35.0	0.0	0.0	0.0	0.00	26.9
30.0	30.0	30.0	360.0	35.0	0.0	0.0	0.0	0.00	40.5
40.0	40.0	40.0	360.0	35.0	0.0	0.0	0.0	0.00	53.7
50.0	50.0	50.0	360.0	35.0	0.0	0.0	0.0	0.00	61.2
60.0	60.0	60.0	360.0	35.0	0.0	0.0	0.0	0.00	61.7
70.0	70.0	70.0	360.0	35.0	0.0	0.0	0.0	0.00	57.9
80.0	80.0	80.0	360.0	35.0	0.0	0.0	0.0	0.00	3.2
90.0	90.0	90.0	360.0	35.0	0.0	0.0	0.0	0.00	49.5
100.0	100.0	100.0	180.0	35.0	0.0	0.0	0.0	0.00	47.0
110.0	110.0	110.0	180.0	35.0	0.0	0.0	0.0	0.00	45.0
120.0	120.0	120.0	180.0	35.0	0.0	0.0	0.0	0.00	42.1
130.0	130.0	130.0	180.0	35.0	0.0	0.0	0.0	0.00	36.8
140.0	140.0	140.0	180.0	35.0	0.0	0.0	0.0	0.00	28.6
150.0	150.0	150.0	180.0	35.0	0.0	0.0	0.0	0.00	19.2
160.0	160.0	160.0	180.0	35.0	0.0	0.0	0.0	0.00	11.5
170.0	170.0	170.0	180.0	35.0	0.0	0.0	0.0	0.00	5.5
180.0	180.0	180.0	180.0	35.0	0.0	0.0	0.0	0.00	4.6
190.0	190.0	190.0	180.0	35.0	0.0	0.0	0.0	0.00	5.5
200.0	200.0	200.0	180.0	35.0	0.0	0.0	0.0	0.00	11.5
210.0	210.0	210.0	180.0	35.0	0.0	0.0	0.0	0.00	19.2
220.0	220.0	220.0	180.0	35.0	0.0	0.0	0.0	0.00	28.6
230.0	230.0	230.0	180.0	35.0	0.0	0.0	0.0	0.00	36.8
240.0	240.0	240.0	180.0	35.0	0.0	0.0	0.0	0.00	42.1
250.0	250.0	250.0	180.0	35.0	0.0	0.0	0.0	0.00	45.0
260.0	260.0	260.0	180.0	35.0	0.0	0.0	0.0	0.00	47.0
270.0	270.0	270.0	0.0	35.0	0.0	0.0	0.0	0.00	49.5
280.0	280.0	280.0	0.0	35.0	0.0	0.0	0.0	0.00	53.2
290.0	290.0	290.0	0.0	35.0	0.0	0.0	0.0	0.00	57.9
300.0	300.0	300.0	0.0	35.0	0.0	0.0	0.0	0.00	61.7
310.0	310.0	310.0	0.0	35.0	0.0	0.0	0.0	0.00	61.2
320.0	320.0	320.0	0.0	35.0	0.0	0.0	0.0	0.00	53.7
330.0	330.0	330.0	0.0	35.0	0.0	0.0	0.0	0.00	40.5
340.0	340.0	340.0	0.0	35.0	0.0	0.0	0.0	0.00	26.9
350.0	350.0	350.0	0.0	35.0	0.0	0.0	0.0	0.00	13.8
360.0	360.0	360.0	0.0	35.0	0.0	0.0	0.0	0.00	3.2

6.39.2 Relative contributions of force components

Case 39 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	93.4	0.0	0.0	0.0	6.6	100.0
10.0	93.5	0.0	0.0	0.0	6.5	100.0
20.0	93.5	0.0	0.0	0.0	6.5	100.0
30.0	93.5	0.0	0.0	0.0	6.5	100.0
40.0	93.5	0.0	0.0	0.0	6.5	100.0
50.0	93.5	0.0	0.0	0.0	6.5	100.0
60.0	93.5	0.0	0.0	0.0	6.5	100.0
70.0	93.5	0.0	0.0	0.0	6.5	100.0
80.0	93.5	0.0	0.0	0.0	6.5	100.0
90.0	93.5	0.0	0.0	0.0	6.5	100.0
100.0	93.5	0.0	0.0	0.0	6.5	100.0
110.0	93.5	0.0	0.0	0.0	6.5	100.0
120.0	93.5	0.0	0.0	0.0	6.5	100.0
130.0	93.5	0.0	0.0	0.0	6.5	100.0
140.0	93.5	0.0	0.0	0.0	6.5	100.0
150.0	93.5	0.0	0.0	0.0	6.5	100.0
160.0	93.5	0.0	0.0	0.0	6.5	100.0
170.0	93.5	0.0	0.0	0.0	6.5	100.0
180.0	93.4	0.0	0.0	0.0	6.6	100.0
190.0	93.5	0.0	0.0	0.0	6.5	100.0
200.0	93.5	0.0	0.0	0.0	6.5	100.0
210.0	93.5	0.0	0.0	0.0	6.5	100.0
220.0	93.5	0.0	0.0	0.0	6.5	100.0
230.0	93.5	0.0	0.0	0.0	6.5	100.0
240.0	93.5	0.0	0.0	0.0	6.5	100.0
250.0	93.5	0.0	0.0	0.0	6.5	100.0
260.0	93.5	0.0	0.0	0.0	6.5	100.0
270.0	93.5	0.0	0.0	0.0	6.5	100.0
280.0	93.5	0.0	0.0	0.0	6.5	100.0
290.0	93.5	0.0	0.0	0.0	6.5	100.0
300.0	93.5	0.0	0.0	0.0	6.5	100.0
310.0	93.5	0.0	0.0	0.0	6.5	100.0
320.0	93.5	0.0	0.0	0.0	6.5	100.0
330.0	93.5	0.0	0.0	0.0	6.5	100.0
340.0	93.5	0.0	0.0	0.0	6.5	100.0
350.0	93.5	0.0	0.0	0.0	6.5	100.0
360.0	93.4	0.0	0.0	0.0	6.6	100.0

6.39.3 Environment forces

Case 39 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	0.0	0.0	0.0	-0.5	-7.2
10.0	-6.8	0.0	0.0	0.0	-0.5	-7.3
20.0	-7.0	0.0	0.0	0.0	-0.5	-7.5
30.0	-7.1	0.0	0.0	0.0	-0.5	-7.6
40.0	-6.7	0.0	0.0	0.0	-0.5	-7.2
50.0	-5.6	0.0	0.0	0.0	-0.4	-6.0
60.0	-4.1	0.0	0.0	0.0	-0.3	-4.4
70.0	-2.6	0.0	0.0	0.0	-0.2	-2.7
80.0	-1.2	0.0	0.0	0.0	-0.1	-1.3
90.0	0.0	0.0	0.0	0.0	0.0	0.0
100.0	1.4	0.0	0.0	0.0	0.1	1.5
110.0	3.0	0.0	0.0	0.0	0.2	3.2
120.0	4.8	0.0	0.0	0.0	0.3	5.1
130.0	6.5	0.0	0.0	0.0	0.5	7.0
140.0	7.8	0.0	0.0	0.0	0.5	8.3
150.0	8.3	0.0	0.0	0.0	0.6	8.9
160.0	8.2	0.0	0.0	0.0	0.6	8.8
170.0	8.1	0.0	0.0	0.0	0.6	8.6
180.0	8.0	0.0	0.0	0.0	0.6	8.5
190.0	8.1	0.0	0.0	0.0	0.6	8.6
200.0	8.2	0.0	0.0	0.0	0.6	8.8
210.0	8.3	0.0	0.0	0.0	0.6	8.9
220.0	7.8	0.0	0.0	0.0	0.5	8.3
230.0	6.5	0.0	0.0	0.0	0.5	7.0
240.0	4.8	0.0	0.0	0.0	0.3	5.1
250.0	3.0	0.0	0.0	0.0	0.2	3.2
260.0	1.4	0.0	0.0	0.0	0.1	1.5
270.0	0.0	0.0	0.0	0.0	0.0	0.0
280.0	-1.2	0.0	0.0	0.0	-0.1	-1.3
290.0	-2.6	0.0	0.0	0.0	-0.2	-2.7
300.0	-4.1	0.0	0.0	0.0	-0.3	-4.4
310.0	-5.6	0.0	0.0	0.0	-0.4	-6.0
320.0	-6.7	0.0	0.0	0.0	-0.5	-7.2
330.0	-7.1	0.0	0.0	0.0	-0.5	-7.6
340.0	-7.0	0.0	0.0	0.0	-0.5	-7.5
350.0	-6.8	0.0	0.0	0.0	-0.5	-7.3
360.0	-6.7	0.0	0.0	0.0	-0.5	-7.2

Case 39 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	-5.3	0.0	0.0	0.0	-0.4	-5.6
20.0	-11.2	0.0	0.0	0.0	-0.8	-11.9
30.0	-17.9	0.0	0.0	0.0	-1.3	-19.1
40.0	-24.5	0.0	0.0	0.0	-1.7	-26.3
50.0	-29.3	0.0	0.0	0.0	-2.0	-31.3
60.0	-31.0	0.0	0.0	0.0	-2.2	-33.1
70.0	-30.7	0.0	0.0	0.0	-2.1	-32.8
80.0	-29.8	0.0	0.0	0.0	-2.1	-31.9
90.0	-29.4	0.0	0.0	0.0	-2.1	-31.5
100.0	-29.8	0.0	0.0	0.0	-2.1	-31.8
110.0	-30.5	0.0	0.0	0.0	-2.1	-32.6
120.0	-30.7	0.0	0.0	0.0	-2.1	-32.8
130.0	-28.8	0.0	0.0	0.0	-2.0	-30.9
140.0	-24.2	0.0	0.0	0.0	-1.7	-25.9
150.0	-17.7	0.0	0.0	0.0	-1.2	-18.9
160.0	-11.1	0.0	0.0	0.0	-0.8	-11.9
170.0	-5.2	0.0	0.0	0.0	-0.4	-5.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	5.2	0.0	0.0	0.0	0.4	5.6
200.0	11.1	0.0	0.0	0.0	0.8	11.9
210.0	17.7	0.0	0.0	0.0	1.2	18.9
220.0	24.2	0.0	0.0	0.0	1.7	25.9
230.0	28.8	0.0	0.0	0.0	2.0	30.9
240.0	30.7	0.0	0.0	0.0	2.1	32.8
250.0	30.5	0.0	0.0	0.0	2.1	32.6
260.0	29.8	0.0	0.0	0.0	2.1	31.8
270.0	29.4	0.0	0.0	0.0	2.1	31.5
280.0	29.8	0.0	0.0	0.0	2.1	31.9
290.0	30.7	0.0	0.0	0.0	2.1	32.8
300.0	31.0	0.0	0.0	0.0	2.2	33.1
310.0	29.3	0.0	0.0	0.0	2.0	31.3
320.0	24.5	0.0	0.0	0.0	1.7	26.3
330.0	17.9	0.0	0.0	0.0	1.3	19.1
340.0	11.2	0.0	0.0	0.0	0.8	11.9
350.0	5.3	0.0	0.0	0.0	0.4	5.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

Case 39 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	-184.0	0.0	0.0	0.0	-12.7	-196.7
20.0	-351.6	0.0	0.0	0.0	-24.3	-375.8
30.0	-501.2	0.0	0.0	0.0	-34.6	-535.8
40.0	-601.9	0.0	0.0	0.0	-41.5	-643.5
50.0	-615.1	0.0	0.0	0.0	-42.5	-657.5
60.0	-543.1	0.0	0.0	0.0	-37.5	-580.6
70.0	-430.1	0.0	0.0	0.0	-29.7	-459.8
80.0	-314.1	0.0	0.0	0.0	-21.7	-335.8
90.0	-207.2	0.0	0.0	0.0	-14.3	-221.5
100.0	-105.5	0.0	0.0	0.0	-7.3	-112.8
110.0	-1.5	0.0	0.0	0.0	-0.1	-1.6
120.0	105.7	0.0	0.0	0.0	7.3	113.0
130.0	200.3	0.0	0.0	0.0	13.8	214.1
140.0	252.6	0.0	0.0	0.0	17.4	270.1
150.0	246.7	0.0	0.0	0.0	17.0	263.7
160.0	193.5	0.0	0.0	0.0	13.4	206.8
170.0	109.9	0.0	0.0	0.0	7.6	117.4
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	-109.9	0.0	0.0	0.0	-7.6	-117.4
200.0	-193.5	0.0	0.0	0.0	-13.4	-206.8
210.0	-246.7	0.0	0.0	0.0	-17.0	-263.7
220.0	-252.6	0.0	0.0	0.0	-17.4	-270.1
230.0	-200.3	0.0	0.0	0.0	-13.8	-214.1
240.0	-105.7	0.0	0.0	0.0	-7.3	-113.0
250.0	1.5	0.0	0.0	0.0	0.1	1.6
260.0	105.5	0.0	0.0	0.0	7.3	112.8
270.0	207.2	0.0	0.0	0.0	14.3	221.5
280.0	314.1	0.0	0.0	0.0	21.7	335.8
290.0	430.1	0.0	0.0	0.0	29.7	459.8
300.0	543.1	0.0	0.0	0.0	37.5	580.6
310.0	615.1	0.0	0.0	0.0	42.5	657.5
320.0	601.9	0.0	0.0	0.0	41.5	643.5
330.0	501.2	0.0	0.0	0.0	34.6	535.8
340.0	351.6	0.0	0.0	0.0	24.3	375.8
350.0	184.0	0.0	0.0	0.0	12.7	196.7
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.39.4 Thruster use

Case 39 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	3.6	0.0	3.6	0.0	0.0	90.0	7.2	360.0
10.0	5.1	359.2	2.2	358.2	5.8	90.0	9.2	37.6
20.0	6.8	1.0	0.7	9.0	11.7	90.0	14.1	57.8
30.0	8.4	4.3	1.0	142.6	17.9	90.0	20.6	68.4
40.0	9.5	8.7	2.6	149.3	23.5	90.0	27.2	74.7
50.0	9.8	14.2	4.2	147.2	26.6	90.0	31.9	79.1
60.0	9.3	20.8	5.3	144.0	26.8	90.0	33.4	82.5
70.0	8.3	28.5	5.9	140.6	25.0	90.0	32.9	85.2
80.0	7.6	37.2	6.4	137.5	23.0	90.0	31.9	87.7
90.0	7.2	46.8	7.0	134.7	21.3	90.0	31.5	90.0
100.0	7.1	57.6	7.8	133.0	20.2	90.0	31.9	92.7
110.0	7.4	69.0	8.8	131.8	19.2	90.0	32.8	95.6
120.0	7.7	80.5	9.7	131.4	17.9	90.0	33.2	98.9
130.0	7.9	92.2	10.1	131.8	15.5	90.0	31.6	102.8
140.0	7.4	104.4	9.4	133.6	11.9	90.0	27.2	107.9
150.0	6.4	117.9	8.0	137.4	7.9	90.0	20.9	115.1
160.0	5.3	134.1	6.3	144.7	4.4	90.0	14.8	126.6
170.0	4.5	154.8	4.9	157.9	1.9	90.0	10.3	146.9
180.0	4.3	180.0	4.3	180.0	0.0	90.0	8.7	180.0
190.0	4.9	202.1	4.5	205.2	-1.9	90.0	10.3	213.1
200.0	6.3	215.3	5.3	225.9	-4.4	90.0	14.8	233.4
210.0	8.0	222.6	6.4	242.1	-7.9	90.0	20.9	244.9
220.0	9.4	226.4	7.4	255.6	-11.9	90.0	27.2	252.1
230.0	10.1	228.2	7.5	267.8	-15.5	90.0	31.6	257.2
240.0	9.7	228.6	7.7	279.5	-17.9	90.0	33.2	261.1
250.0	8.8	228.2	7.4	291.0	-19.2	90.0	32.8	264.4
260.0	7.8	227.0	7.1	302.4	-20.2	90.0	31.9	267.3
270.0	7.0	225.3	7.2	313.2	-21.3	90.0	31.5	270.0
280.0	6.4	222.5	7.6	322.8	-23.0	90.0	31.9	272.3
290.0	5.9	219.4	8.3	331.5	-25.0	90.0	32.9	274.8
300.0	5.3	216.0	9.3	339.2	-26.8	90.0	33.4	277.5
310.0	4.2	212.8	9.8	345.8	-26.6	90.0	31.9	280.9
320.0	2.6	210.7	9.5	351.3	-23.5	90.0	27.2	285.3
330.0	1.0	217.4	8.4	355.7	-17.9	90.0	20.6	291.6
340.0	0.7	351.0	6.8	359.0	-11.7	90.0	14.1	302.2
350.0	2.2	1.8	5.1	0.8	-5.8	90.0	9.2	322.4
360.0	3.6	0.0	3.6	0.0	0.0	90.0	7.2	360.0

6.39.5 Thruster loss

Case 39 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.99	0.99	1.00
10.0	0.99	0.99	0.97
20.0	0.99	0.96	0.97
30.0	0.99	0.92	0.97
40.0	0.98	0.92	0.97
50.0	0.98	0.92	0.97
60.0	0.98	0.92	0.97
70.0	0.97	0.92	0.97
80.0	0.97	0.92	0.97
90.0	0.97	0.93	0.97
100.0	0.97	0.93	0.97
110.0	0.97	0.93	0.97
120.0	0.97	0.93	0.97
130.0	0.97	0.93	0.97
140.0	0.97	0.93	0.97
150.0	0.97	0.92	0.97
160.0	0.97	0.92	0.97
170.0	0.95	0.90	0.97
180.0	0.81	0.81	1.00
190.0	0.90	0.95	0.97
200.0	0.92	0.97	0.97
210.0	0.92	0.97	0.97
220.0	0.93	0.97	0.97
230.0	0.93	0.97	0.97
240.0	0.93	0.97	0.97
250.0	0.93	0.97	0.97
260.0	0.93	0.97	0.97
270.0	0.93	0.97	0.97
280.0	0.92	0.97	0.97
290.0	0.92	0.97	0.97
300.0	0.92	0.98	0.97
310.0	0.92	0.98	0.97
320.0	0.92	0.98	0.97
330.0	0.92	0.99	0.97
340.0	0.96	0.99	0.97
350.0	0.99	0.99	0.97
360.0	0.99	0.99	1.00

Preliminary Design, @IDR5

7 Load coefficients

7.1 Wind load coefficients

Wind load coefficients			
Dir [deg]	Surge [tf s ² /m ²]	Sway [tf s ² /m ²]	Yaw [tf s ² /m]
0.0	-2.078E-002	0.000E+000	0.000E+000
5.0	-2.085E-002	-7.969E-003	-2.929E-001
10.0	-2.105E-002	-1.621E-002	-5.676E-001
15.0	-2.133E-002	-2.497E-002	-8.306E-001
20.0	-2.164E-002	-3.441E-002	-1.084E+000
25.0	-2.187E-002	-4.455E-002	-1.326E+000
30.0	-2.188E-002	-5.518E-002	-1.546E+000
35.0	-2.152E-002	-6.581E-002	-1.729E+000
40.0	-2.066E-002	-7.572E-002	-1.857E+000
45.0	-1.925E-002	-8.407E-002	-1.915E+000
50.0	-1.733E-002	-9.024E-002	-1.897E+000
55.0	-1.507E-002	-9.399E-002	-1.812E+000
60.0	-1.263E-002	-9.557E-002	-1.675E+000
65.0	-1.020E-002	-9.553E-002	-1.508E+000
70.0	-7.877E-003	-9.454E-002	-1.327E+000
75.0	-5.716E-003	-9.320E-002	-1.147E+000
80.0	-3.711E-003	-9.194E-002	-9.088E-001
85.0	-1.824E-003	-9.108E-002	-8.005E-001
90.0	1.074E-009	-9.078E-002	-6.391E-001
95.0	2.155E-003	-9.105E-002	-4.819E-001
100.0	4.380E-003	-9.182E-002	-3.254E-001
105.0	6.733E-003	-9.291E-002	-1.669E-001
110.0	9.261E-003	-9.404E-002	-4.501E-003
115.0	1.196E-002	-9.478E-002	1.612E-001
120.0	1.477E-002	-9.457E-002	3.261E-001
125.0	1.758E-002	-9.279E-002	4.822E-001
130.0	2.019E-002	-8.894E-002	6.177E-001
135.0	2.241E-002	-8.282E-002	7.199E-001
140.0	2.406E-002	-7.463E-002	7.792E-001
145.0	2.510E-002	-6.497E-002	7.920E-001
150.0	2.559E-002	-5.460E-002	7.610E-001
155.0	2.564E-002	-4.420E-002	6.933E-001
160.0	2.544E-002	-3.423E-002	5.967E-001
165.0	2.514E-002	-2.490E-002	4.775E-001
170.0	2.484E-002	-1.619E-002	3.389E-001
175.0	2.463E-002	-7.966E-003	1.807E-001
180.0	2.456E-002	7.936E-009	-1.939E-007

7.2 Current load coefficients

Current load coefficients			
Dir [deg]	Surge [tf s ² /m ²]	Sway [tf s ² /m ²]	Yaw [tf s ² /m]
0.0	-3.397E+000	3.139E-006	1.531E-004
5.0	-3.412E+000	-2.262E+000	-1.520E+002
10.0	-3.397E+000	-4.565E+000	-2.991E+002
15.0	-3.351E+000	-6.945E+000	-4.366E+002
20.0	-3.273E+000	-9.429E+000	-5.601E+002
25.0	-3.163E+000	-1.204E+001	-6.656E+002
30.0	-3.020E+000	-1.477E+001	-7.497E+002
35.0	-2.845E+000	-1.761E+001	-8.096E+002
40.0	-2.639E+000	-2.053E+001	-8.433E+002
45.0	-2.402E+000	-2.349E+001	-8.495E+002
50.0	-2.136E+000	-2.643E+001	-8.279E+002
55.0	-1.844E+000	-2.929E+001	-7.789E+002
60.0	-1.528E+000	-3.197E+001	-7.040E+002
65.0	-1.192E+000	-3.441E+001	-6.052E+002
70.0	-8.373E-001	-3.654E+001	-4.854E+002
75.0	-4.691E-001	-3.827E+001	-3.482E+002
80.0	-9.080E-002	-3.955E+001	-1.976E+002
85.0	2.934E-001	-4.034E+001	-3.879E+001
90.0	6.793E-001	-4.061E+001	1.251E+002
95.0	1.063E+000	-4.034E+001	2.875E+002
100.0	1.439E+000	-3.955E+001	4.440E+002
105.0	1.805E+000	-3.827E+001	5.898E+002
110.0	2.155E+000	-3.654E+001	7.204E+002
115.0	2.487E+000	-3.441E+001	8.318E+002
120.0	2.796E+000	-3.197E+001	9.206E+002
125.0	3.080E+000	-2.929E+001	9.838E+002
130.0	3.336E+000	-2.643E+001	1.019E+003
135.0	3.561E+000	-2.349E+001	1.026E+003
140.0	3.755E+000	-2.053E+001	1.004E+003
145.0	3.914E+000	-1.761E+001	9.531E+002
150.0	4.039E+000	-1.477E+001	8.748E+002
155.0	4.129E+000	-1.204E+001	7.714E+002
160.0	4.185E+000	-9.429E+000	6.457E+002
165.0	4.206E+000	-6.945E+000	5.013E+002
170.0	4.194E+000	-4.565E+000	3.425E+002
175.0	4.150E+000	-2.262E+000	1.738E+002
180.0	4.076E+000	0.000E+000	0.000E+000

7.3 Wave-drift load coefficients

Wave drift angle of attack: 0.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-3.587E-004	2.821E-011	-1.311E-008
1.776e-001	-4.640E-004	3.649E-011	-2.346E-008
2.072e-001	-6.216E-004	4.893E-011	-4.770E-008
2.487e-001	-8.829E-004	6.979E-011	-1.107E-007
2.764e-001	-1.061E-003	7.700E-011	-1.748E-007
3.110e-001	-1.318E-003	1.125E-010	-2.700E-007
3.455e-001	-1.604E-003	1.783E-010	-3.304E-007
3.658e-001	-1.800E-003	2.090E-010	-2.938E-007
3.886e-001	-2.037E-003	3.561E-010	-8.462E-008
4.146e-001	-2.344E-003	9.672E-011	7.367E-007
4.288e-001	-2.507E-003	1.847E-010	1.639E-006
4.442e-001	-2.666E-003	7.145E-010	7.383E-007
4.606e-001	-2.952E-003	-4.259E-010	-2.253E-006
4.783e-001	-3.173E-003	6.782E-010	-2.478E-006
4.975e-001	-3.477E-003	9.926E-010	-1.944E-006
5.182e-001	-4.049E-003	7.668E-010	-1.161E-006
5.408e-001	-6.106E-003	-5.721E-010	-4.531E-006
5.653e-001	-1.319E-002	-3.211E-009	-1.909E-006
5.922e-001	-3.610E-002	-2.641E-009	4.005E-006
6.218e-001	-1.034E-001	-1.790E-009	7.310E-006
6.546e-001	-2.822E-001	2.312E-008	1.073E-005
6.909e-001	-7.005E-001	4.468E-008	1.714E-005
7.316e-001	-1.526E+000	7.599E-008	2.229E-005
7.773e-001	-2.873E+000	7.850E-008	2.641E-005
8.291e-001	-4.232E+000	4.833E-007	2.524E-005
8.883e-001	-5.407E+000	6.865E-007	2.626E-005
9.576e-001	-5.737E+000	1.223E-006	2.074E-005
1.036e+000	-5.344E+000	1.849E-006	-7.625E-006
1.131e+000	-4.375E+000	7.442E-007	7.383E-006
1.244e+000	-2.594E+000	8.402E-007	-5.438E-007
1.382e+000	-2.365E+000	1.145E-006	-1.962E-005
1.555e+000	-1.964E+000	7.527E-007	-6.586E-006
1.777e+000	-1.861E+000	8.684E-007	-1.595E-005
2.073e+000	-1.928E+000	1.170E-006	-1.034E-006

Wave drift angle of attack: 15.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-3.349E-004	-8.072E-005	3.549E-002
1.776e-001	-4.383E-004	-1.056E-004	6.422E-002
2.072e-001	-5.924E-004	-1.428E-004	1.329E-001
2.487e-001	-8.335E-004	-2.009E-004	3.184E-001
2.764e-001	-1.029E-003	-2.480E-004	5.173E-001
3.110e-001	-1.332E-003	-3.207E-004	8.468E-001
3.455e-001	-1.783E-003	-4.288E-004	1.194E+000
3.658e-001	-2.273E-003	-5.463E-004	1.320E+000
3.886e-001	-3.508E-003	-8.438E-004	1.235E+000
4.146e-001	-8.680E-003	-2.100E-003	5.005E-001
4.288e-001	-1.936E-002	-4.702E-003	5.517E-002
4.442e-001	-3.892E-002	-9.482E-003	3.162E+000
4.606e-001	-2.687E-002	-6.541E-003	6.738E+000
4.783e-001	-1.477E-002	-3.575E-003	5.849E+000
4.975e-001	-1.020E-002	-2.431E-003	4.228E+000
5.182e-001	-8.616E-003	-1.959E-003	2.125E+000
5.408e-001	-9.354E-003	-1.891E-003	-8.377E-001
5.653e-001	-1.481E-002	-2.525E-003	-5.117E+000
5.922e-001	-3.439E-002	-5.467E-003	1.138E+001
6.218e-001	-9.358E-002	-1.551E-002	-2.018E+001
6.546e-001	-2.540E-001	-4.599E-002	-3.216E+001
6.909e-001	-6.384E-001	-1.288E-001	-4.765E+001
7.316e-001	-1.423E+000	-3.117E-001	-6.589E+001
7.773e-001	-2.698E+000	-7.775E-001	-8.352E+001
8.291e-001	-5.220E+000	-1.650E+000	-9.243E+001
8.883e-001	-5.529E+000	-3.113E+000	-8.076E+001
9.566e-001	-5.861E+000	-4.905E+000	-3.748E+001
1.036e+000	-5.281E+000	-5.992E+000	1.548E+001
1.131e+000	-4.707E+000	-5.415E+000	-5.300E+000
1.244e+000	-3.148E+000	-5.423E+000	-4.814E+001
1.382e+000	-2.799E+000	-6.128E+000	-2.412E+001
1.555e+000	-2.624E+000	-6.613E+000	-5.275E+001
1.777e+000	-2.612E+000	-7.030E+000	-7.296E+001
2.073e+000	-2.700E+000	-7.331E+000	-9.064E+001

Wave drift angle of attack: 30.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-2.728E-004	-1.417E-004	5.473E-002
1.776e-001	-3.504E-004	-1.820E-004	9.703E-002
2.072e-001	-4.759E-004	-2.472E-004	1.969E-001
2.487e-001	-7.017E-004	-3.644E-004	4.661E-001
2.764e-001	-9.049E-004	-4.699E-004	7.562E-001
3.110e-001	-1.291E-003	-6.702E-004	1.244E+000
3.455e-001	-2.169E-003	-1.125E-003	1.780E+000
3.658e-001	-3.345E-003	-1.735E-003	2.006E+000
3.886e-001	-6.727E-003	-3.490E-003	1.983E+000
4.146e-001	-2.273E-002	-1.181E-002	1.265E+000
4.288e-001	-5.647E-002	-2.938E-002	1.327E+000
4.442e-001	-1.183E-001	-6.160E-002	7.485E+000
4.606e-001	-7.901E-002	-4.123E-002	1.251E+001
4.783e-001	-3.991E-002	-2.088E-002	1.072E+001
4.975e-001	-2.472E-002	-1.299E-002	8.399E+000
5.182e-001	-1.845E-002	-9.709E-003	5.682E+000
5.408e-001	-1.635E-002	-8.427E-003	1.935E+000
5.653e-001	-1.859E-002	-8.825E-003	-3.534E+000
5.922e-001	-3.065E-002	-1.264E-002	1.177E+001
6.218e-001	-7.013E-002	-2.630E-002	-2.371E+001
6.546e-001	-1.831E-001	-6.912E-002	-4.071E+001
6.909e-001	-4.721E-001	-1.904E-001	-6.411E+001
7.316e-001	-1.117E+000	-5.154E-001	-9.480E+001
7.773e-001	-2.311E+000	-1.248E+000	-1.314E+002
8.291e-001	-5.021E+000	-2.822E+000	-1.668E+002
8.883e-001	-5.747E+000	-5.730E+000	-1.833E+002
9.566e-001	-6.414E+000	-9.991E+000	-1.451E+002
1.036e+000	-5.515E+000	-1.410E+001	-1.841E+001
1.131e+000	-5.100E+000	-1.543E+001	5.988E+001
1.244e+000	-4.733E+000	-1.546E+001	-3.745E+001
1.382e+000	-3.873E+000	-1.731E+001	-5.911E+001
1.555e+000	-4.043E+000	-1.819E+001	-1.150E+002
1.777e+000	-4.231E+000	-1.891E+001	-1.723E+002
2.073e+000	-3.931E+000	-1.852E+001	-1.992E+002

Wave drift angle of attack: 45.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-1.806E-004	-1.624E-004	5.257E-002
1.776e-001	-2.367E-004	-2.129E-004	8.937E-002
2.072e-001	-3.258E-004	-2.931E-004	1.746E-001
2.487e-001	-5.040E-004	-4.534E-004	4.019E-001
2.764e-001	-6.922E-004	-6.226E-004	6.485E-001
3.110e-001	-1.137E-003	-1.023E-003	1.072E+000
3.455e-001	-2.279E-003	-2.048E-003	1.573E+000
3.658e-001	-4.016E-003	-3.609E-003	1.836E+000
3.886e-001	-9.115E-003	-8.193E-003	2.012E+000
4.146e-001	-3.332E-002	-2.996E-002	2.222E+000
4.288e-001	-8.428E-002	-7.583E-002	3.995E+000
4.442e-001	-1.766E-001	-1.590E-001	1.277E+001
4.606e-001	-1.162E-001	-1.049E-001	1.579E+001
4.783e-001	-5.718E-002	-5.190E-002	1.266E+001
4.975e-001	-3.443E-002	-3.162E-002	1.034E+001
5.182e-001	-2.494E-002	-2.340E-002	8.297E+000
5.408e-001	-2.101E-002	-2.030E-002	5.774E+000
5.653e-001	-2.087E-002	-2.057E-002	2.030E+000
5.922e-001	-2.645E-002	-2.517E-002	3.530E+000
6.218e-001	-4.659E-002	-3.950E-002	-1.224E+001
6.546e-001	-1.068E-001	-8.017E-002	-2.535E+001
6.909e-001	-2.732E-001	-1.940E-001	-4.501E+001
7.316e-001	-6.907E-001	-5.134E-001	-7.444E+001
7.773e-001	-1.610E+000	-1.303E+000	-1.184E+002
8.291e-001	3.280E+000	-3.223E+000	-1.815E+002
8.883e-001	5.568E+000	-7.303E+000	-2.569E+002
9.566e-001	-7.354E+000	-1.428E+001	-2.988E+002
1.036e+000	-7.307E+000	-2.249E+001	-2.197E+002
1.131e+000	-5.499E+000	-2.776E+001	-3.670E+001
1.244e+000	-5.075E+000	-2.928E+001	3.074E+001
1.382e+000	-5.088E+000	-2.942E+001	-1.352E+002
1.555e+000	-4.848E+000	-3.056E+001	-1.982E+002
1.777e+000	-4.870E+000	-3.022E+001	-2.470E+002
2.073e+000	-4.765E+000	-3.097E+001	-2.690E+002

Wave drift angle of attack: 60.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-9.146E-005	-1.425E-004	3.619E-002
1.776e-001	-1.215E-004	-1.893E-004	5.769E-002
2.072e-001	-1.712E-004	-2.667E-004	1.054E-001
2.487e-001	-2.861E-004	-4.458E-004	2.292E-001
2.764e-001	-4.292E-004	-6.686E-004	3.643E-001
3.110e-001	-8.220E-004	-1.280E-003	6.064E-001
3.455e-001	-1.920E-003	-2.990E-003	9.339E-001
3.658e-001	-3.609E-003	-5.620E-003	1.176E+000
3.886e-001	-8.617E-003	-1.342E-002	1.574E+000
4.146e-001	-3.214E-002	-5.002E-002	3.137E+000
4.288e-001	-8.112E-002	-1.263E-001	7.195E+000
4.442e-001	-1.681E-001	-2.619E-001	1.783E+001
4.606e-001	-1.087E-001	-1.698E-001	1.621E+001
4.783e-001	-5.226E-002	-8.224E-002	1.107E+001
4.975e-001	-3.076E-002	-4.925E-002	8.602E+000
5.182e-001	-2.189E-002	-3.636E-002	7.168E+000
5.408e-001	-1.829E-002	-3.240E-002	5.890E+000
5.653e-001	-1.789E-002	-3.473E-002	4.237E+000
5.922e-001	-2.104E-002	-4.481E-002	1.634E+000
6.218e-001	-3.092E-002	-6.861E-002	-2.421E+000
6.546e-001	-5.805E-002	-1.232E-001	-9.153E+000
6.909e-001	-1.330E-001	-2.550E-001	-2.034E+001
7.316e-001	-3.383E-001	-5.142E-001	-3.961E+001
7.773e-001	-8.748E-001	-1.512E+000	-7.430E+001
8.291e-001	-1.411E+000	-4.022E+000	-1.362E+002
8.883e-001	-1.569E+000	-1.013E+001	-2.175E+002
9.566e-001	-7.222E+000	-2.012E+001	-2.386E+002
1.036e+000	-8.527E+000	-2.987E+001	-2.228E+002
1.131e+000	-7.917E+000	-3.431E+001	-2.392E+002
1.244e+000	-6.292E+000	-3.749E+001	-2.246E+002
1.382e+000	-5.140E+000	-3.994E+001	-1.357E+002
1.555e+000	-5.190E+000	-4.115E+001	-1.186E+002
1.777e+000	-5.377E+000	-4.179E+001	-2.411E+002
2.073e+000	-5.179E+000	-4.245E+001	-2.262E+002

Wave drift angle of attack: 75.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-2.531E-005	-8.498E-005	1.703E-002
1.776e-001	-3.425E-005	-1.150E-004	2.513E-002
2.072e-001	-5.167E-005	-1.735E-004	4.186E-002
2.487e-001	-1.010E-004	-3.392E-004	8.423E-002
2.764e-001	-1.744E-004	-5.854E-004	1.323E-001
3.110e-001	-3.950E-004	-1.326E-003	2.300E-001
3.455e-001	-1.055E-003	-3.542E-003	4.152E-001
3.658e-001	-2.081E-003	-6.980E-003	6.312E-001
3.886e-001	-5.104E-003	-1.711E-002	1.198E+000
4.146e-001	-1.913E-002	-6.408E-002	3.847E+000
4.288e-001	-4.798E-002	-1.606E-001	9.709E+000
4.442e-001	-9.817E-002	-3.287E-001	2.139E+001
4.606e-001	-6.226E-002	-2.090E-001	1.544E+001
4.783e-001	-2.920E-002	-9.881E-002	8.472E+000
4.975e-001	-1.674E-002	-5.791E-002	5.604E+000
5.182e-001	-1.170E-002	-4.253E-002	4.232E+000
5.408e-001	-9.800E-003	-3.908E-002	3.347E+000
5.653e-001	-9.874E-003	-4.516E-002	2.504E+000
5.922e-001	-1.204E-002	-6.438E-002	1.334E+000
6.218e-001	-1.765E-002	-1.082E-001	-4.132E-001
6.546e-001	-3.065E-002	-2.054E-001	-3.529E+000
6.909e-001	-6.243E-002	-4.295E-001	-9.170E+000
7.316e-001	-1.478E-001	-9.154E-001	-1.988E+001
7.773e-001	-3.945E-001	-2.483E+000	-4.124E+001
8.291e-001	-1.200E+000	-6.764E+000	-8.271E+001
8.883e-001	2.996E+000	-1.764E+001	-1.306E+002
9.566e-001	-5.350E+000	-3.236E+001	-6.315E+001
1.036e+000	-5.741E+000	-4.032E+001	8.476E+001
1.137e+000	-5.556E+000	-4.205E+001	1.445E+002
1.244e+000	-5.906E+000	-4.282E+001	1.008E+002
1.382e+000	-5.916E+000	-4.361E+001	-7.948E-001
1.555e+000	-5.894E+000	-4.580E+001	-1.309E+002
1.777e+000	-5.660E+000	-4.838E+001	-1.901E+002
2.073e+000	-5.069E+000	-4.979E+001	-1.294E+002

Wave drift angle of attack: 90.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	2.946E-029	-3.705E-006	1.903E-004
1.776e-001	7.989E-029	-1.071E-005	5.291E-004
2.072e-001	-2.782E-011	-3.427E-005	1.729E-003
2.487e-001	-4.571E-010	-1.546E-004	7.621E-003
2.764e-001	-3.491E-009	-3.761E-004	1.913E-002
3.110e-001	-3.520E-008	-1.126E-003	5.893E-002
3.455e-001	-3.050E-007	-3.473E-003	1.891E-001
3.658e-001	-1.119E-006	-7.143E-003	3.993E-001
3.886e-001	-5.191E-006	-1.804E-002	1.040E+000
4.146e-001	-3.768E-005	-6.837E-002	4.100E+000
4.288e-001	-1.327E-004	-1.714E-001	1.051E+001
4.442e-001	-3.827E-004	-3.492E-001	2.192E+001
4.606e-001	-3.426E-004	-2.199E-001	1.410E+001
4.783e-001	-2.258E-004	-1.027E-001	6.641E+000
4.975e-001	-1.787E-004	-5.942E-002	3.748E+000
5.182e-001	-1.660E-004	-4.336E-002	2.485E+000
5.408e-001	-1.724E-004	-4.029E-002	1.858E+000
5.653e-001	-1.973E-004	-4.831E-002	1.510E+000
5.922e-001	-2.541E-004	-7.219E-002	1.414E+000
6.218e-001	-4.034E-004	-1.272E-001	1.453E+000
6.546e-001	-8.763E-004	-2.505E-001	1.667E+000
6.909e-001	-2.578E-003	-5.370E-001	2.060E+000
7.316e-001	-8.971E-003	-1.249E+000	2.410E+000
7.773e-001	-3.381E-002	-3.164E+000	1.285E+000
8.291e-001	-1.386E-001	-8.635E+000	-8.641E+000
8.883e-001	6.226E-001	-2.247E+001	-5.297E+001
9.566e-001	-2.252E+000	-3.969E+001	-1.127E+002
1.036e+000	-4.303E+000	-4.546E+001	-1.112E+001
1.137e+000	-4.303E+000	-4.638E+001	9.253E+001
1.244e+000	-3.506E+000	-4.609E+001	8.939E+001
1.382e+000	-3.273E+000	-4.730E+001	3.341E+001
1.555e+000	-3.171E+000	-4.976E+001	-1.719E+001
1.777e+000	-3.432E+000	-5.117E+001	-3.617E+001
2.073e+000	-3.835E+000	-5.196E+001	-1.289E+001

Preliminary Design, @IDR5

Wave drift angle of attack: 105.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-2.304E-005	7.736E-005	-1.670E-002
1.776e-001	-2.819E-005	9.463E-005	-2.419E-002
2.072e-001	-3.231E-005	1.085E-004	-3.876E-002
2.487e-001	-1.793E-005	6.022E-005	-7.047E-002
2.764e-001	2.998E-005	-1.006E-004	-9.761E-002
3.110e-001	2.130E-004	-7.150E-004	-1.239E-001
3.455e-001	8.267E-004	-2.776E-003	-7.467E-002
3.658e-001	1.815E-003	-6.093E-003	8.706E-002
3.886e-001	4.779E-003	-1.605E-002	6.721E-001
4.146e-001	1.865E-002	-6.266E-002	3.523E+000
4.288e-001	4.725E-002	-1.589E-001	9.183E+000
4.442e-001	9.710E-002	-3.272E-001	1.800E+001
4.606e-001	6.150E-002	-2.082E-001	9.882E+000
4.783e-001	2.867E-002	-9.817E-002	3.451E+000
4.975e-001	1.627E-002	-5.721E-002	1.118E+000
5.182e-001	1.120E-002	-4.166E-002	2.145E-001
5.408e-001	9.281E-003	-3.813E-002	-3.982E-002
5.653e-001	9.302E-003	-4.407E-002	2.107E-001
5.922e-001	1.138E-002	-6.305E-002	1.037E+000
6.218e-001	1.683E-002	-1.065E-001	2.777E+000
6.546e-001	2.942E-002	-2.025E-001	5.997E+000
6.909e-001	6.032E-002	-4.235E-001	1.173E+001
7.316e-001	1.441E-001	-9.177E-001	2.173E+001
7.773e-001	3.926E-001	-2.419E+000	3.827E+001
8.291e-001	1.150E+000	-6.502E+000	5.737E+001
8.883e-001	3.038E+000	-1.668E+001	2.952E+001
9.566e-001	4.758E+000	-3.054E+001	-8.325E+001
1.036e+000	3.658E+000	-3.953E+001	5.726E+001
1.131e+000	2.436E+000	-4.299E+001	2.560E+002
1.244e+000	1.949E+000	-4.521E+001	2.998E+002
1.382e+000	1.264E+000	-4.562E+001	2.233E+002
1.555e+000	-3.432E-002	-4.445E+001	1.476E+002
1.777e+000	-9.993E-001	-4.558E+001	1.371E+002
2.073e+000	-1.209E+000	-4.650E+001	1.090E+002

Wave drift angle of attack: 120.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-8.813E-005	1.373E-004	-3.591E-002
1.776e-001	-1.121E-004	1.747E-004	-5.693E-002
2.072e-001	-1.418E-004	2.210E-004	-1.030E-001
2.487e-001	-1.572E-004	2.449E-004	-2.194E-001
2.764e-001	-1.088E-004	1.695E-004	-3.396E-001
3.110e-001	1.384E-004	-2.153E-004	-5.300E-001
3.455e-001	1.085E-003	-1.690E-003	-6.896E-001
3.658e-001	2.655E-003	-4.135E-003	-6.605E-001
3.886e-001	7.487E-003	-1.166E-002	-2.335E-001
4.146e-001	3.066E-002	-4.776E-002	2.140E+000
4.288e-001	7.928E-002	-1.235E-001	6.326E+000
4.442e-001	1.663E-001	-2.594E-001	1.035E+001
4.606e-001	1.076E-001	-1.683E-001	1.893E+000
4.783e-001	5.130E-002	-8.091E-002	-2.560E+000
4.975e-001	2.977E-002	-4.782E-002	-3.819E+000
5.182e-001	2.083E-002	-3.478E-002	-4.027E+000
5.408e-001	1.717E-002	-3.069E-002	-3.593E+000
5.653e-001	1.673E-002	-3.290E-002	-2.436E+000
5.922e-001	1.982E-002	-4.268E-002	-2.130E-001
6.218e-001	2.986E-002	-6.612E-002	3.630E+000
6.546e-001	5.784E-002	-1.196E-001	9.949E+000
6.909e-001	1.364E-001	-2.476E-001	2.019E+001
7.316e-001	3.587E-001	-5.128E-001	3.687E+001
7.773e-001	9.711E-001	-1.437E+000	6.387E+001
8.291e-001	2.551E+000	-3.736E+000	1.017E+002
8.883e-001	5.967E+000	-9.176E+000	1.201E+002
9.566e-001	9.955E+000	-1.820E+001	1.073E+002
1.036e+000	9.984E+000	-2.809E+001	2.144E+002
1.131e+000	6.121E+000	-3.310E+001	2.682E+002
1.244e+000	3.065E+000	-3.324E+001	2.129E+002
1.382e+000	2.084E+000	-3.289E+001	2.175E+002
1.555e+000	2.458E+000	-3.426E+001	2.251E+002
1.777e+000	2.503E+000	-3.493E+001	2.245E+002
2.073e+000	2.333E+000	-3.541E+001	2.184E+002

Wave drift angle of attack: 135.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-1.775E-004	1.597E-004	-5.242E-002
1.776e-001	-2.281E-004	2.052E-004	-8.888E-002
2.072e-001	-2.969E-004	2.671E-004	-1.731E-001
2.487e-001	-3.805E-004	3.423E-004	-3.966E-001
2.764e-001	-3.828E-004	3.445E-004	-6.349E-001
3.110e-001	-2.134E-004	1.925E-004	-1.031E+000
3.455e-001	6.564E-004	-5.886E-004	-1.440E+000
3.658e-001	2.173E-003	-1.951E-003	-1.557E+000
3.886e-001	7.002E-003	-6.289E-003	-1.286E+000
4.146e-001	3.073E-002	-2.761E-002	6.336E-001
4.288e-001	8.129E-002	-7.306E-002	3.316E+000
4.442e-001	1.737E-001	-1.563E-001	2.457E+000
4.606e-001	1.143E-001	-1.030E-001	-6.022E+000
4.783e-001	5.527E-002	-5.007E-002	-8.080E+000
4.975e-001	3.241E-002	-2.971E-002	-7.782E+000
5.182e-001	2.277E-002	-2.136E-002	-6.645E+000
5.408e-001	1.874E-002	-1.818E-002	-4.606E+000
5.653e-001	1.862E-002	-1.843E-002	-1.238E+000
5.922e-001	2.434E-002	-2.302E-002	4.158E+000
6.218e-001	4.488E-002	-3.727E-002	1.249E+001
6.546e-001	1.066E-001	-7.732E-002	2.505E+001
6.909e-001	2.780E-001	-1.882E-001	4.366E+001
7.316e-001	7.145E-001	-4.154E-001	7.081E+001
7.773e-001	1.701E+000	-1.236E+000	1.089E+002
8.291e-001	3.591E+000	-2.964E+000	1.544E+002
8.883e-001	5.350E+000	-6.431E+000	1.825E+002
9.566e-001	8.356E+000	-1.206E+001	1.712E+002
1.036e+000	6.856E+000	-1.832E+001	1.388E+002
1.131e+000	4.635E+000	-2.160E+001	8.956E+001
1.244e+000	5.433E+000	-2.253E+001	1.404E+002
1.382e+000	5.036E+000	-2.224E+001	1.862E+002
1.555e+000	4.717E+000	-2.215E+001	2.021E+002
1.777e+000	4.982E+000	-2.151E+001	2.516E+002
2.073e+000	5.239E+000	-2.194E+001	2.507E+002

Wave drift angle of attack: 150.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-2.717E-004	1.411E-004	-5.465E-002
1.776e-001	-3.467E-004	1.801E-004	-9.678E-002
2.072e-001	-4.631E-004	2.405E-004	-1.964E-001
2.487e-001	-6.207E-004	3.224E-004	-4.642E-001
2.764e-001	-7.085E-004	3.681E-004	-7.515E-001
3.110e-001	-6.981E-004	3.630E-004	-1.229E+000
3.455e-001	-2.679E-004	1.410E-004	-1.733E+000
3.658e-001	6.671E-004	-3.426E-004	-1.907E+000
3.886e-001	3.735E-003	-1.931E-003	-1.725E+000
4.146e-001	1.926E-002	-9.974E-003	-2.499E-001
4.288e-001	5.268E-002	-2.729E-002	1.267E+000
4.442e-001	1.145E-001	-5.936E-002	-2.094E+000
4.606e-001	7.580E-002	-3.932E-002	-9.072E+000
4.783e-001	3.660E-002	-1.903E-002	-9.129E+000
4.975e-001	2.128E-002	-1.112E-002	-7.528E+000
5.182e-001	1.491E-002	-7.816E-003	-5.144E+000
5.408e-001	1.272E-002	-6.515E-003	-1.592E+000
5.653e-001	1.487E-002	-6.884E-003	3.725E+000
5.922e-001	2.710E-002	-1.077E-002	1.179E+001
6.218e-001	6.698E-002	-2.455E-002	2.351E+001
6.546e-001	1.809E-001	-6.704E-002	4.017E+001
6.909e-001	4.718E-001	-1.862E-001	6.308E+001
7.316e-001	1.119E+000	-4.108E-001	9.296E+001
7.773e-001	2.309E+000	-1.188E+000	1.276E+002
8.291e-001	3.951E+000	-2.584E+000	1.558E+002
8.883e-001	5.423E+000	-4.955E+000	1.529E+002
9.566e-001	5.962E+000	-8.104E+000	1.118E+002
1.036e+000	6.412E+000	-1.071E+001	9.107E+001
1.131e+000	8.128E+000	-1.055E+001	1.308E+002
1.244e+000	7.920E+000	-9.376E+000	1.544E+002
1.382e+000	6.864E+000	-9.788E+000	1.145E+002
1.555e+000	6.958E+000	-9.987E+000	1.124E+002
1.777e+000	6.982E+000	-1.055E+001	1.256E+002
2.073e+000	7.205E+000	-1.104E+001	1.472E+002

Wave drift angle of attack: 165.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-3.396E-004	8.186E-005	-3.544E-002
1.776e-001	-4.346E-004	1.048E-004	-6.420E-002
2.072e-001	-5.912E-004	1.425E-004	-1.329E-001
2.487e-001	-8.089E-004	1.950E-004	-3.181E-001
2.764e-001	-9.776E-004	2.357E-004	-5.165E-001
3.110e-001	-1.135E-003	2.739E-004	-8.448E-001
3.455e-001	-1.166E-003	2.824E-004	-1.187E+000
3.658e-001	-9.615E-004	2.342E-004	-1.305E+000
3.886e-001	-8.988E-005	2.675E-005	-1.197E+000
4.146e-001	4.709E-003	-1.120E-003	-3.496E-001
4.288e-001	1.516E-002	-3.619E-003	3.279E-001
4.442e-001	3.459E-002	-8.252E-003	-2.378E+000
4.606e-001	2.253E-002	-5.355E-003	-6.252E+000
4.783e-001	1.028E-002	-2.421E-003	-5.638E+000
4.975e-001	5.470E-003	-1.254E-003	-4.128E+000
5.182e-001	3.792E-003	-7.834E-004	-2.084E+000
5.408e-001	4.432E-003	-7.150E-004	8.336E+000
5.653e-001	9.961E-003	-1.392E-003	5.093E+000
5.922e-001	2.964E-002	-4.381E-003	1.126E+001
6.218e-001	8.904E-002	-1.451E-002	1.996E+001
6.546e-001	2.494E-001	-4.480E-002	3.183E+001
6.909e-001	6.312E-001	-1.263E-001	4.723E+001
7.316e-001	1.400E+000	-3.128E-001	6.550E+001
7.773e-001	2.609E+000	-7.397E-001	8.314E+001
8.291e-001	5.901E+000	-1.504E+000	9.101E+001
8.883e-001	1.714E+000	-2.671E+000	7.741E+001
9.566e-001	5.508E+000	-3.981E+000	5.426E+001
1.036e+000	8.094E+000	-4.563E+000	7.273E+001
1.131e+000	9.361E+000	-3.449E+000	1.142E+002
1.244e+000	7.788E+000	-2.607E+000	9.452E+001
1.382e+000	8.017E+000	-2.623E+000	8.787E+001
1.555e+000	8.176E+000	-2.232E+000	6.916E+001
1.777e+000	8.502E+000	-2.099E+000	6.198E+001
2.073e+000	8.517E+000	-2.309E+000	6.151E+001

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Wave drift angle of attack: 180.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-3.585E-004	-3.055E-031	-3.465E-029
1.776e-001	-4.653E-004	-2.770E-031	-1.086E-028
2.072e-001	-6.244E-004	-8.618E-030	-7.551E-012
2.487e-001	-8.801E-004	-1.475E-029	8.379E-012
2.764e-001	-1.055E-003	-7.651E-012	-1.585E-010
3.110e-001	-1.307E-003	-1.074E-011	1.383E-009
3.455e-001	-1.556E-003	-3.598E-011	1.776E-009
3.658e-001	-1.678E-003	1.146E-010	-9.151E-009
3.886e-001	-1.782E-003	4.554E-011	-5.592E-009
4.146e-001	-1.891E-003	-4.151E-010	-2.721E-008
4.288e-001	-1.923E-003	-2.533E-010	3.598E-009
4.442e-001	-1.931E-003	3.976E-011	1.838E-008
4.606e-001	-1.891E-003	1.010E-011	-4.468E-008
4.783e-001	-1.883E-003	-4.829E-010	-2.242E-008
4.975e-001	-1.759E-003	2.529E-010	2.387E-008
5.182e-001	-1.288E-003	-7.090E-010	-5.349E-008
5.408e-001	6.427E-004	5.586E-010	2.958E-008
5.653e-001	7.748E-003	2.856E-009	-1.350E-008
5.922e-001	3.071E-002	5.013E-009	-5.351E-008
6.218e-001	9.820E-002	-6.695E-009	-2.996E-007
6.546e-001	2.764E-001	-7.136E-009	2.812E-007
6.909e-001	6.903E-001	-3.335E-008	-3.188E-007
7.316e-001	1.493E+000	9.122E-009	-4.997E-007
7.773e-001	2.682E+000	1.325E-008	-3.126E-006
8.291e-001	3.831E+000	-1.061E-008	6.908E-007
8.883e-001	4.506E+000	-1.012E-008	-6.842E-007
9.566e-001	5.607E+000	-2.524E-007	-2.267E-006
1.036e+000	8.749E+000	6.161E-007	-8.715E-006
1.131e+000	9.249E+000	6.173E-008	-6.793E-006
1.244e+000	7.681E+000	4.398E-008	7.865E-006
1.382e+000	8.000E+000	-4.487E-007	1.504E-005
1.555e+000	8.208E+000	3.338E-008	3.782E-006
1.777e+000	8.623E+000	-1.776E-007	-3.720E-006
2.073e+000	8.566E+000	-1.444E-007	3.543E-007

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7. Appendix B: Kongsberg DP Report, With 50% Bow Thruster Power Limit

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DP Capability Analysis Report Arctic Research Vessel

Foot no:	Foot_8092_RevG2.scp				
KM project:	N/A				
Product:	The Kongsberg Maritime computer program StatCap Report v 3.3.4.1 has been used for the calculations.				
Synopsis:	This document contains a DP capability analysis for Arctic Research Vessel.				
Document no:	N/A			Revision:	G
Customer doc no:	N/A			Version:	2
Contract no:	N/A			Pages:	350
Rev	Date	Reason for issue	Made by	Checked	Approved
A	Jun 23, 2022	First issue	MatthewD		
B	Sep 19, 2022	Redesign	MatthewD		
C	Sep 20, 2022	Updated Cases	matthewd		
D	Sep 27, 2022	Changed wave spectrum & frequency	MatthewD		
E	Dec 15, 2022	Modified Wind Profile	MatthewD		
F	Jan 06, 2023	Bow Thruster - 50% Power	MatthewD		
G	Jun 21, 2023	Updated Wind Profile	matthewd		

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Document history

<i>Revision</i>	<i>Description of change</i>
A	First issue
B	Updated wind model, LOA, LPP, breadth, draught, displacement, thruster size and locations
C	
D	
E	
F	
G	

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References

<i>Reference 1</i>	<i>General arrangement</i>
<i>Reference 2</i>	<i>Thruster data and location input</i>
<i>Reference 3</i>	<i>Power configuration</i>
<i>Reference 4</i>	<p><i>Wind load coefficients</i> <i>Brix, J. (editor)</i> Manoeuvring Technical Manual Seehafen Verlag, 1993.</p>
<i>Reference 5</i>	<p><i>Current load coefficients</i> <i>Faltinsen, O. M.</i> Sea Loads on Ships and Offshore Structures Cambridge University Press 1990.</p>
<i>Reference 6</i>	<p><i>Wave-drift load coefficients</i> Scaled from similar vessel.</p>
<i>Reference 7</i>	<p><i>Thrust to power relationship</i> <i>The International Marine Contractors Association</i> Specification for DP capability plots IMCA M 140 Rev. 1, June 2000.</p>
<i>Reference 8</i>	<p><i>Thrust loss calculations</i> <i>Lehn, E.</i> Practical methods for estimation of thrust losses MARINTEK publication R-102.80, October 1990. <i>Lehn, E. and Larsen, K.</i> Thrusters in extreme condition, part 1 & part 2. FPS-2000 1.6B, January, 1990. <i>Svensen, T.</i> Thruster considerations in the design of DP assisted vessels NIF, June, 1992.</p>

<p><i>Reference 9 Thruster forbidden zones</i></p> <p><i>Lehn, E.</i> On the propeller race interaction effects <i>MARINTEK publication P-01.85, September 1985.</i></p>
<p><i>Reference 10 Wave spectrum</i></p> <p><i>Faltinsen, O. M.</i> Sea Loads on Ships and Offshore Structures <i>Cambridge University Press 1990.</i></p> <p>Model for a doubly peaked wave spectrum <i>SINTEF STF22 A96204, 1996.</i></p>
<p><i>Reference 11 Wind spectrum</i></p> <p><i>Norwegian Petroleum Directorate</i> Regulations relating to loadbearing structures in the petroleum activities <i>Guidelines relating to loads and load effects etc., 1998</i></p>
<p><i>Reference 12 Wind speed and wave height relationship</i></p> <p><i>The International Marine Contractors Association</i> Specification for DP capability plots <i>IMCA M 140 Rev. 1, June 2000.</i></p>

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1 Summary

This document contains a DP capability analysis for Arctic Research Vessel. The analysis has been based upon the information given in Reference 1 and Reference 2. The nominal bollard thrust is calculated from power according to Reference 7. The Kongsberg Maritime computer program StatCap Report has been used for the calculations.

The simulation case definitions are given in Table 1. T1 denotes thruster number 1, T2 thruster number 2 and so on. For details regarding thruster layout, see Figure 10.

<i>Case no.</i>	<i>Thrusters active</i>	<i>Case description</i>
1	T1-T3	Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 4
2	T1-T3	Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 4
3	T1-T3	Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 4
4	T1-T3	Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 4
5	T1-T3	Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 4
6	T1-T3	Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 4
7	T1-T3	Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 4
8	T1-T3	Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 4
9	T1-T3	Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 4
10	T1-T3	Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 4
11	T1-T3	Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 4
12	T1-T3	Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 4
13	T1-T3	Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 4
14	T1-T3	Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 4
15	T1-T3	Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 4
16	T1-T3	Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 4

		current, Sea State 4
17	T1-T3	Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 4
18	T1-T3	Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 4
19	T1-T3	Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 4
20	T1-T3	Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 5
21	T1-T3	Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 5
22	T1-T3	Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 5
23	T1-T3	Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 5
24	T1-T3	Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 5
25	T1-T3	Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 5
26	T1-T3	Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 5
27	T1-T3	Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 5
28	T1-T3	Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 5
29	T1-T3	Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 5
30	T1-T3	Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 5
31	T1-T3	Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 5
32	T1-T3	Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 5
33	T1-T3	Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 5
34	T1-T3	Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 5
35	T1-T3	Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 5
36	T1-T3	Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 5
37	T1-T3	Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 5

38	T1-T3	Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 5
39	T1-T3	Thrust Utilization: 35 knots wind. 0 current, 0 waves

Table 1: Simulation case definitions.

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The simulation results are summarised in Table 2 showing the limiting conditions at the most unfavourable directions.

Case no.	Wind speed [kts]	Wind direction [deg]	Wave height Hs [m]	Wave period, Tz [s]	Wave period, Tp [s]	Current speed [kts]	Thrust utilisation [%]
1	35.00	0	2.50	6.05	8.50	2.00	96.0
2	35.00	10	2.50	6.05	8.50	2.00	> 100.0
3	35.00	20	2.50	6.05	8.50	2.00	> 100.0
4	35.00	30	2.50	6.05	8.50	2.00	> 100.0
5	35.00	40	2.50	6.05	8.50	2.00	> 100.0
6	35.00	50	2.50	6.05	8.50	2.00	> 100.0
7	35.00	60	2.50	6.05	8.50	2.00	> 100.0
8	35.00	70	2.50	6.05	8.50	2.00	> 100.0
9	35.00	80	2.50	6.05	8.50	2.00	> 100.0
10	35.00	90	2.50	6.05	8.50	2.00	> 100.0
11	35.00	100	2.50	6.05	8.50	2.00	> 100.0
12	35.00	110	2.50	6.05	8.50	2.00	> 100.0
13	35.00	120	2.50	6.05	8.50	2.00	> 100.0
14	35.00	130	2.50	6.05	8.50	2.00	> 100.0
15	35.00	140	2.50	6.05	8.50	2.00	> 100.0
16	35.00	150	2.50	6.05	8.50	2.00	> 100.0
17	35.00	160	2.50	6.05	8.50	2.00	> 100.0
18	35.00	170	2.50	6.05	8.50	2.00	> 100.0
19	35.00	180	2.50	6.05	8.50	2.00	> 100.0
20	35.00	0	4.00	6.69	9.40	2.00	98.1
21	35.00	10	4.00	6.69	9.40	2.00	> 100.0
22	35.00	20	4.00	6.69	9.40	2.00	> 100.0
23	35.00	30	6.35	6.69	9.40	2.00	> 100.0
24	35.00	40	4.00	6.69	9.40	2.00	> 100.0
25	35.00	50	4.00	6.69	9.40	2.00	> 100.0
26	35.00	60	4.00	6.69	9.40	2.00	> 100.0
27	35.00	70	4.00	6.69	9.40	2.00	> 100.0
28	35.00	80	4.00	6.69	9.40	2.00	> 100.0
29	35.00	90	4.00	6.69	9.40	2.00	> 100.0
30	35.00	100	4.00	6.69	9.40	2.00	> 100.0
31	35.00	110	4.00	6.69	9.40	2.00	> 100.0
32	35.00	120	4.00	6.69	9.40	2.00	> 100.0
33	35.00	130	4.00	6.69	9.40	2.00	> 100.0
34	35.00	140	4.00	6.69	9.40	2.00	> 100.0

35	35.00	150	4.00	6.69	9.40	2.00	> 100.0
36	35.00	160	4.00	6.69	9.40	2.00	> 100.0
37	35.00	170	4.00	6.69	9.40	2.00	> 100.0
38	35.00	180	4.00	6.69	9.40	2.00	> 100.0
39	35.00	60	0.00	0.00	0.00	0.00	83.4

Table 2: Limiting conditions at most unfavourable directions.

Note! *In normal operating conditions, the thrust is reduced due to current, waves and proximity to the hull. Approximations for the thrust losses are taken into account in the simulations. See section 4.6.*

Note! *A certain amount of dynamic load allowance is included in the simulations. The dynamic allowance is the 'spare' thrust required to compensate for the dynamic effects of the wind and wave drift loads, see section 3.4.*

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2 Coordinate system

The coordinate system used is the orthogonal right-handed system shown in Figure 1 with the positive z-axis pointing downwards. The origin of the coordinate system can be offset a longitudinal distance X_0 from $L_{pp}/2$. The origin of y- and z-axis is centreline and keel.

The directions of the wind, waves and current are defined by means of coming-from directions and are considered positive when turning clockwise, e.g. a wind direction equal to 0 degrees exerts a negative longitudinal force on the vessel.

Unless otherwise stated, the directions of the wind, waves and current are coincident in the analyses.

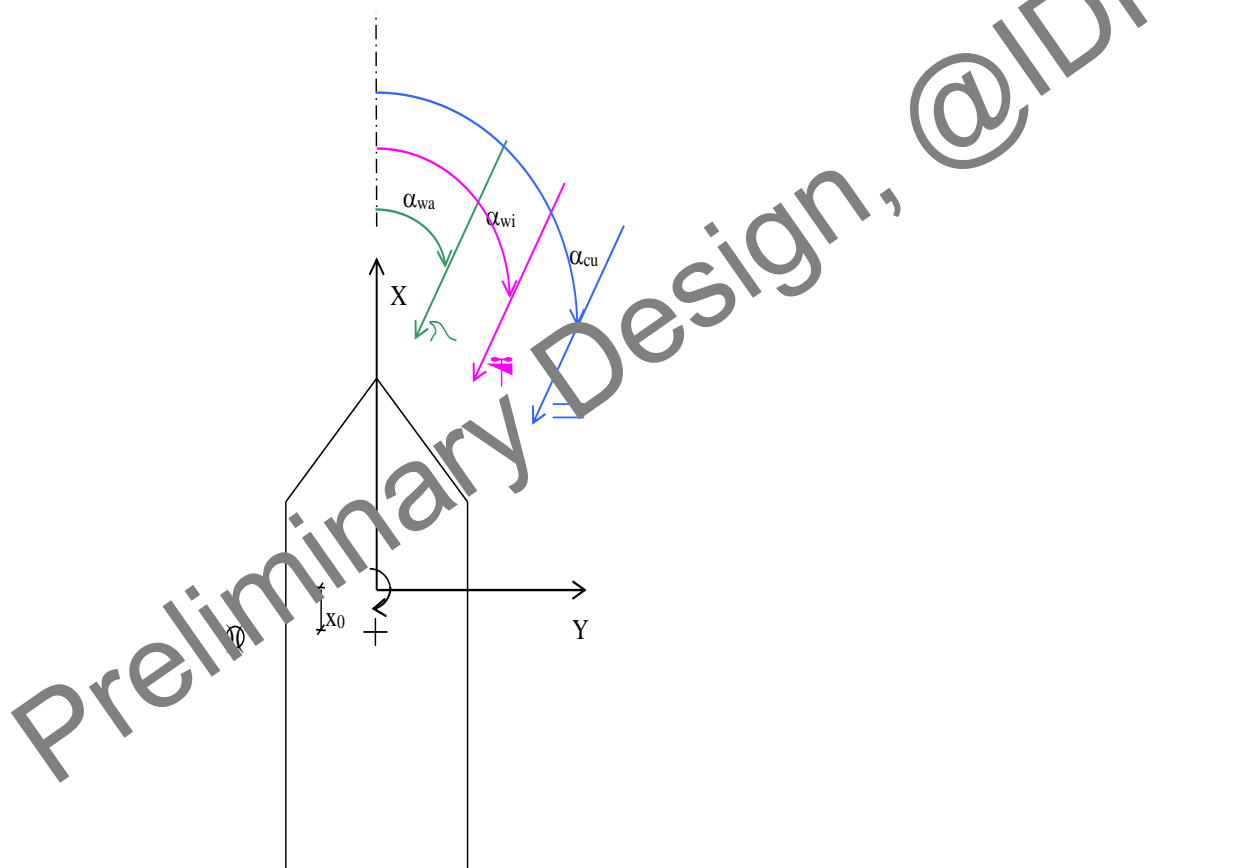


Figure 1: Coordinate system and sign conventions.

3 DP capability

3.1 Definition

DP capability defines a DP vessel's station-keeping ability under given environmental and operational conditions.

3.2 Wind speed envelopes

DP capability analyses are generally used to establish the maximum weather conditions in which a DP vessel can maintain its position and heading for a proposed thruster configuration. The environmental forces and moments are increased until they are exactly balanced by the maximum available thrust offered by the thruster configuration. Thus, a limiting weather condition is obtained as a combination of a mean wind speed, significant wave height and a sea current speed. Wind, current and waves are normally taken as coming from the same direction. By allowing the environmental components to rotate in steps around the vessel, the results of a DP capability analysis can be presented by means of a limiting mean wind speed for a discrete number of wind angles of attack. The resulting polar plot is often referred to as a DP capability envelope.

Limiting weather conditions are limited to 100 kts wind speed to avoid conditions without sufficient statistical data about corresponding sea states.

3.3 Thrust utilisation envelopes

When a design sea state is determined by the client, DP capability can be presented by means of a thrust utilisation envelope instead of a limiting wind speed envelope. The required thrust to maintain position and heading in the design sea state is calculated and compared to the vessel's maximum available thrust. The ratio between the two is plotted as a function of wind direction. A thrust utilisation less than or equal to 100% means that the vessel is able to hold position and heading in the specified design sea state. If the ratio exceeds 100%, the vessel will experience poor positioning performance or drift off.

3.4 Dynamic allowance

A DP vessel needs a certain amount of 'spare' thrust to compensate for the dynamic behaviour of the wind and wave drift loads. The 'spare' thrust is calculated from the spectral densities of the wind and wave drift loads and the controller's restoring and damping characteristics ($1.0 \cdot \text{STD}$ of thrust demand).

The dynamic variations in wind, represented as wind spectra, influences the dynamic allowance. The NPD spectrum is used in the calculations. For descriptions of the wind spectrum refer to the literature, e.g. see Reference 11.

4 Input data

The input data for the calculations are based upon the information given in Reference 1 and Reference 2.

4.1 Main particulars

The vessel main particulars are listed below in Table 3:

Length over all	111.3 m
Length between perpendiculars	102.1 m
Breadth	24.4 m
Draught	9.6 m
Displacement	13 500.0 t
Longitudinal radius of inertia (0.25 * Lpp)	25.5 m
Position of origin ahead of Lpp/2 (Xo)	0.0 m
Wind load coefficients	Calculated (Blendermann)
Current load coefficients	Calculated (Strip-theory)
Wave-drift load coefficients	Database (Scaled by Breadth/Length)

Table 3: Main particulars.

4.2 Wind load coefficients

Blendermann's method is used for obtaining wind load coefficients. The method describes wind loading functions which can be combined with the vessel's wind resistance in head, stern and beam wind. Typical wind resistance for a number of relevant offshore ship types is also described. See Reference 4.

The wind affected areas are calculated on the basis of Reference 1. The wind area projections are presented in Figure 3 and Figure 4. The resulting areas are listed in Table 4.

Vessel type	Research vessel
Area of frontal projection (36 points)	606.0 m ²
Area of lateral projection (67 points)	1,851.6 m ²
Mean height of lateral projection	16.6 m
Dist. to centroid of lateral position	7.0 m

Table 4: Wind area projections.

The wind load coefficients are presented in Figure 2.

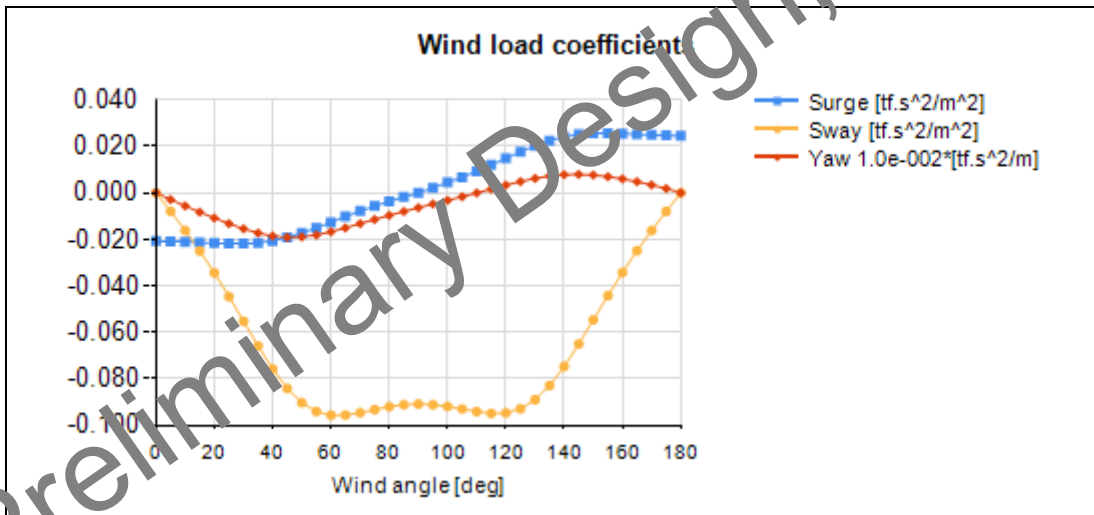


Figure 2: Wind load coefficients.

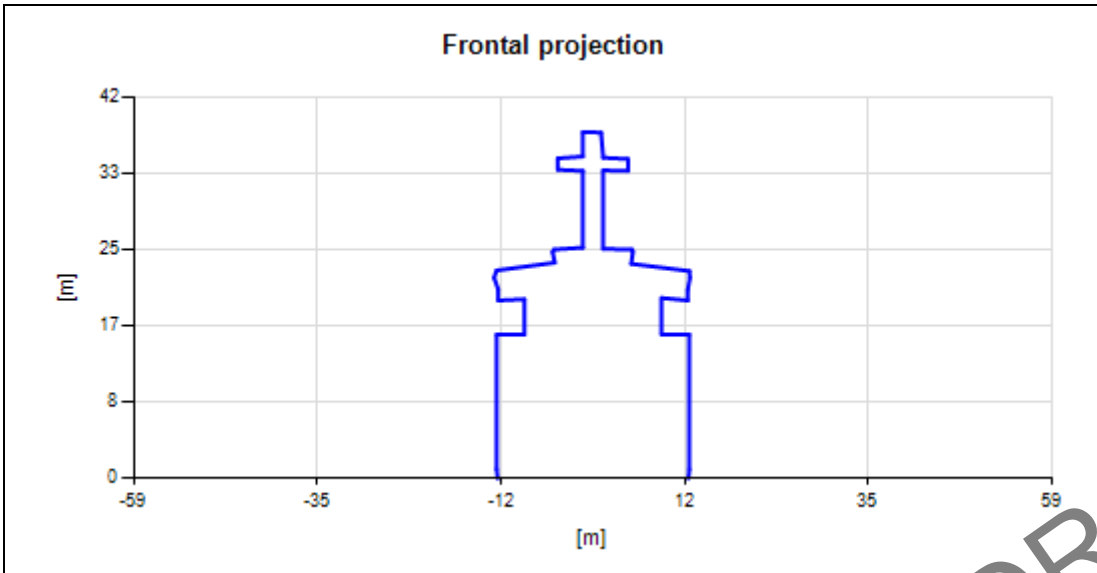


Figure 3: Frontal wind area projections.

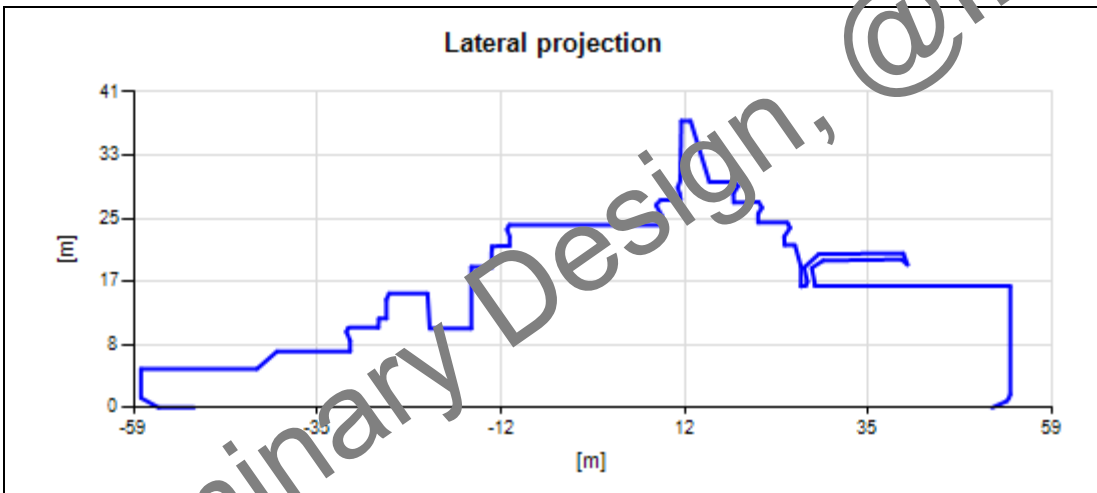


Figure 4: Lateral wind area projections.

4.3 Current load coefficients

A simplified strip-theory approach is applied in order to calculate the transverse and yawing moment current load coefficients. For a description of the strip-theory approach, see Reference 5.

The longitudinal load coefficient is calculated using the method described in Reference 5. However, the longitudinal coefficient has been adjusted for improved match against a number of model test results in the Kongsberg Maritime database.

The current load coefficients are presented in Figure 5.

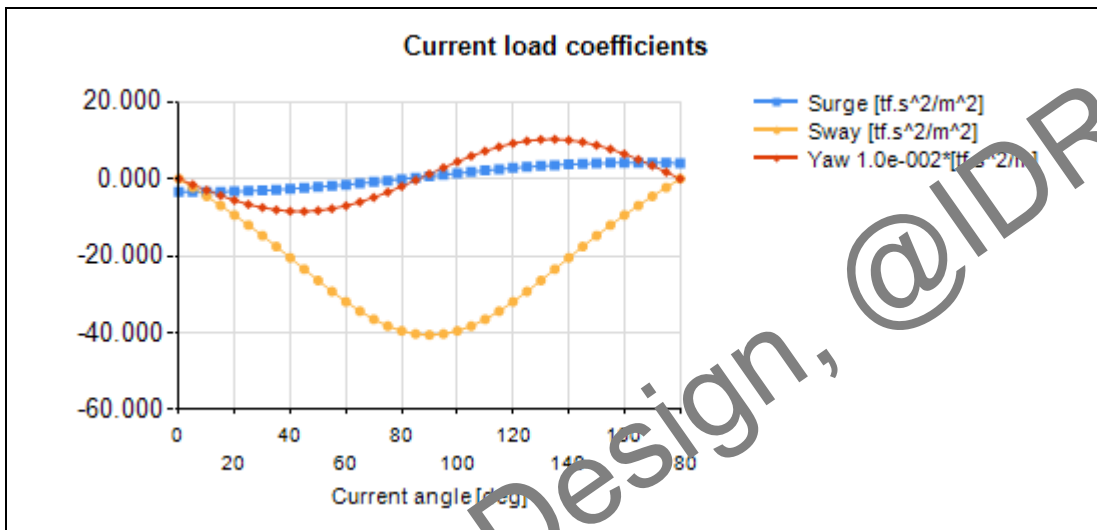


Figure 5: Current load coefficients.

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4.4 Wave-drift load coefficients

StatCap offers two methods to arrive at wave-drift load coefficients, see Table 5. The method used is indicated in 4.1 Main particulars. See Reference 6.

<i>Method</i>	<i>Applicable to</i>	<i>Description</i>
Database scaling	Mono-hulls/semi-submersibles	The wave-drift load coefficients are obtained through scaling of data for a similar vessel in the Kongsberg Maritime database. The coefficients are scaled with respect to length and breadth, length or displacement.
External file input	Mono-hulls/semi-submersibles	Specific wave-drift load coefficients, supplied by the client, are read up and used by StatCap.

Table 5: Methods for obtaining wave-drift load coefficients

The wave-drift load coefficients are presented in Figure 6, Figure 7 and Figure 8.

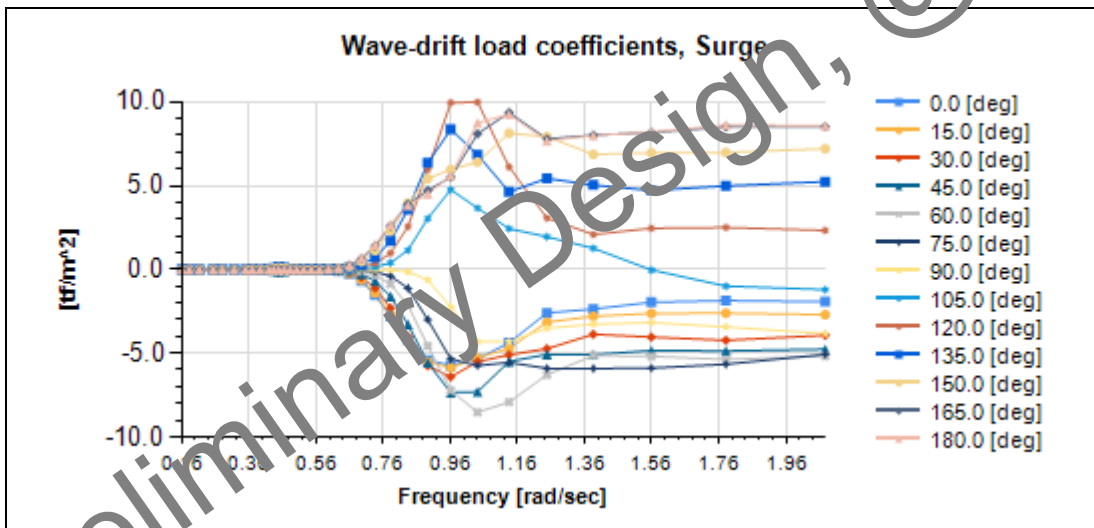


Figure 6: Wave-drift load coefficients for surge.

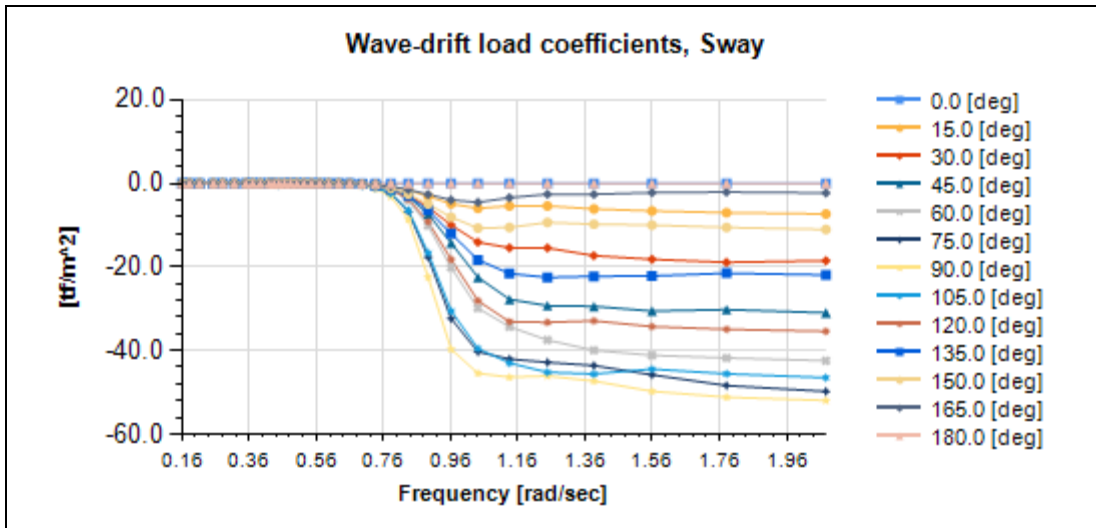


Figure 7: Wave-drift load coefficients for sway.

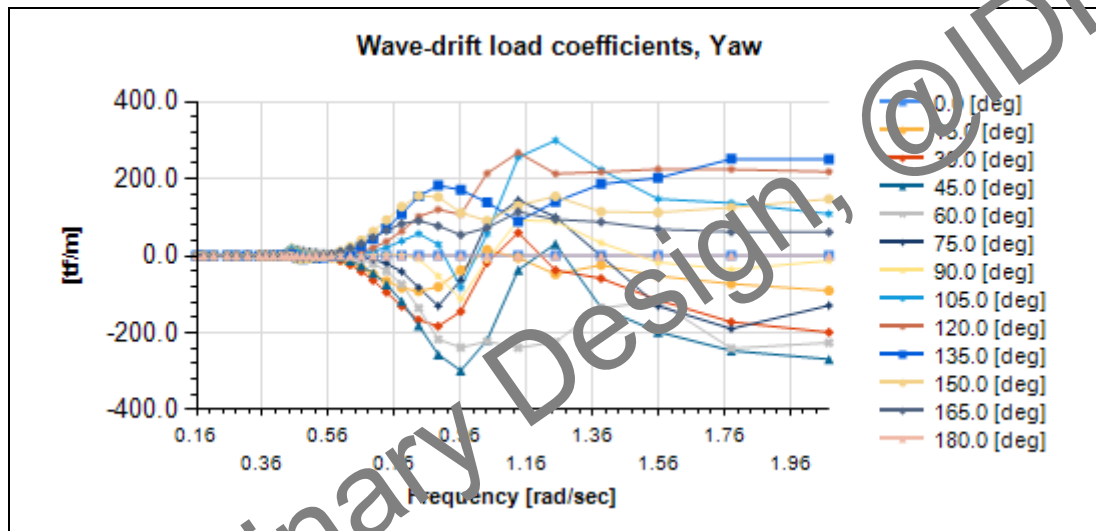


Figure 8: Wave-drift load coefficients for yaw.

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4.5 Wind speed and wave height relationship

Several wind and wave spectrum types are available in StatCap. Each of the wave spectrum types is listed in Table 6 together with a short description. The wind spectrum type selected does not affect the wind loads as such, but has an influence on the dynamic allowance. See section 3.4. The wave spectrum type used in each case are indicated on the capability envelope sheets.

Wave spectrum	Applicable to	Description
Pierson-Moskowitz	North Atlantic	Wave spectrum for fully developed sea and open sea conditions, see Reference 10.
JONSWAP	North Sea	Joint North Sea Wave Project, see Reference 10, valid for sea not fully developed (the fetch has limited length).
Doubly-Peaked	Norwegian Sea	Wave spectrum for wind-generated sea and swell. A modified JONSWAP model is used for both peaks. See Reference 10.

Table 6: Wave spectrum types.

The relationship between wind speed and wave height used in the analyses is defined in Reference 12. The relationship between wind speed and significant wave height is presented in Figure 9.

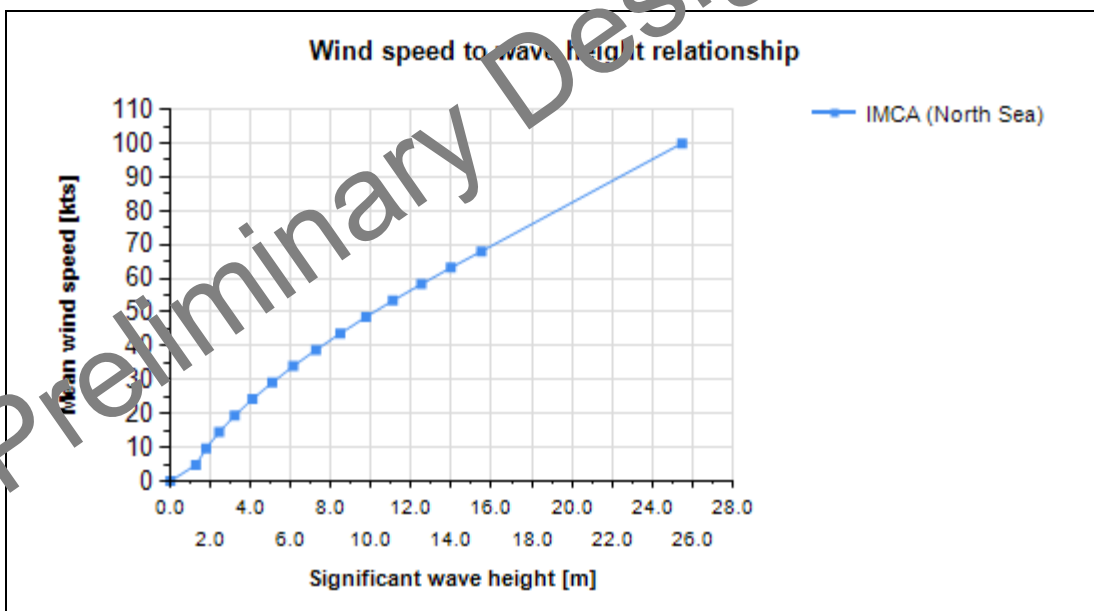


Figure 9: Wind speed to wave height relationship.

4.6 Thruster data

General thruster data is shown below in Table 7. Their locations on the hull can be found in Figure 10. See Reference 2.

Thr. ID	Maker's name	Thruster type	Max power [kW]	Diameter [m]	Ducted
T1		Azimuth	9,500.0	4.60	No
T2		Azimuth	9,500.0	4.60	No
T3		Tunnel	2,126.0	2.70	No

Table 7: General thruster data.



Thr. ID	X-coordinate [m]	Y-coordinate [m]	Z-coordinate [m]
T1	-46.7	-5.5	-3.5
T2	-46.7	5.5	-3.5
T3	30.2	0	-5.0

Figure 10: Thruster layout

The available thrust force is calculated according to Reference 7 based on the information given in Reference 2. The results are given in Table 8 below.

Thr. ID	Effective thrust	
	Forward thrust [tf]	Reversed thrust [tf]
T1	112.20	0.00
T2	112.20	0.00
T3	31.80	-31.80

Table 8: Available thrust forces.

In order to reduce thruster-thruster interaction, azimuth restrictions are imposed, see Table 9. The centre angles are those of the force vectors. The thruster dependency column denotes the thruster on which the zone is dependent. If this particular thruster is not in use, the zone is neglected in the thruster allocation.

Thr. ID	Zone 1			Zone 2			Zone 3		
	Centre angle [deg]	Beam [deg]	Thruster dependency	Centre angle [deg]	Beam [deg]	Thruster dependency	Centre angle [deg]	Beam [deg]	Thruster dependency
T1	-90.0	±29.8	T2	-	-	-	-	-	-
T2	90.0	±29.8	T1	-	-	-	-	-	-

Table 9: Thruster azimuth forbidden zones.

Thrust losses are accounted for. The thrusters' efficiencies are calculated considering the following: thrust loss due to axial and transverse current, thrust loss due to the Coanda effect and thrust loss in waves. For tunnel thrusters the effects of tunnel length, shape of the tunnel inlet and grids are also taken into account. The thrust loss calculations are based on the literature listed under Reference 8.

Each capability envelope sheet states whether power limitations are taken into account. When power limitations are included, the thrusters' power consumption is limited by the total generator capacity on the power bus to which they are connected. The power configurations are listed for each case in section 5. For cases without power limitations, thrusters are assumed to always be able to produce maximum thrust simultaneously at all times irrespective of power used.

5 Results

A capability envelope sheet for each case is presented in Figures *11* to *49*.

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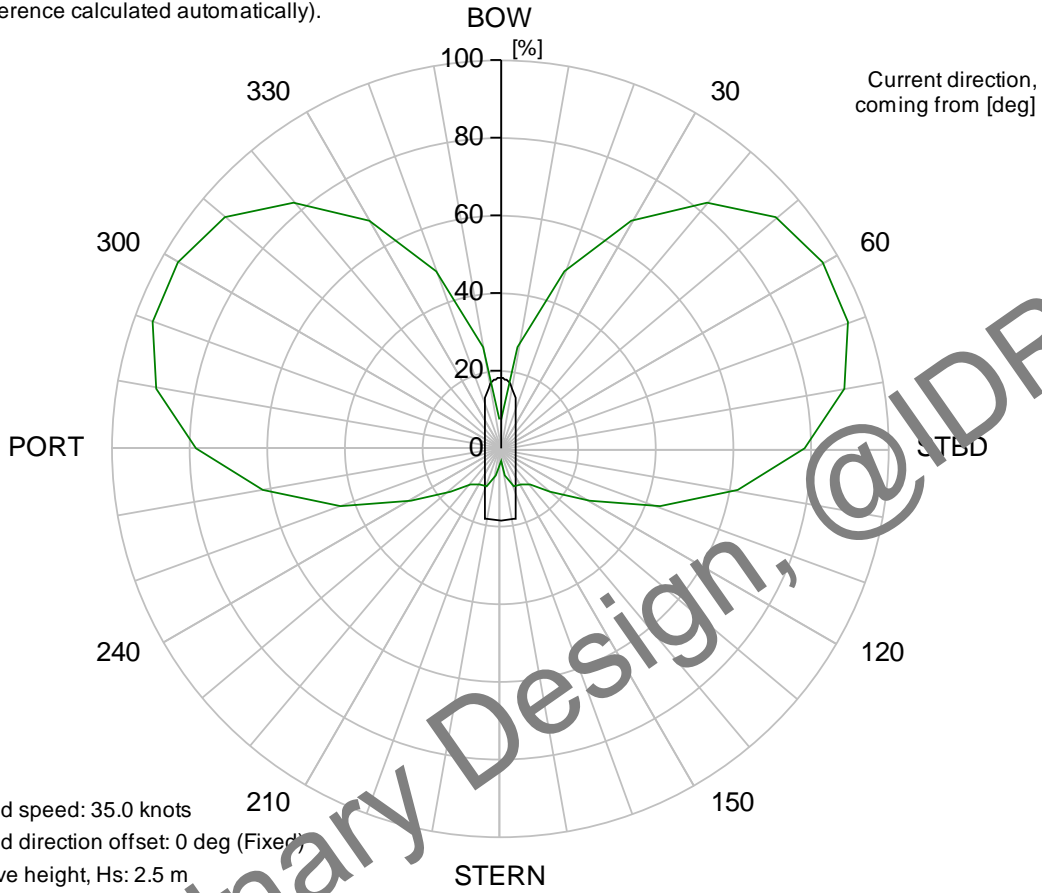
5.1 Case 1 - Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 0 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 0 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 11: DP capability envelope for case 1.

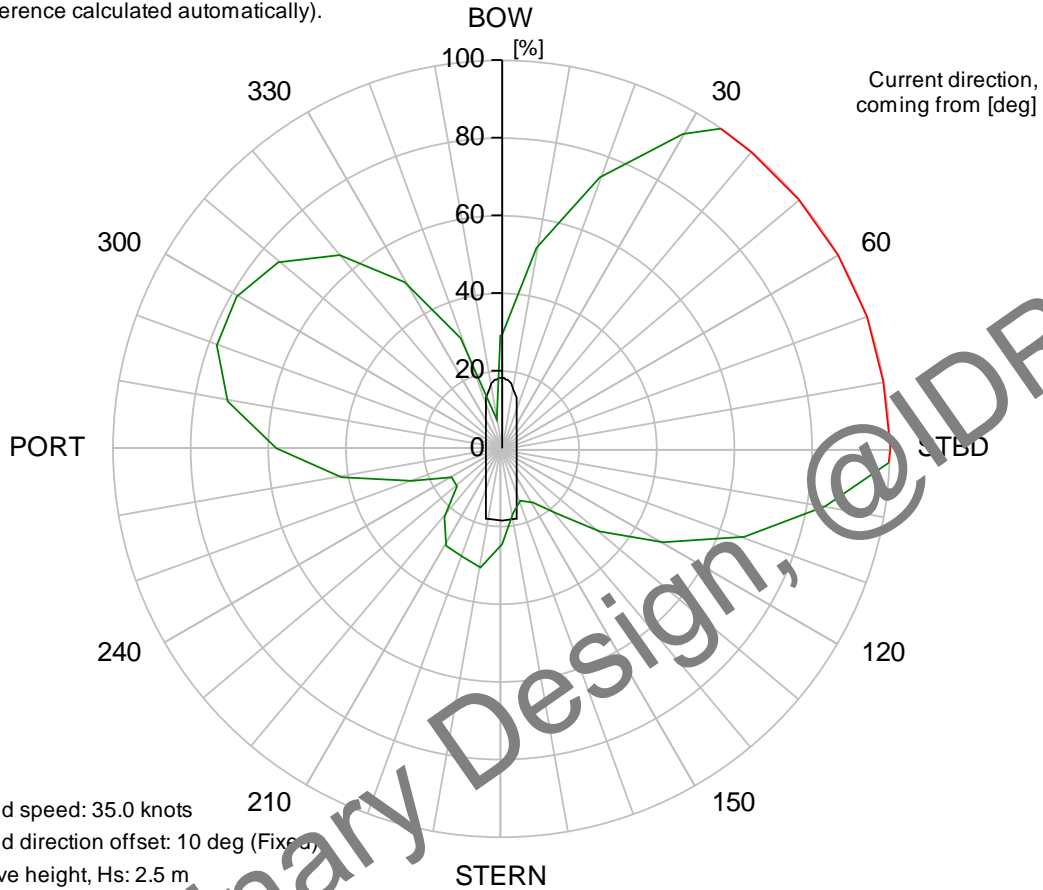
5.2 Case 2 - Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 10 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 10 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 12: DP capability envelope for case 2.

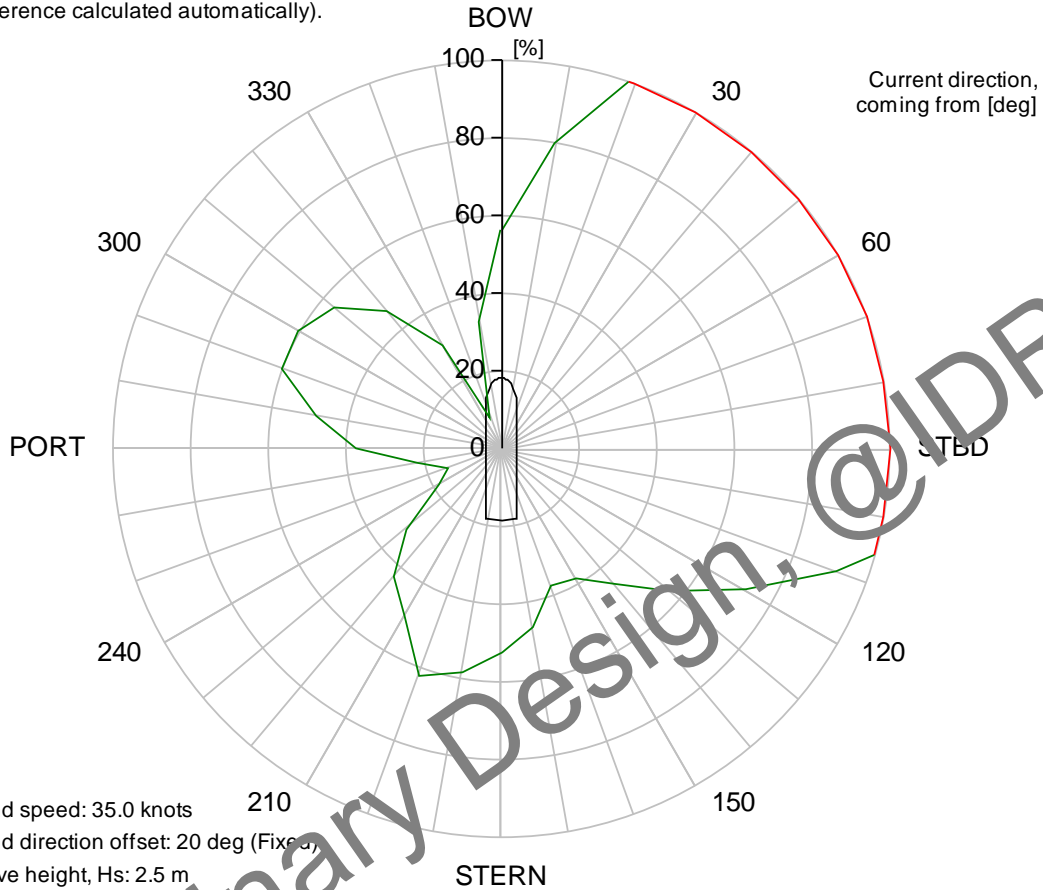
5.3 Case 3 - Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 20 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 20 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 13: DP capability envelope for case 3.

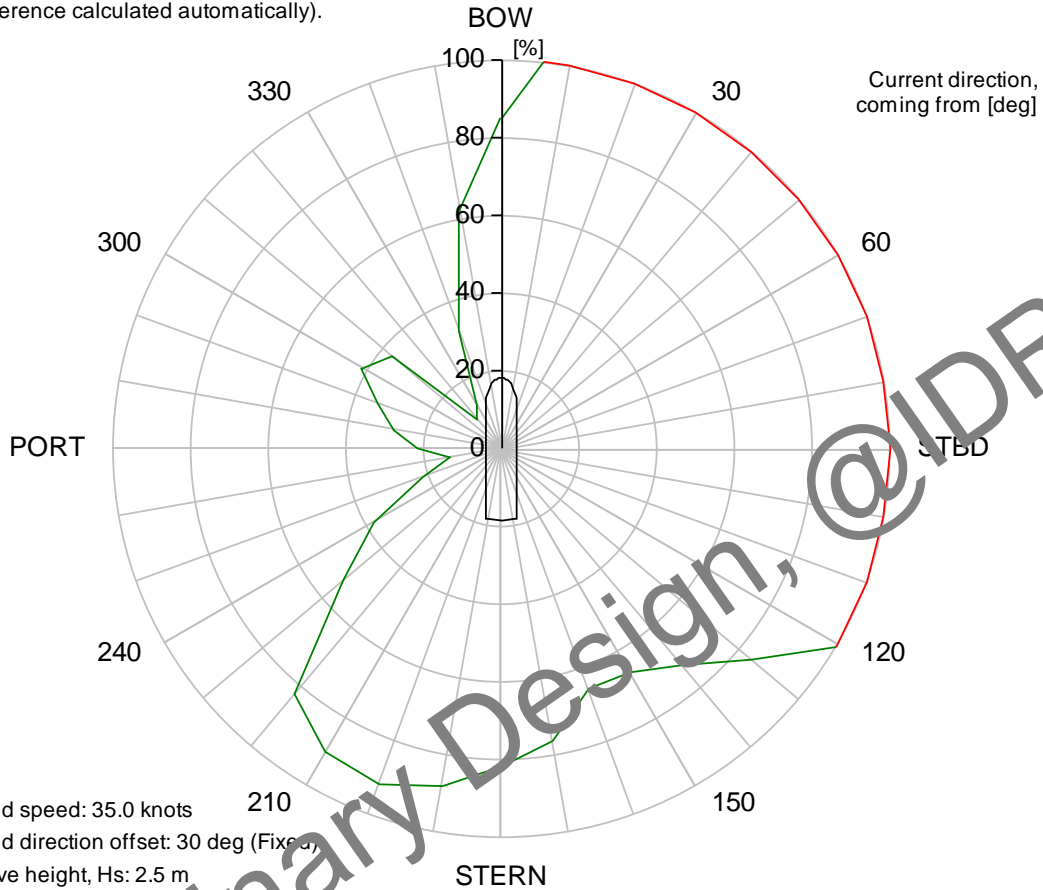
5.4 Case 4 - Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 30 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 30 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 14: DP capability envelope for case 4.

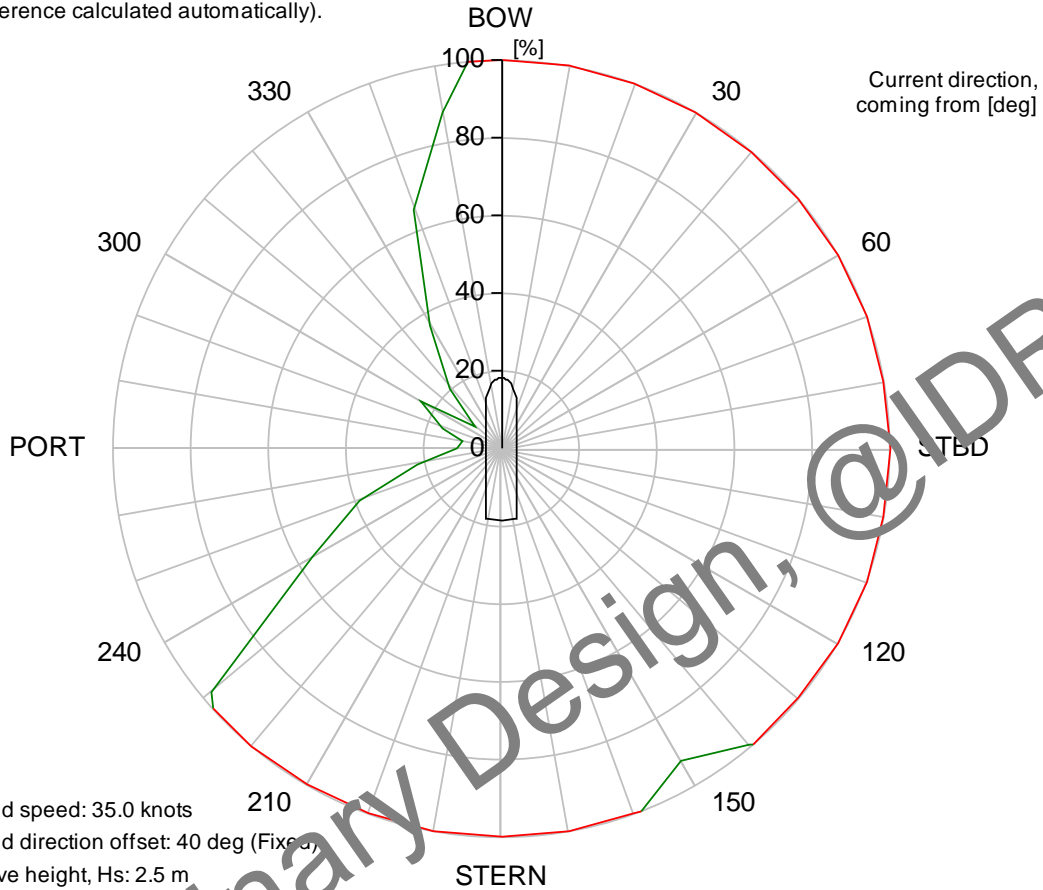
5.5 Case 5 - Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 40 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 40 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
T. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 15: DP capability envelope for case 5.

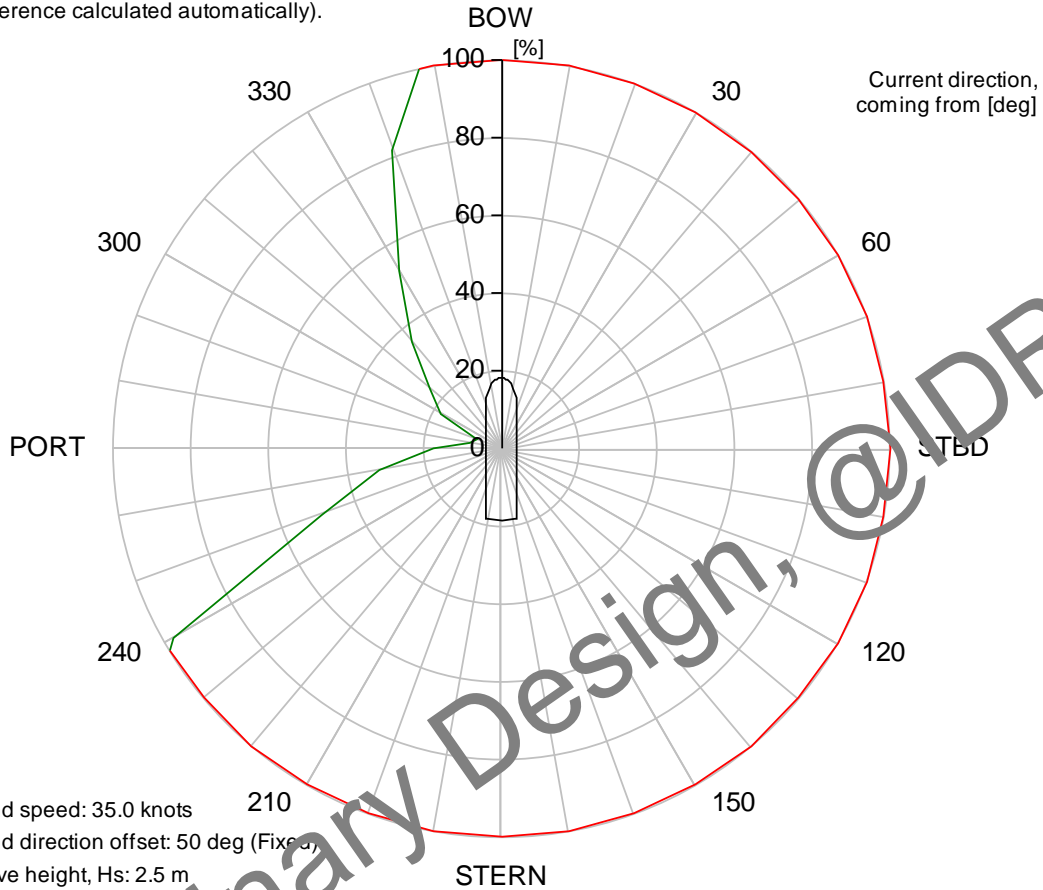
5.6 Case 6 - Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 50 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 30 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 16: DP capability envelope for case 6.

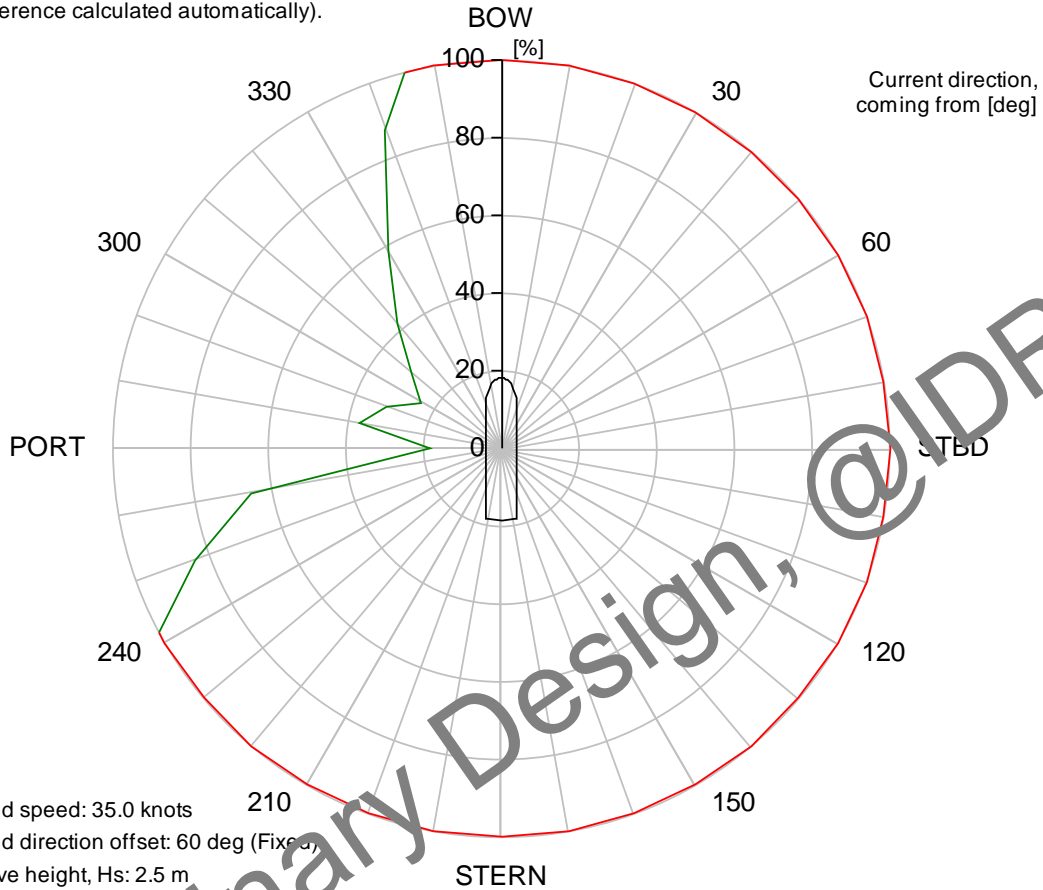
5.7 Case 7 - Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 60 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 60 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 17: DP capability envelope for case 7.

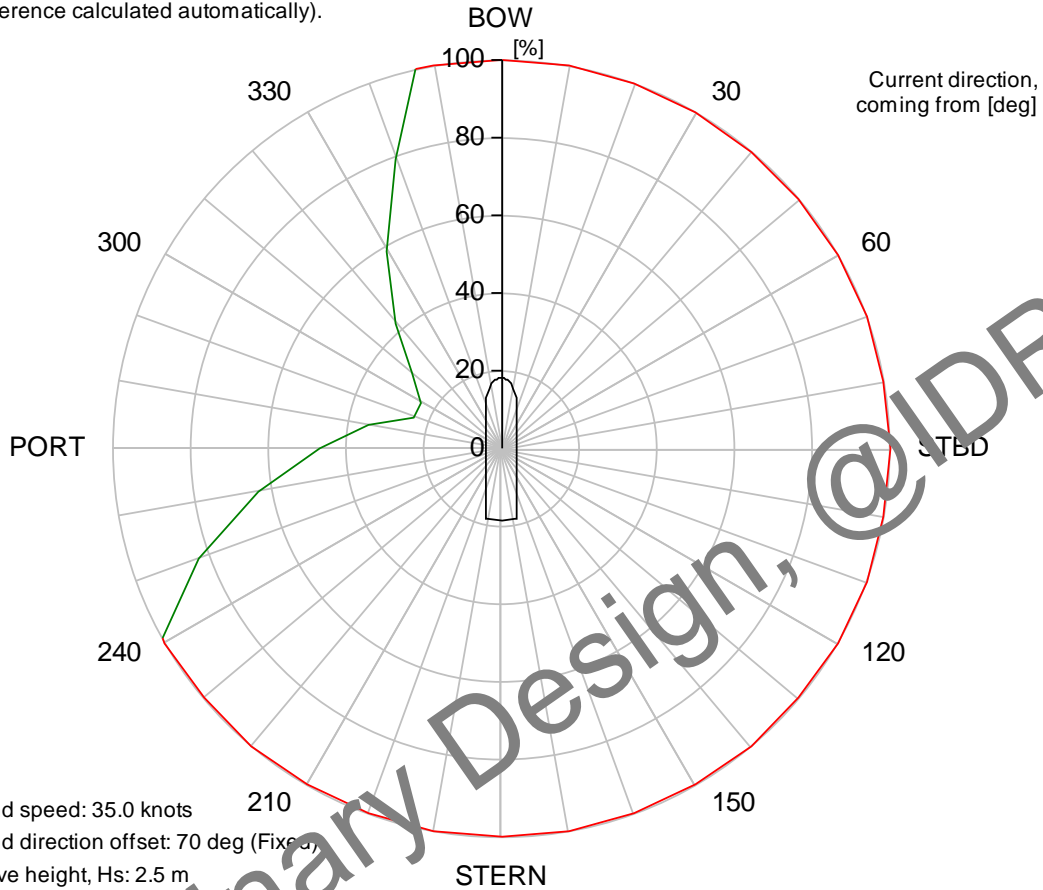
5.8 Case 8 - Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 70 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 70 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 18: DP capability envelope for case 8.

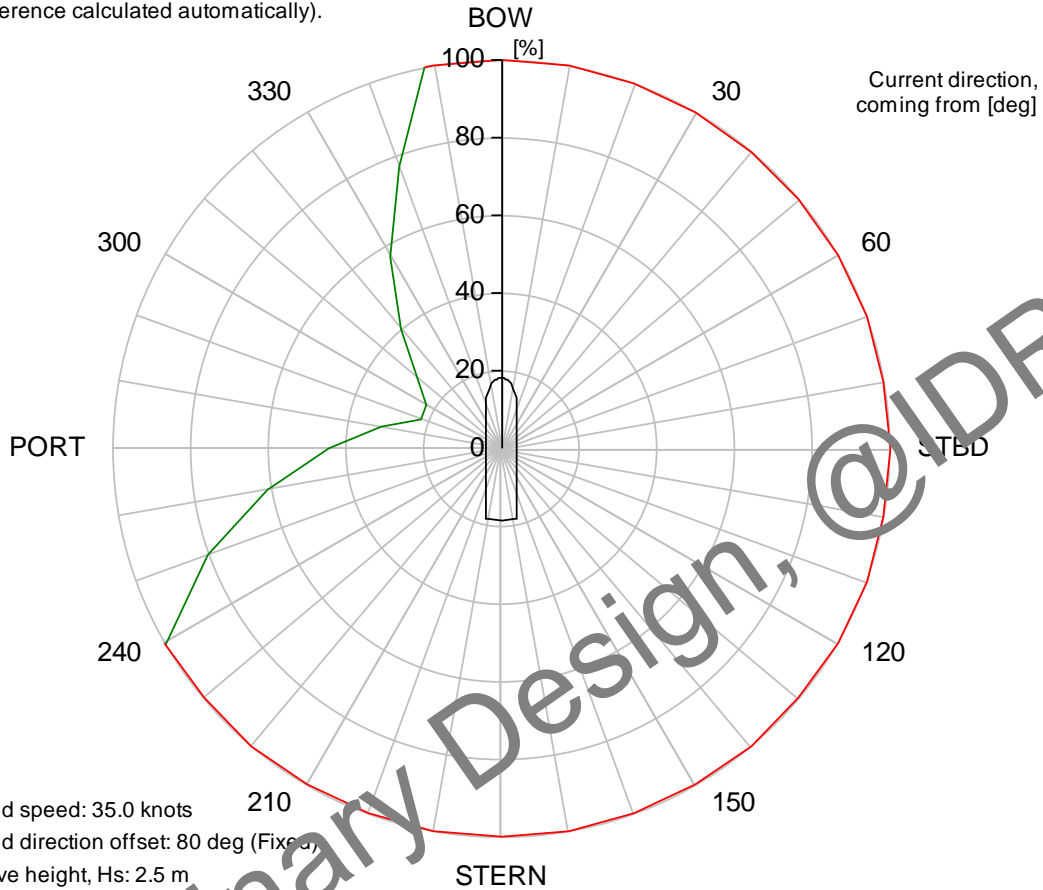
5.9 Case 9 - Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 80 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 80 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 19: DP capability envelope for case 9.

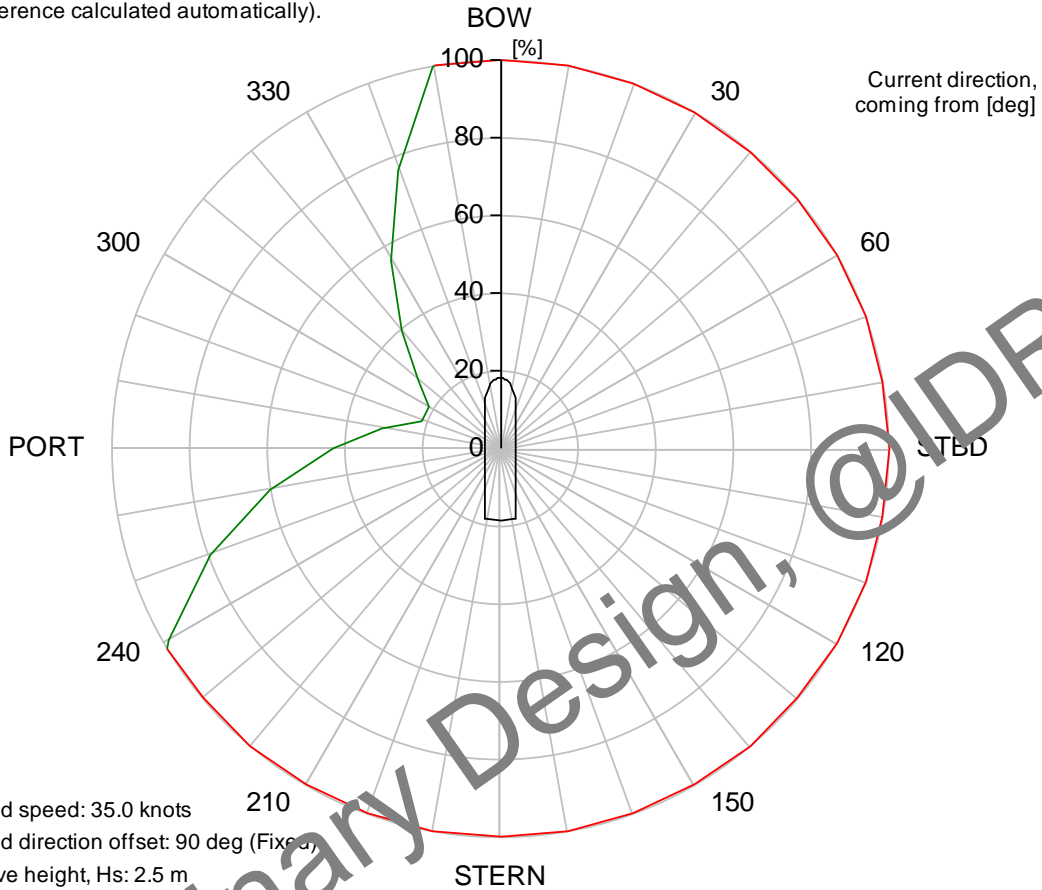
5.10 Case 10 - Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 90 deg (Fixed)
 Wave height, Hs: 2.5 m
 Wave period, Tz: 6.0 s (Tp 8.5 s)
 Wave direction offset: 90 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 20: DP capability envelope for case 10.

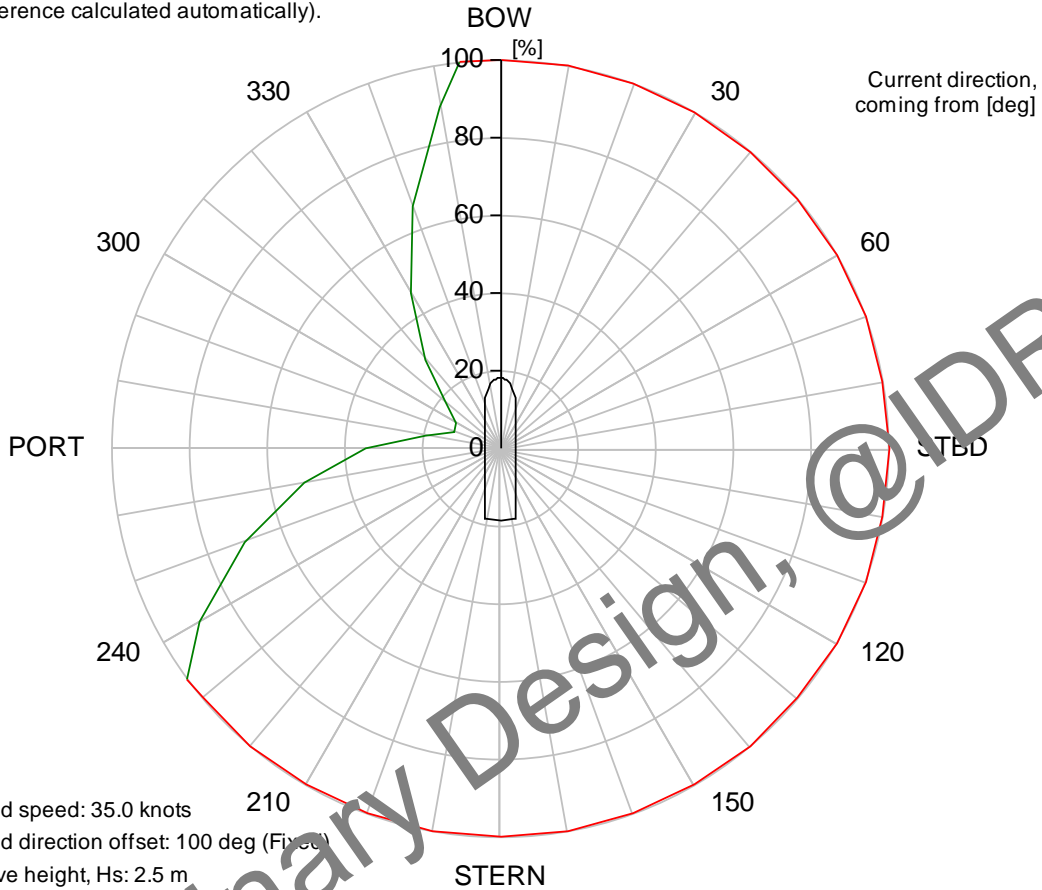
5.11 Case 11 - Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 100 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 100 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 21: DP capability envelope for case 11.

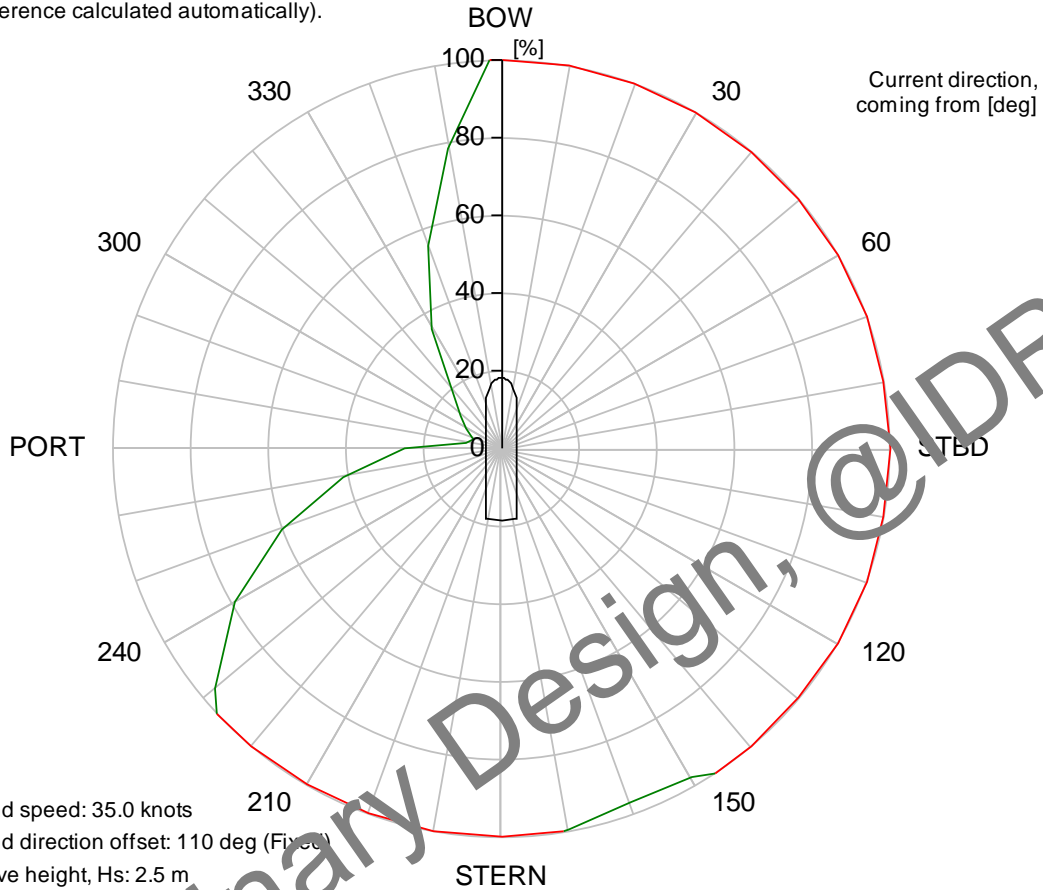
5.12 Case 12 - Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 110 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 110 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 22: DP capability envelope for case 12.

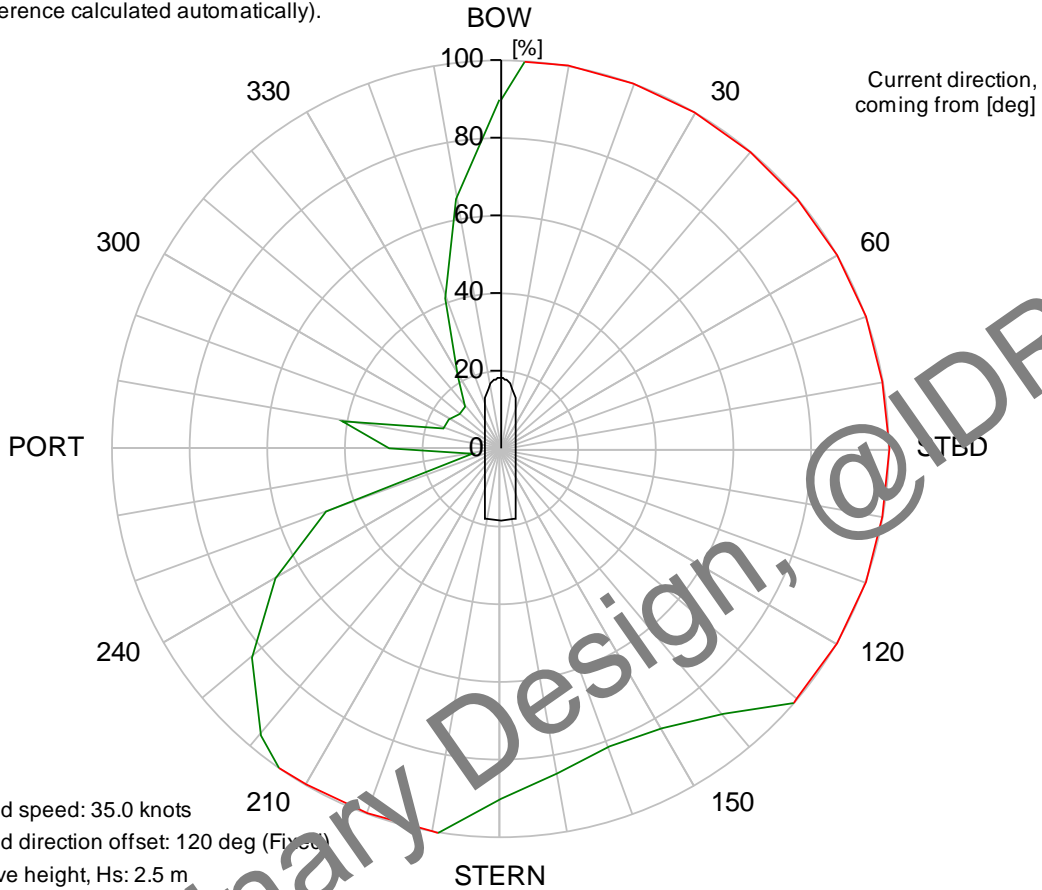
5.13 Case 13 - Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 120 deg (Fixed)
 Wave height, Hs: 2.5 m
 Wave period, Tz: 6.0 s (Tp 8.5 s)
 Wave direction offset: 120 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 23: DP capability envelope for case 13.

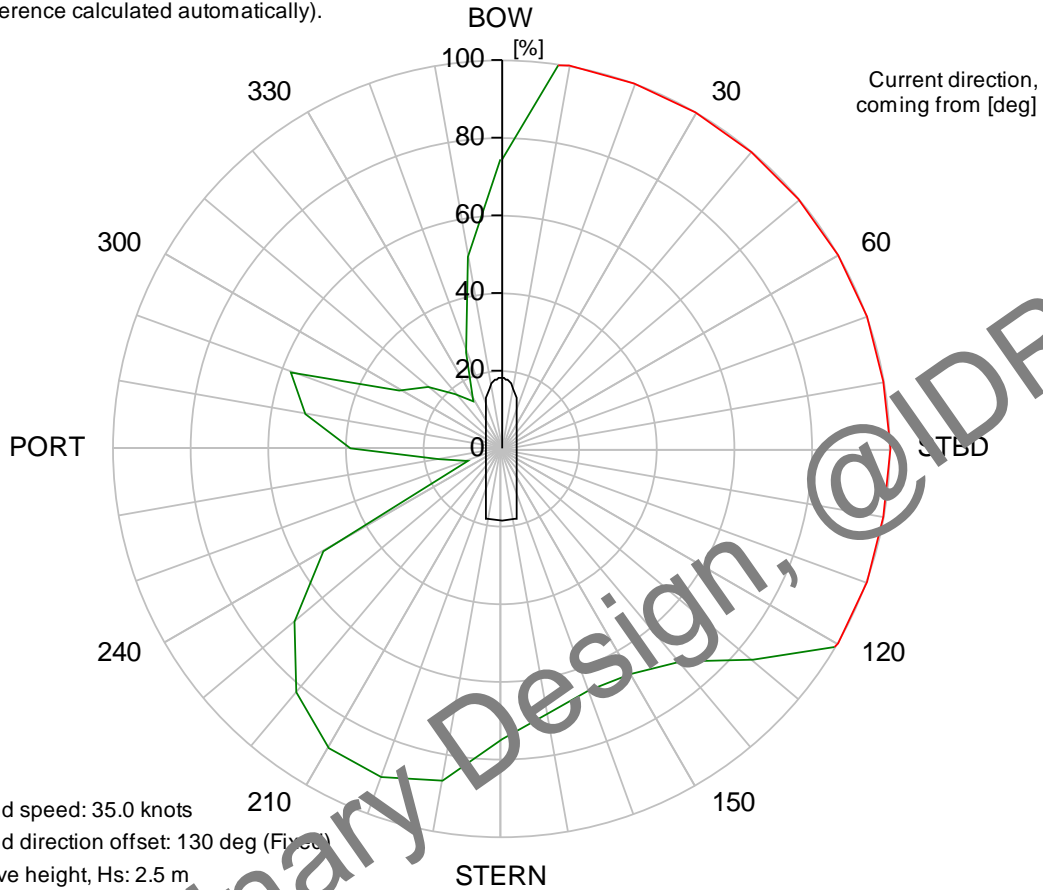
5.14 Case 14 - Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 130 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 130 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 24: DP capability envelope for case 14.

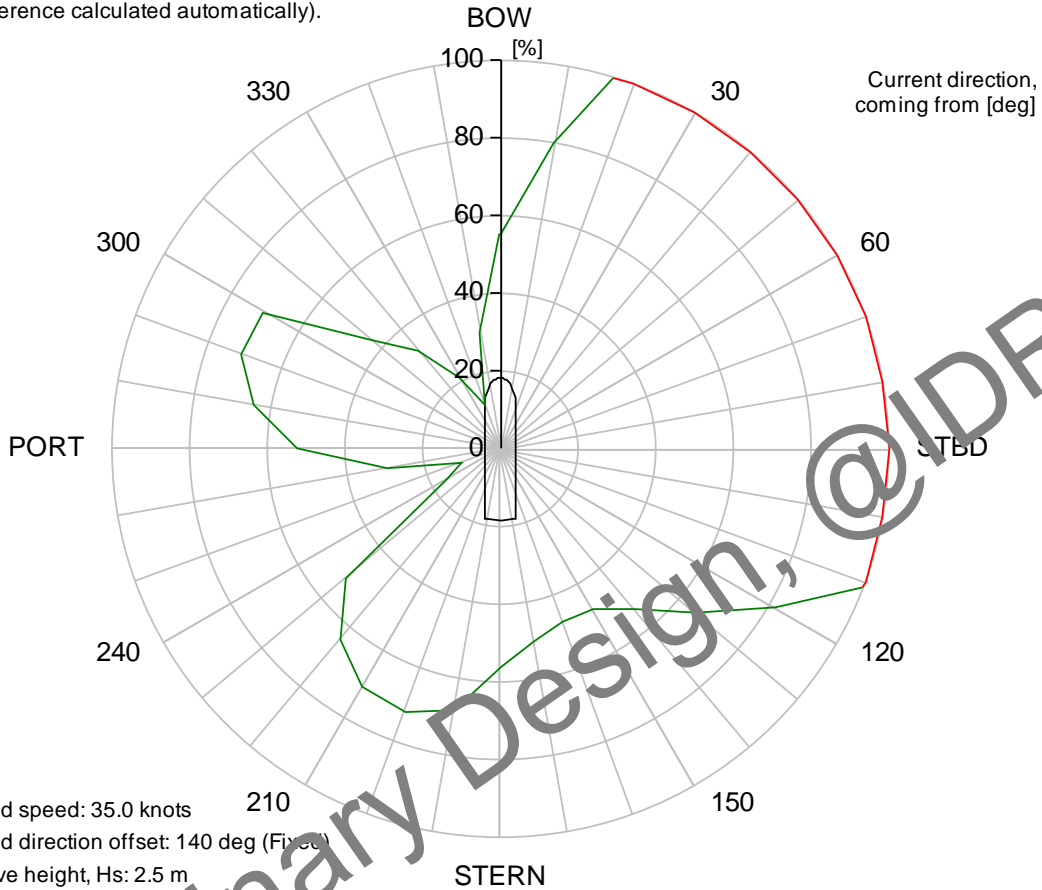
5.15 Case 15 - Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 140 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 140 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 25: DP capability envelope for case 15.

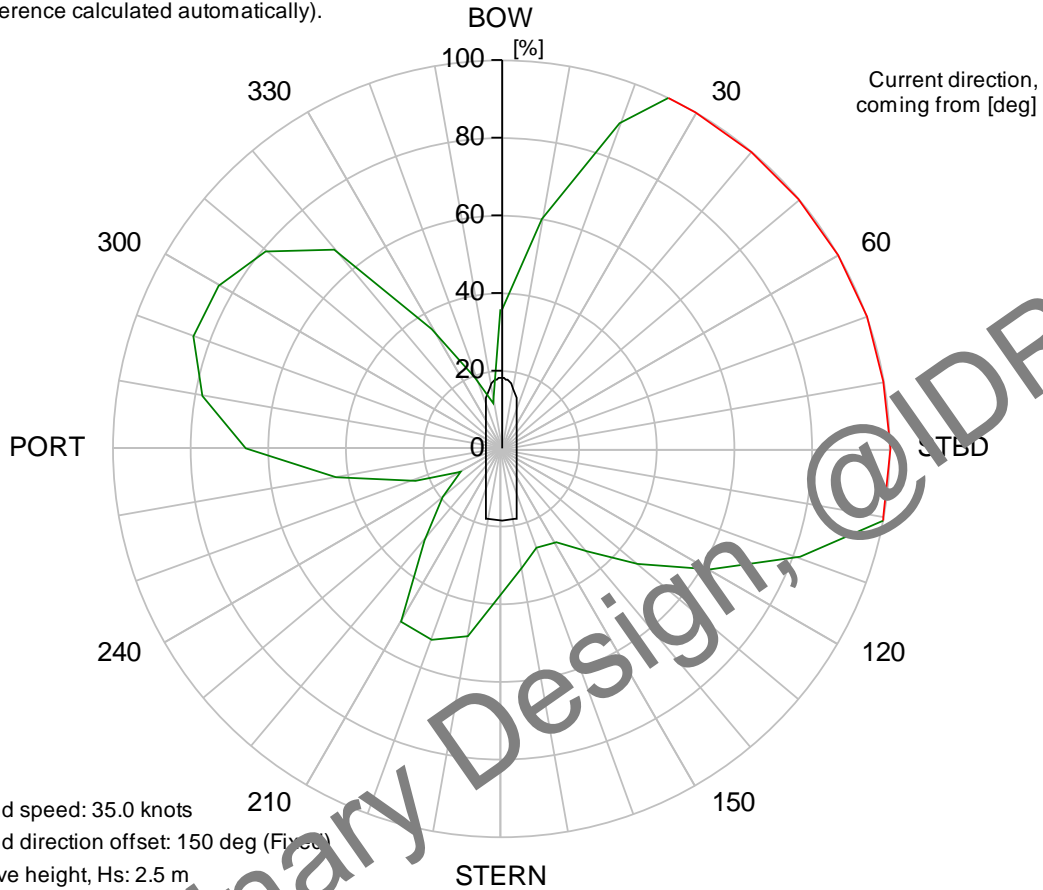
5.16 Case 16 - Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 150 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 150 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 26: DP capability envelope for case 16.

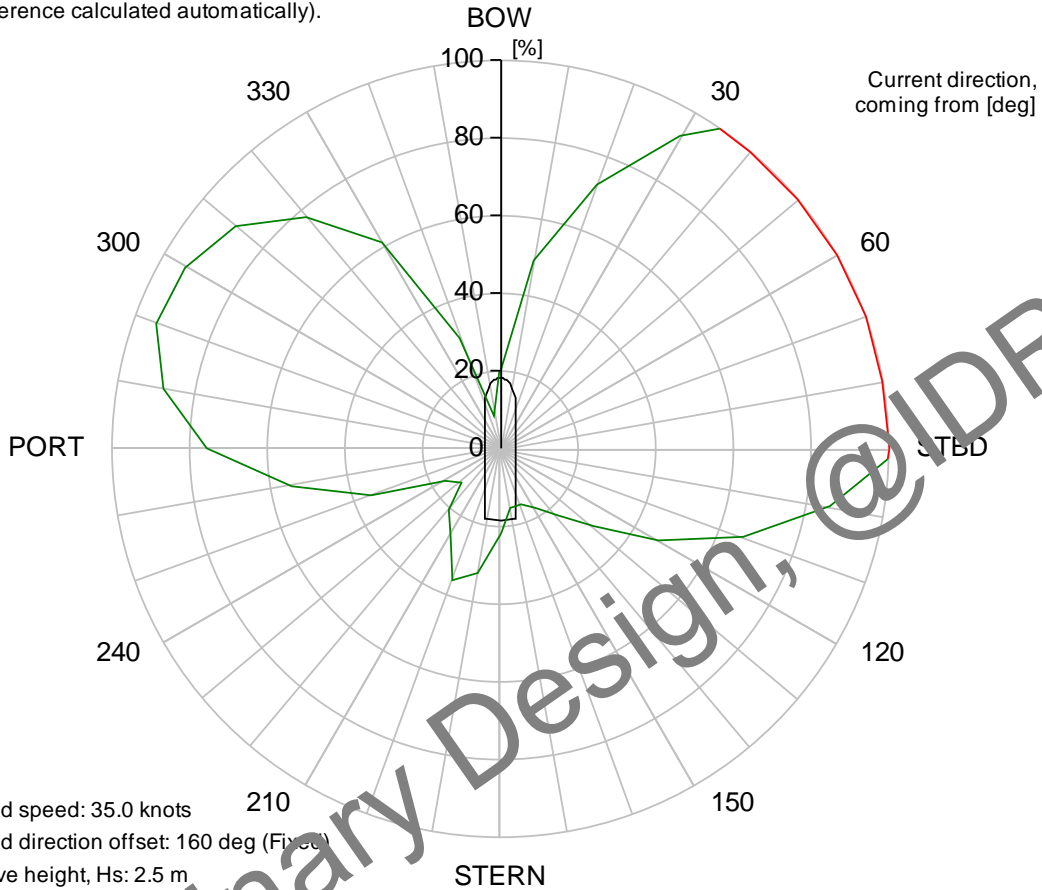
5.17 Case 17 - Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 160 deg (Fixed)
 Wave height, Hs: 2.5 m
 Wave period, Tz: 6.0 s (Tp 8.5 s)
 Wave direction offset: 160 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration				
T1	T2	T3	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	T2	T3	100	112.2	0.0	9500.0			
			100	112.2	0.0	9500.0			
			63	20.0	-20.0	1063.1			

Figure 27: DP capability envelope for case 17.

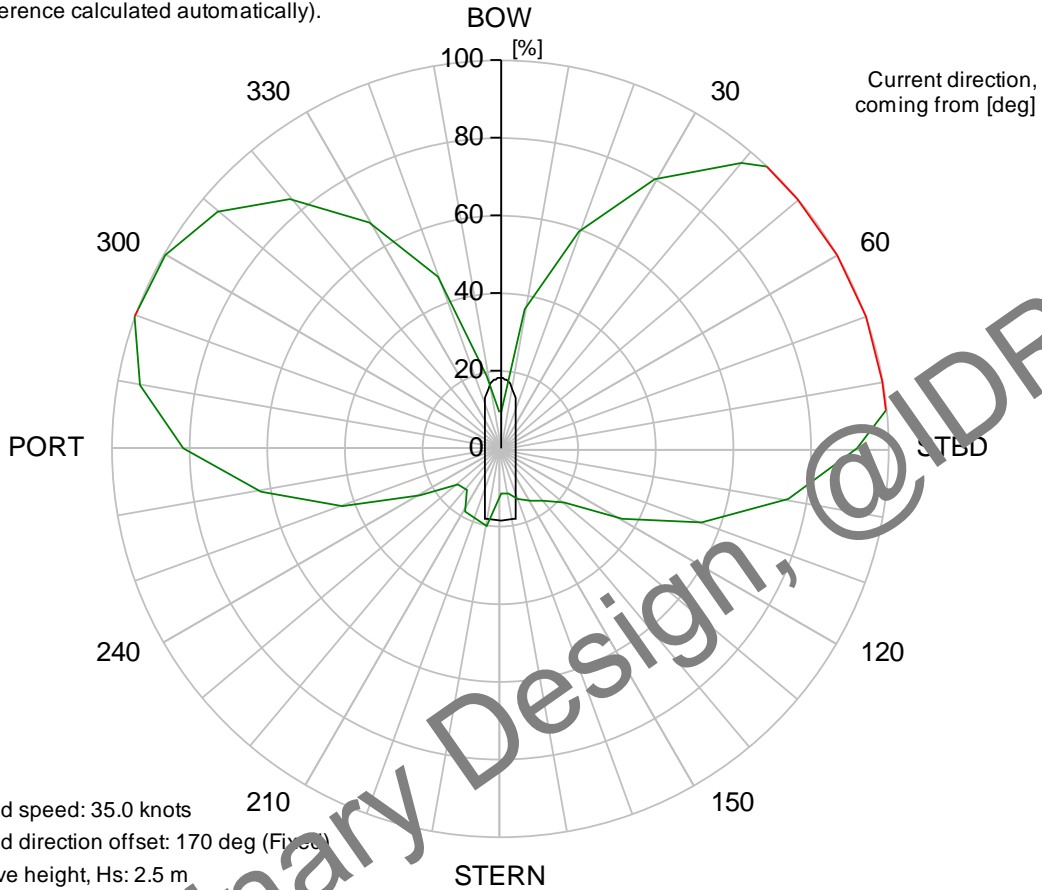
5.18 Case 18 - Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 170 deg (Fixed)

Wave height, Hs: 2.5 m

Wave period, Tz: 6.0 s (Tp 8.5 s)

Wave direction offset: 170 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
T1	T2	T3	Max. forward thrust [tf]	Max. reversed thrust [tf]	Bus name	Connected thrusters	Available power [kW]
100	100	63	112.2	0.0			
			112.2	0.0			9500.0
			20.0	-20.0			1063.1

Figure 28: DP capability envelope for case 18.

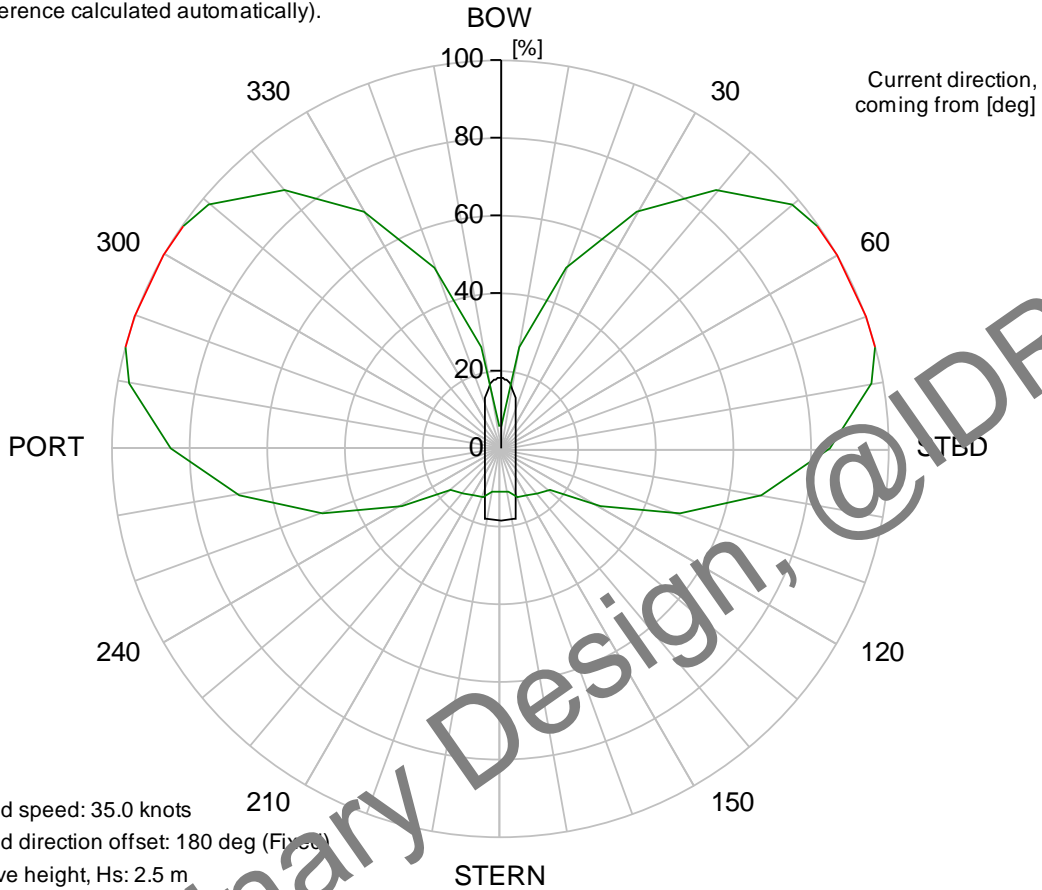
5.19 Case 19 - Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 4

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 180 deg (Fixed)
 Wave height, Hs: 2.5 m
 Wave period, Tz: 6.0 s (Tp 8.5 s)
 Wave direction offset: 180 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 29: DP capability envelope for case 19.

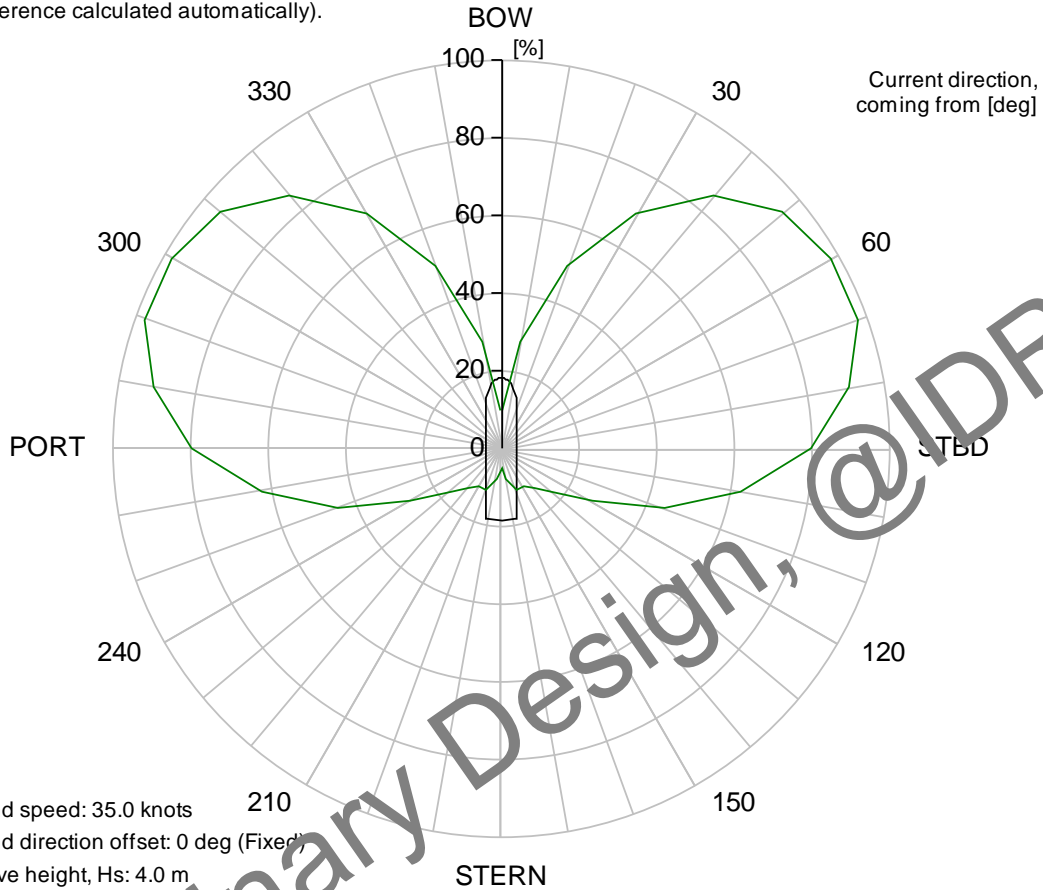
5.20 Case 20 - Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 0 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 0 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 30: DP capability envelope for case 20.

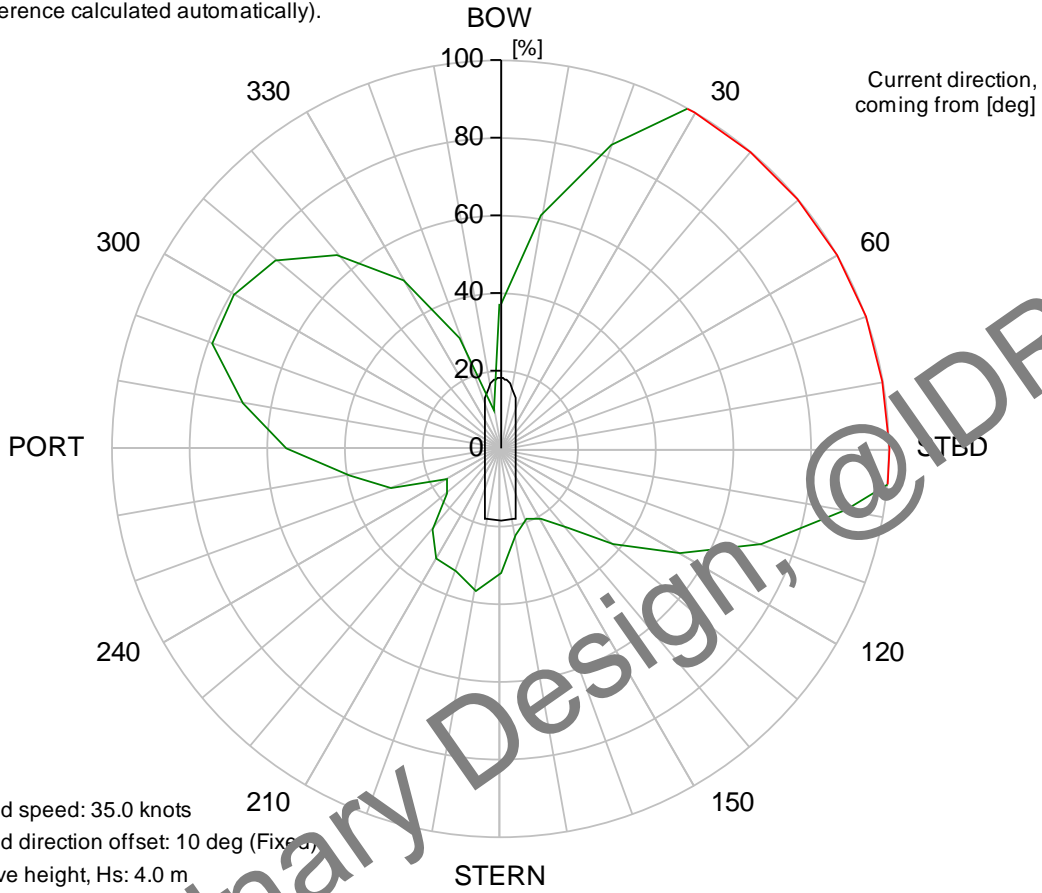
5.21 Case 21 - Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 10 deg (Fixed)
 Wave height, Hs: 4.0 m
 Wave period, Tz: 6.7 s (Tp 9.4 s)
 Wave direction offset: 10 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 31: DP capability envelope for case 21.

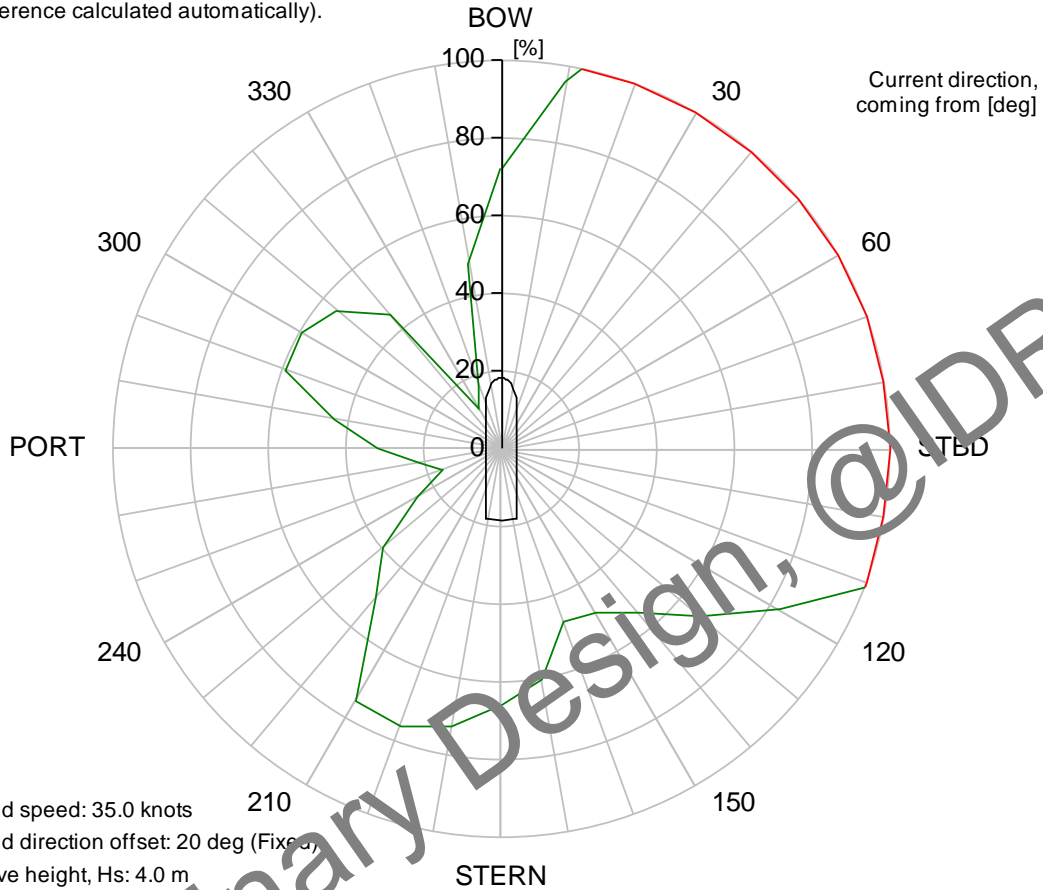
5.22 Case 22 - Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 20 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 20 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 32: DP capability envelope for case 22.

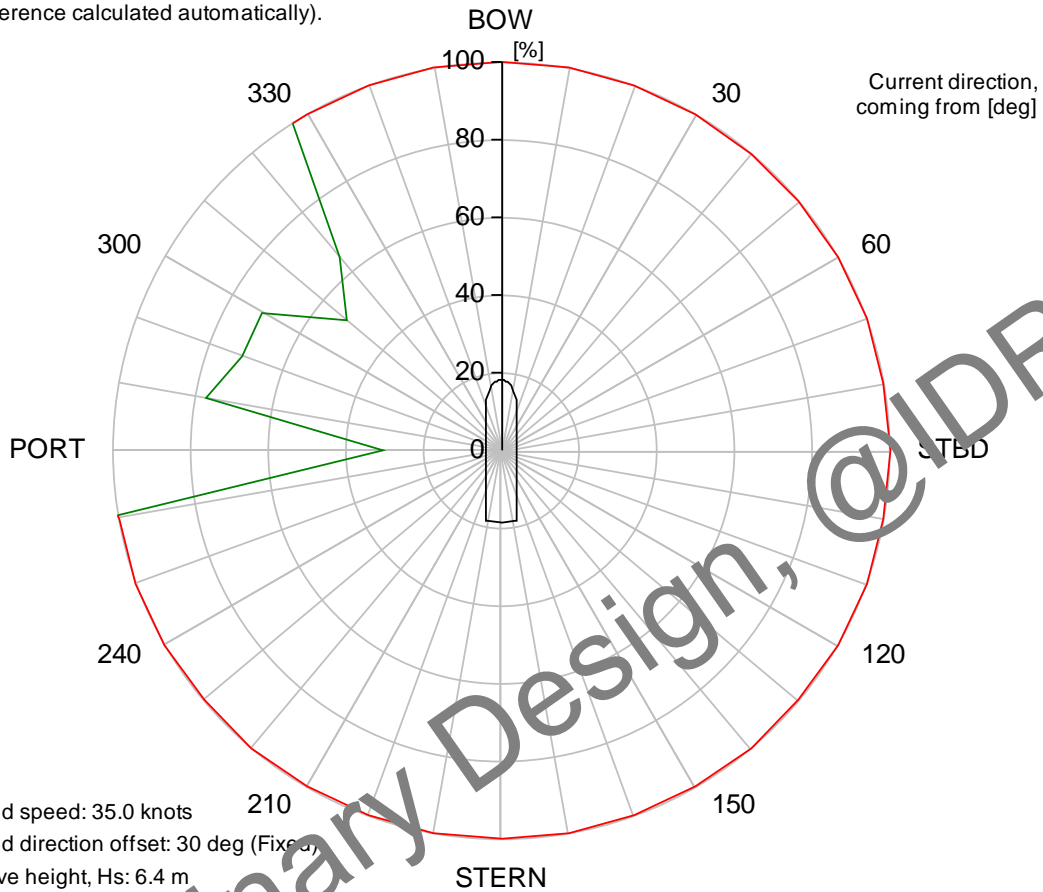
5.23 Case 23 - Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 30 deg (Fixed)

Wave height, Hs: 6.4 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 30 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 33: DP capability envelope for case 23.

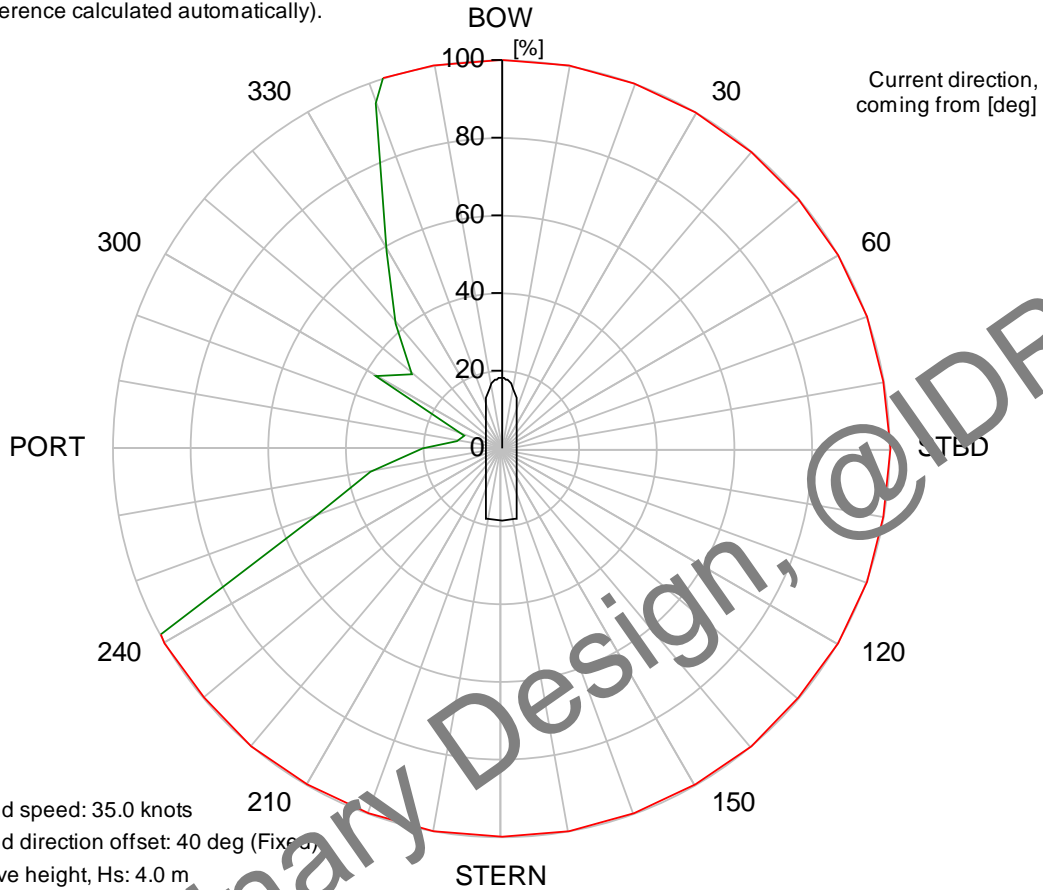
5.24 Case 24 - Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 40 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 40 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 34: DP capability envelope for case 24.

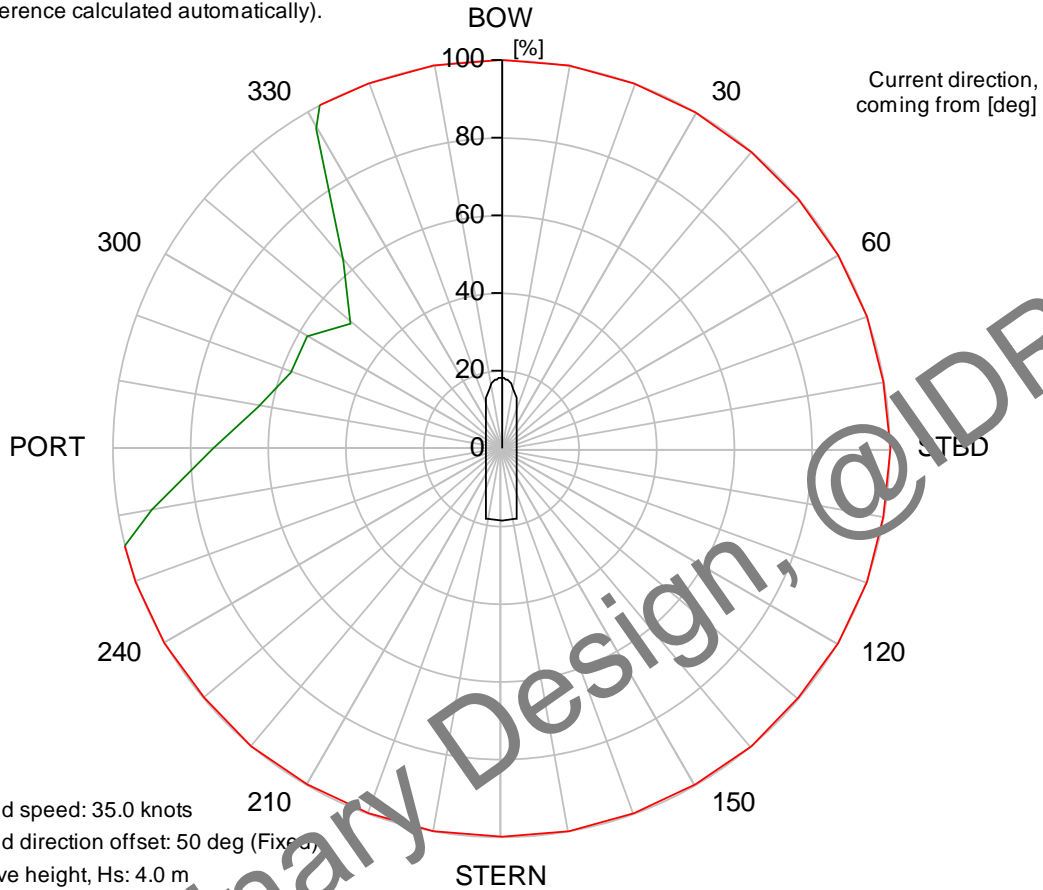
5.25 Case 25 - Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 50 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 50 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 35: DP capability envelope for case 25.

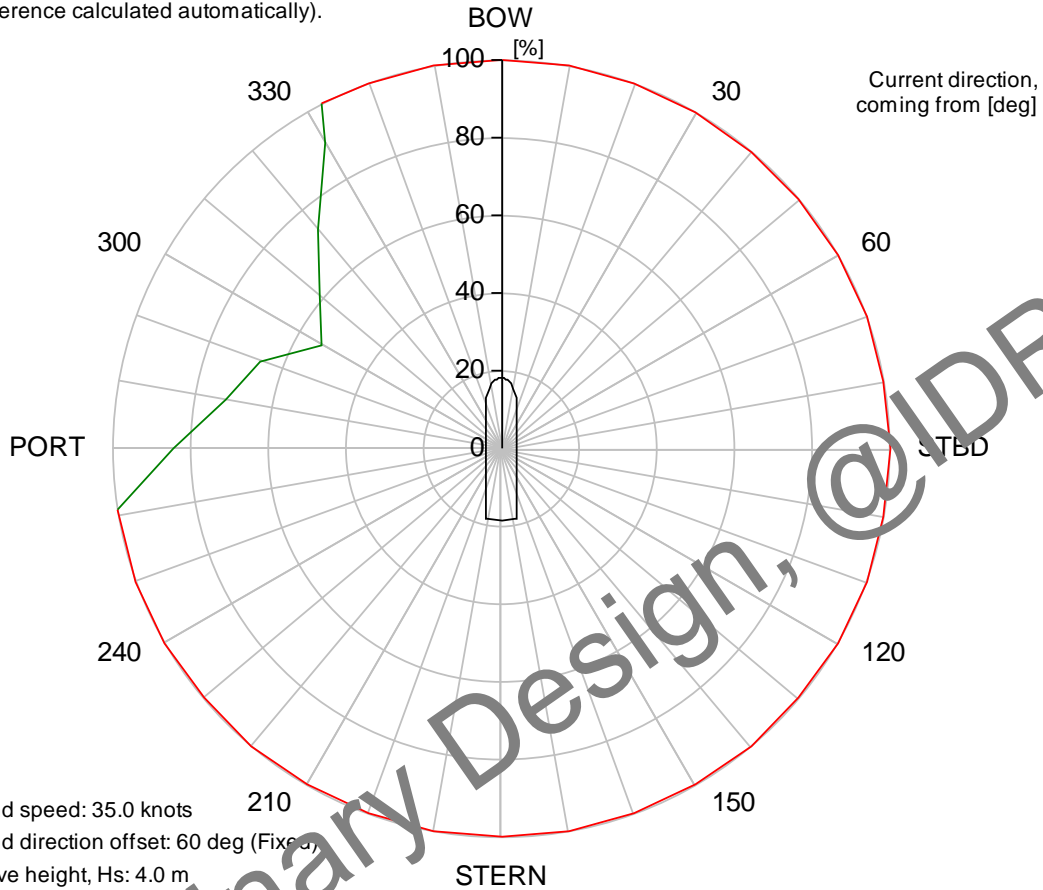
5.26 Case 26 - Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 60 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 60 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 36: DP capability envelope for case 26.

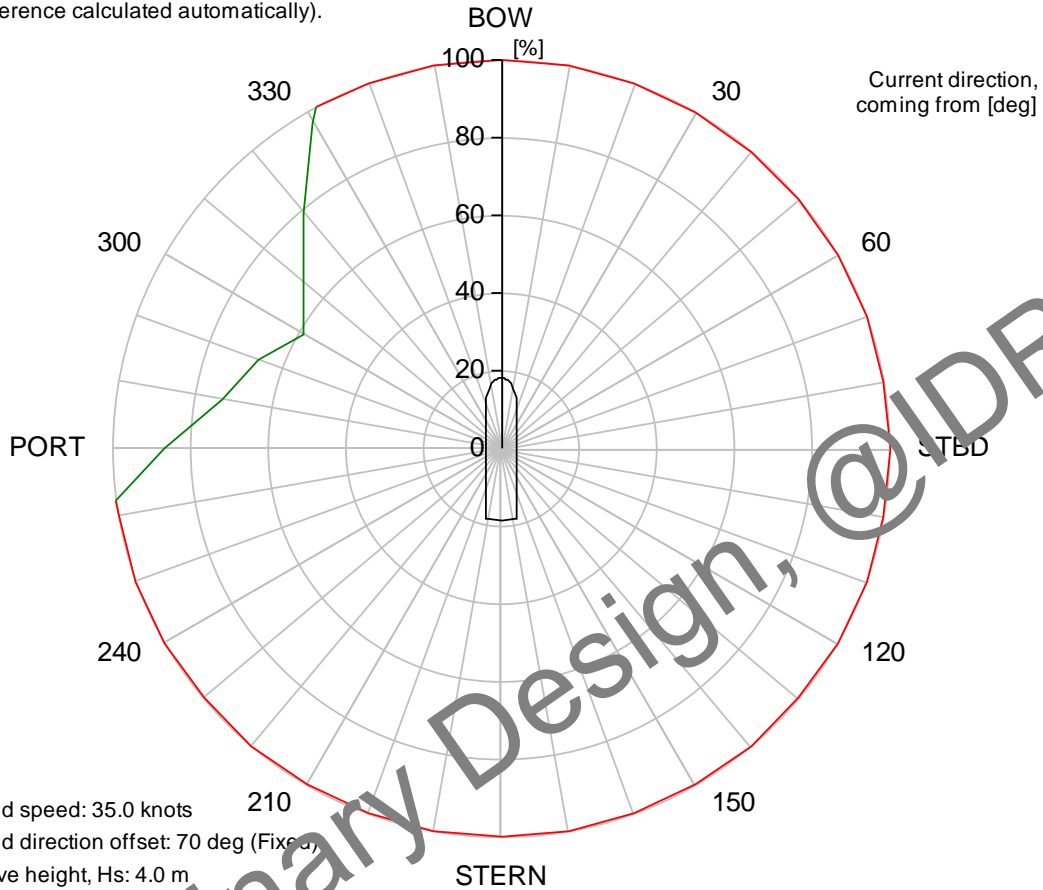
5.27 Case 27 - Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 70 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 70 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 37: DP capability envelope for case 27.

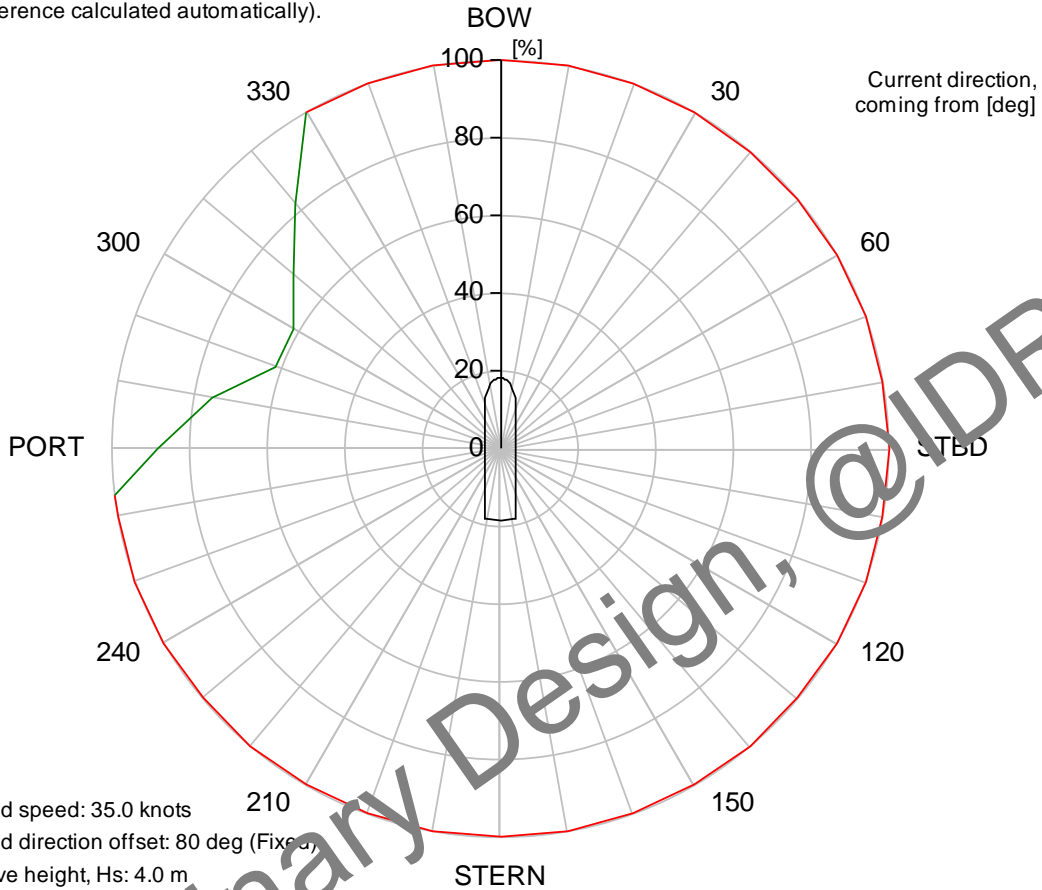
5.28 Case 28 - Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 80 deg (Fixed)
 Wave height, Hs: 4.0 m
 Wave period, Tz: 6.7 s (Tp 9.4 s)
 Wave direction offset: 80 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 38: DP capability envelope for case 28.

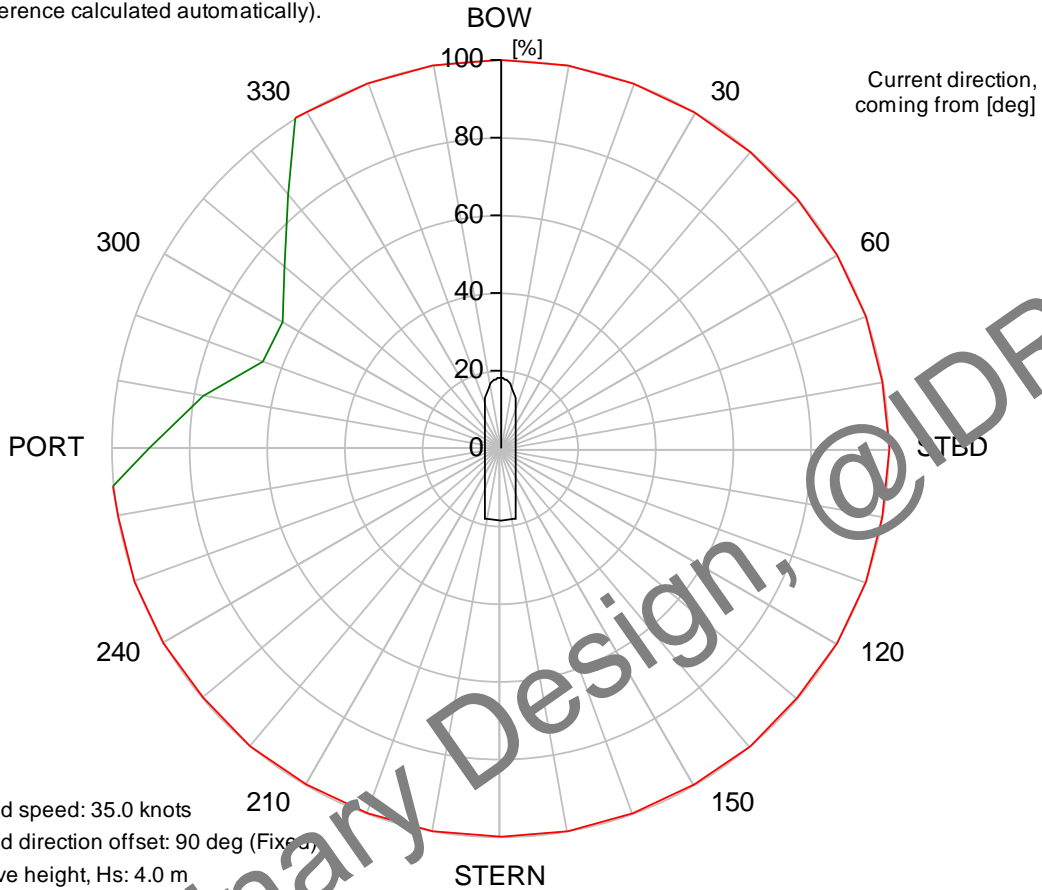
5.29 Case 29 - Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 90 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 90 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 39: DP capability envelope for case 29.

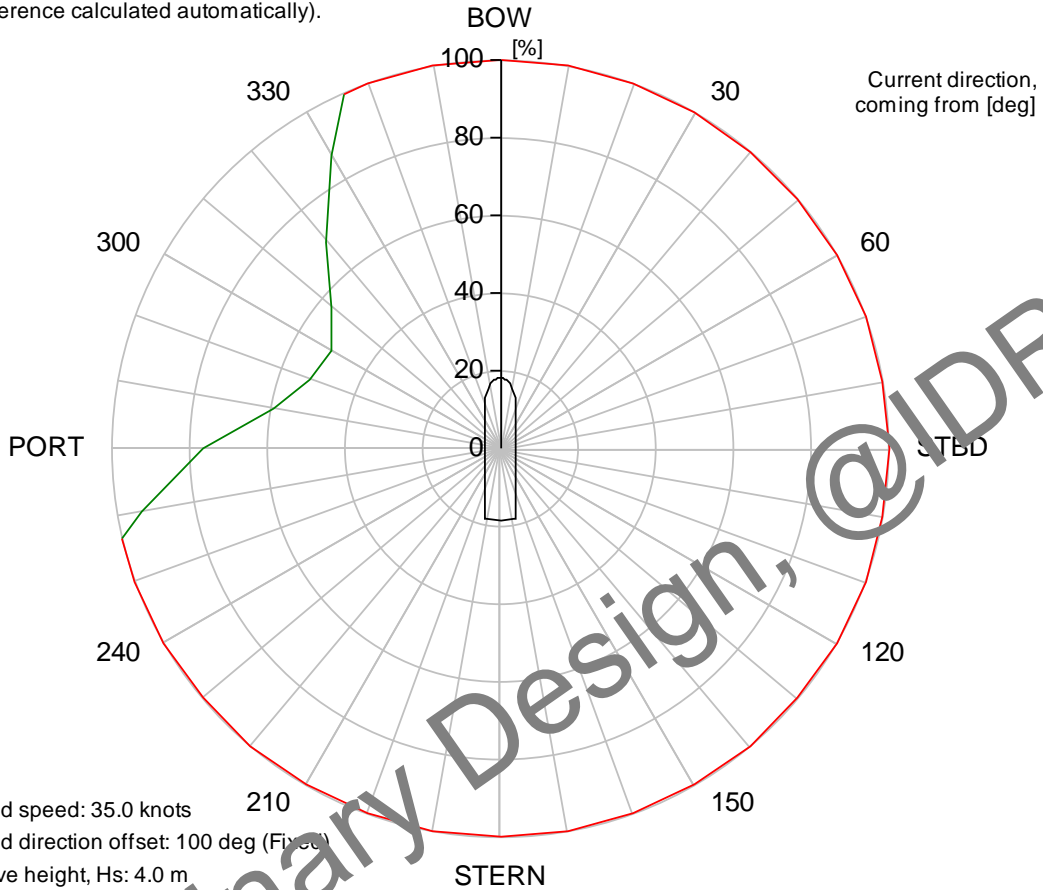
5.30 Case 30 - Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 100 deg (Fixed)
 Wave height, Hs: 4.0 m
 Wave period, Tz: 6.7 s (Tp 9.4 s)
 Wave direction offset: 100 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 40: DP capability envelope for case 30.

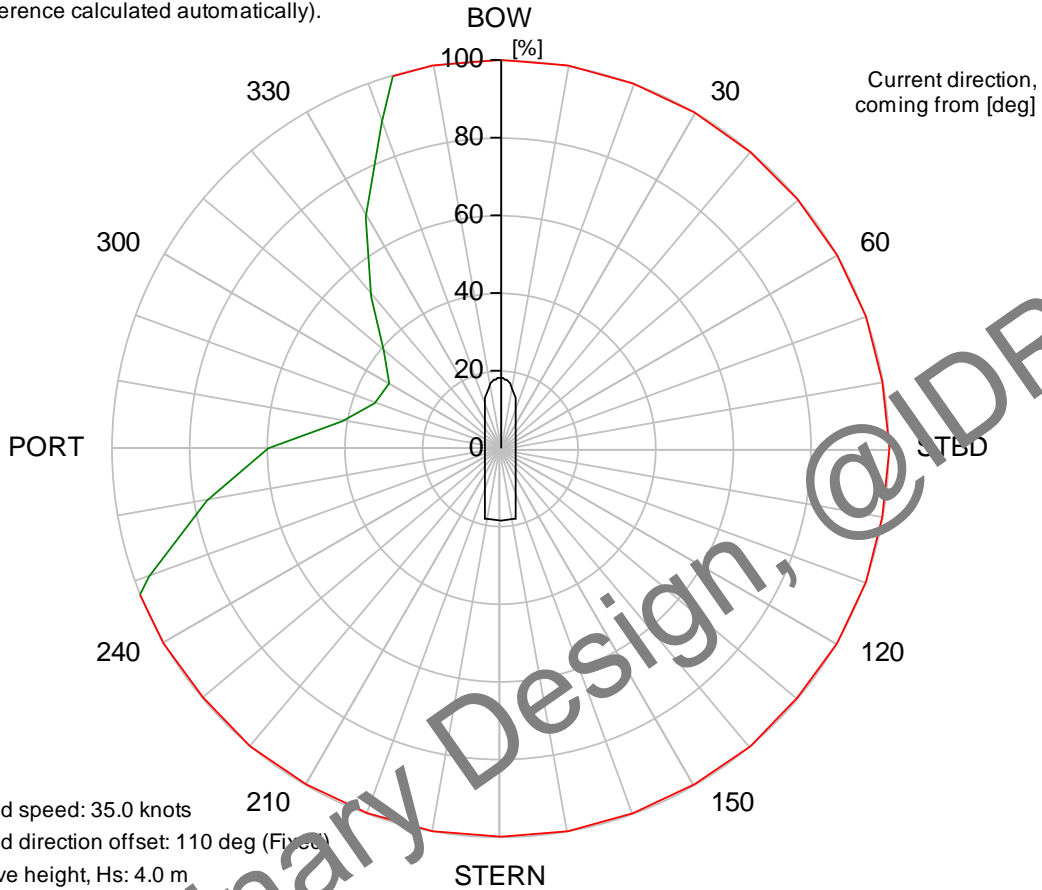
5.31 Case 31 - Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 110 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 110 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 41: DP capability envelope for case 31.

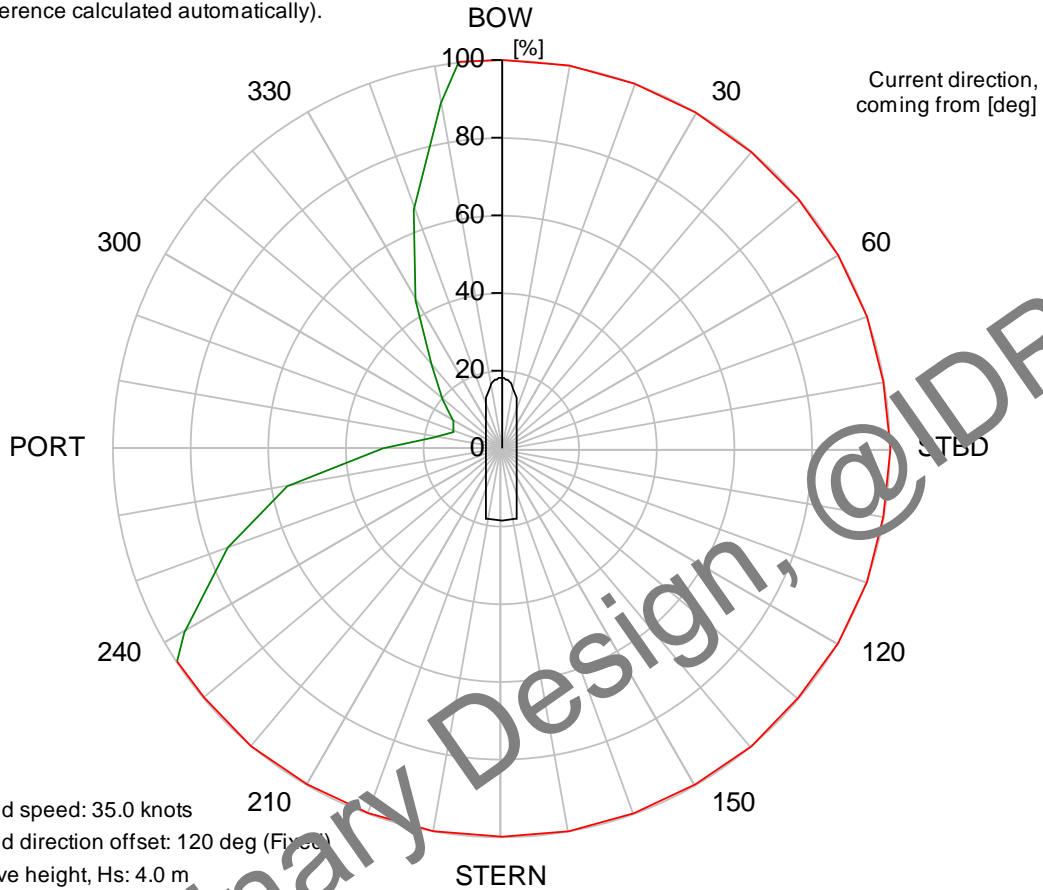
5.32 Case 32 - Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 120 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 120 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
T1 [t]	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 42: DP capability envelope for case 32.

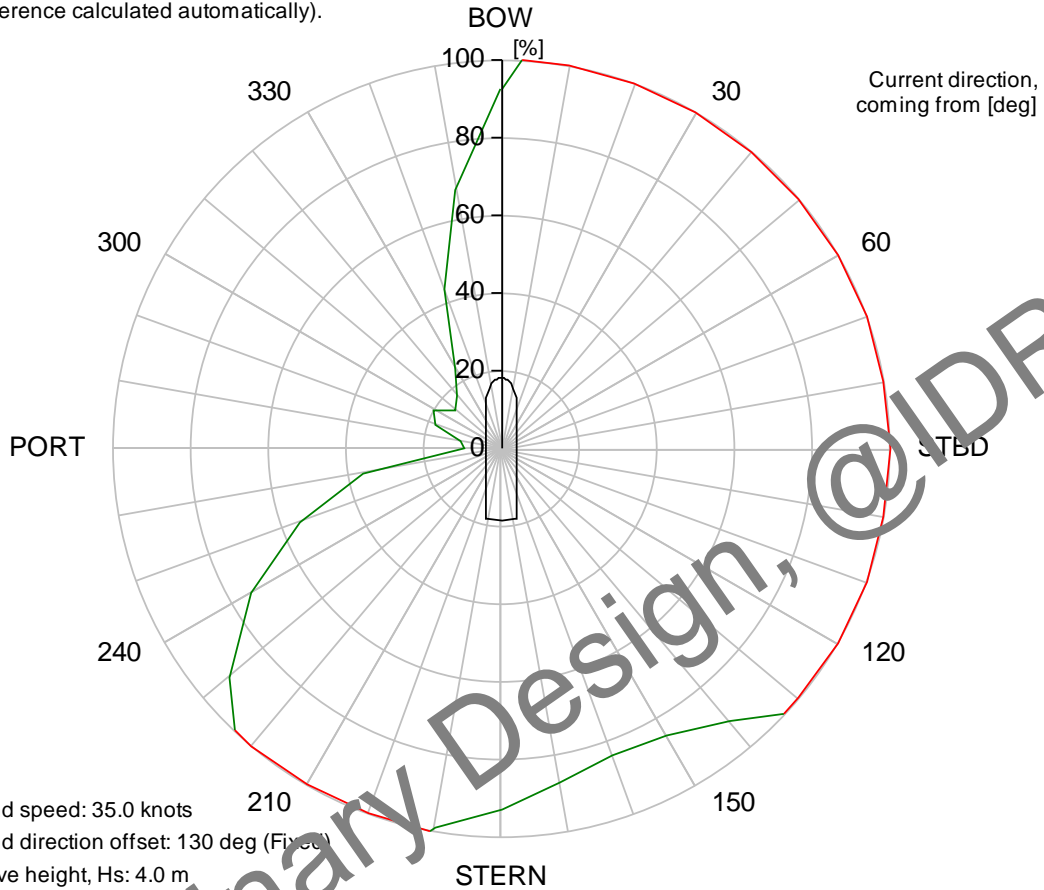
5.33 Case 33 - Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 130 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (To 9.4 s)

Wave direction offset: 130 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 43: DP capability envelope for case 33.

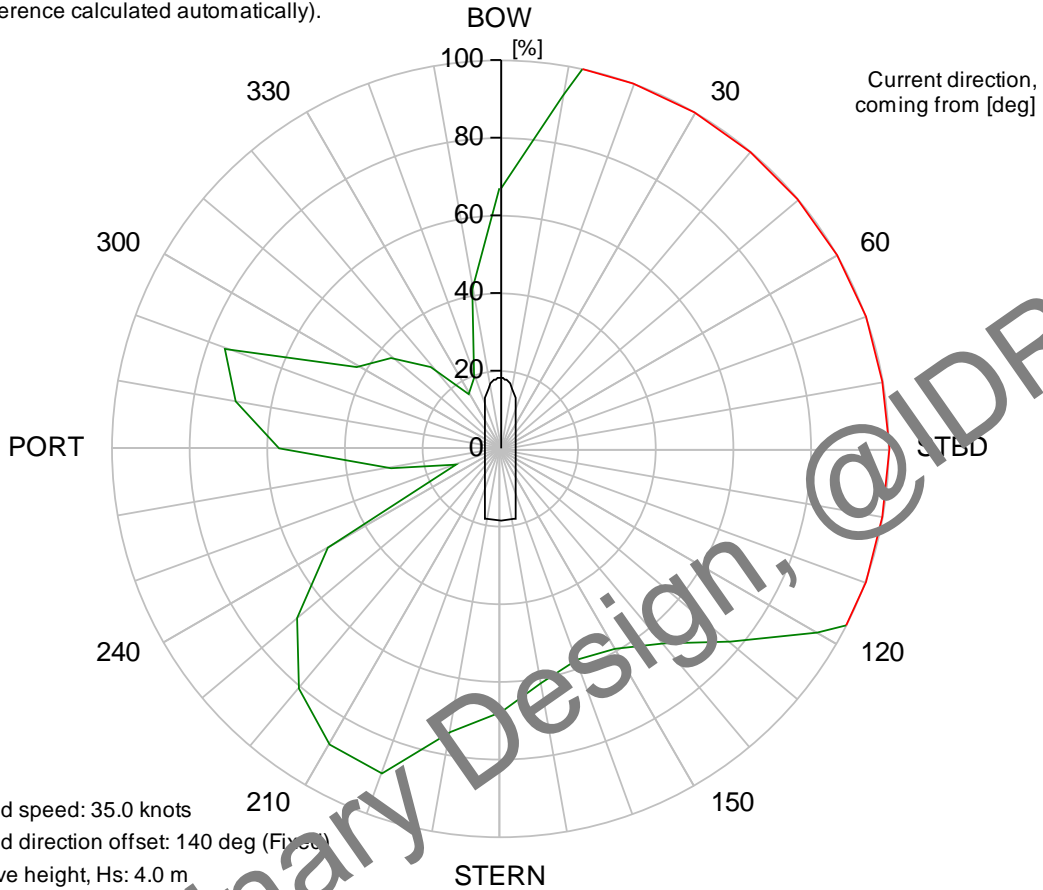
5.34 Case 34 - Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 140 deg (Fixed)
 Wave height, Hs: 4.0 m
 Wave period, Tz: 6.7 s (Tp 9.4 s)
 Wave direction offset: 140 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
T/L	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 44: DP capability envelope for case 34.

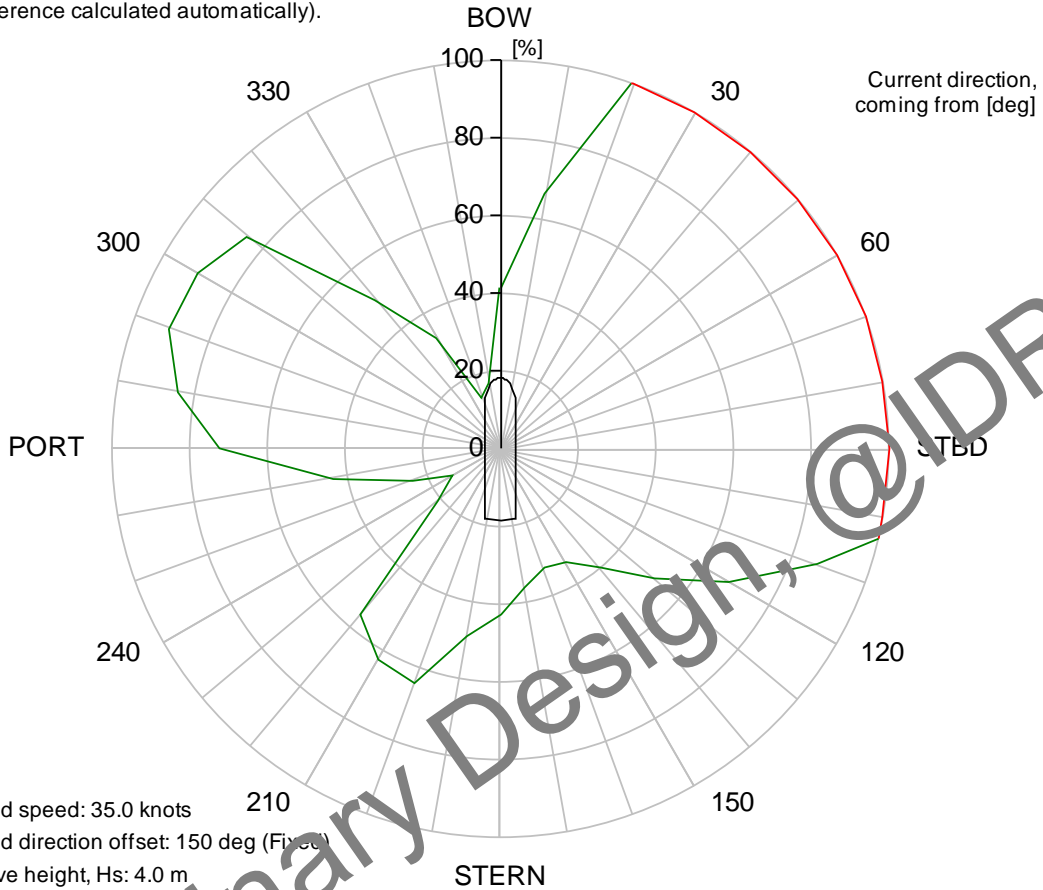
5.35 Case 35 - Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 150 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 150 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 45: DP capability envelope for case 35.

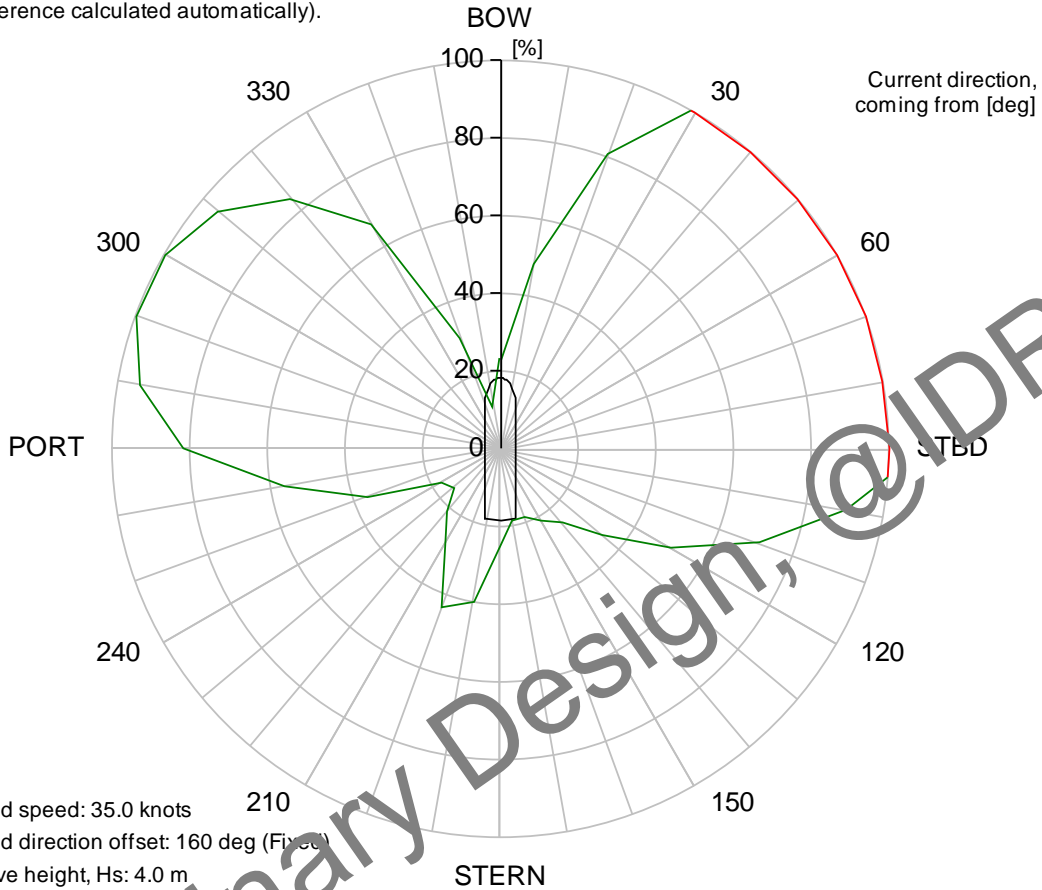
5.36 Case 36 - Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots
 Wind direction offset: 160 deg (Fixed)
 Wave height, Hs: 4.0 m
 Wave period, Tz: 6.7 s (Tp 9.4 s)
 Wave direction offset: 160 deg (Fixed)
 Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots
 Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration				
T1	T2	T3	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	T2	T3	100	112.2	0.0	9500.0			
			100	112.2	0.0	9500.0			
			63	20.0	-20.0	1063.1			

Figure 46: DP capability envelope for case 36.

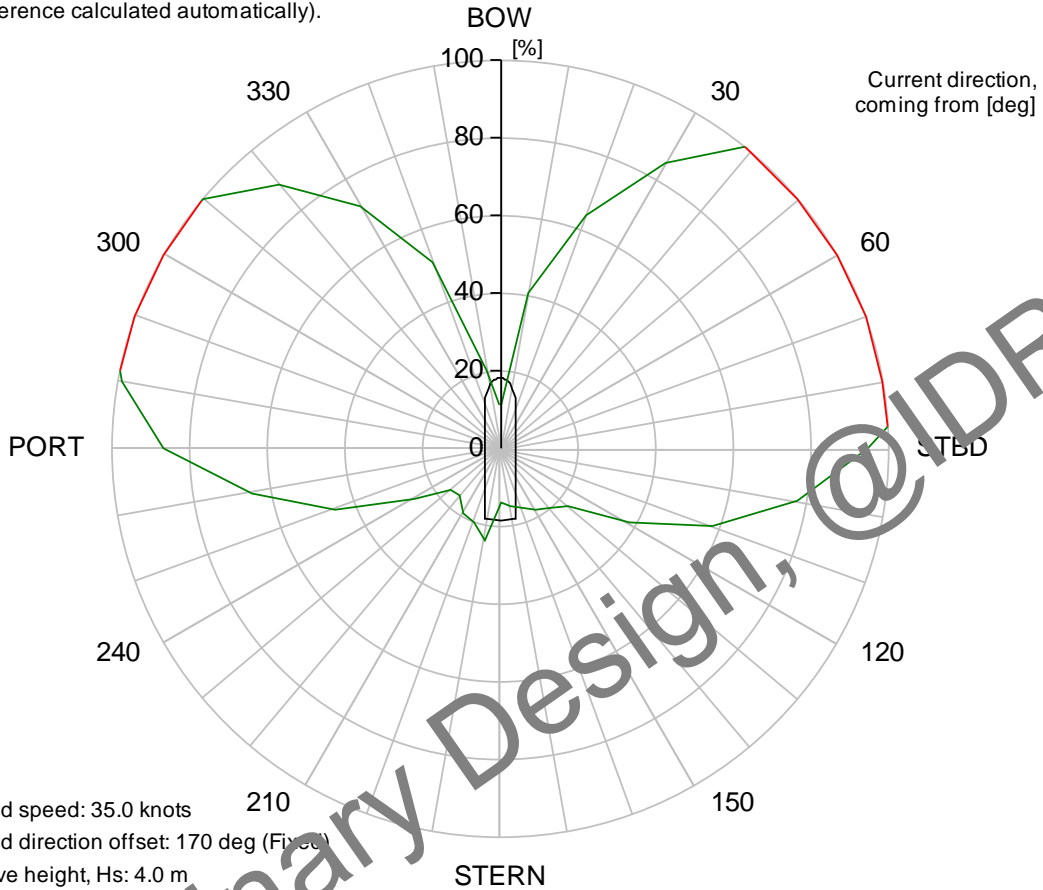
5.37 Case 37 - Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 170 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 170 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thr. ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 47: DP capability envelope for case 37.

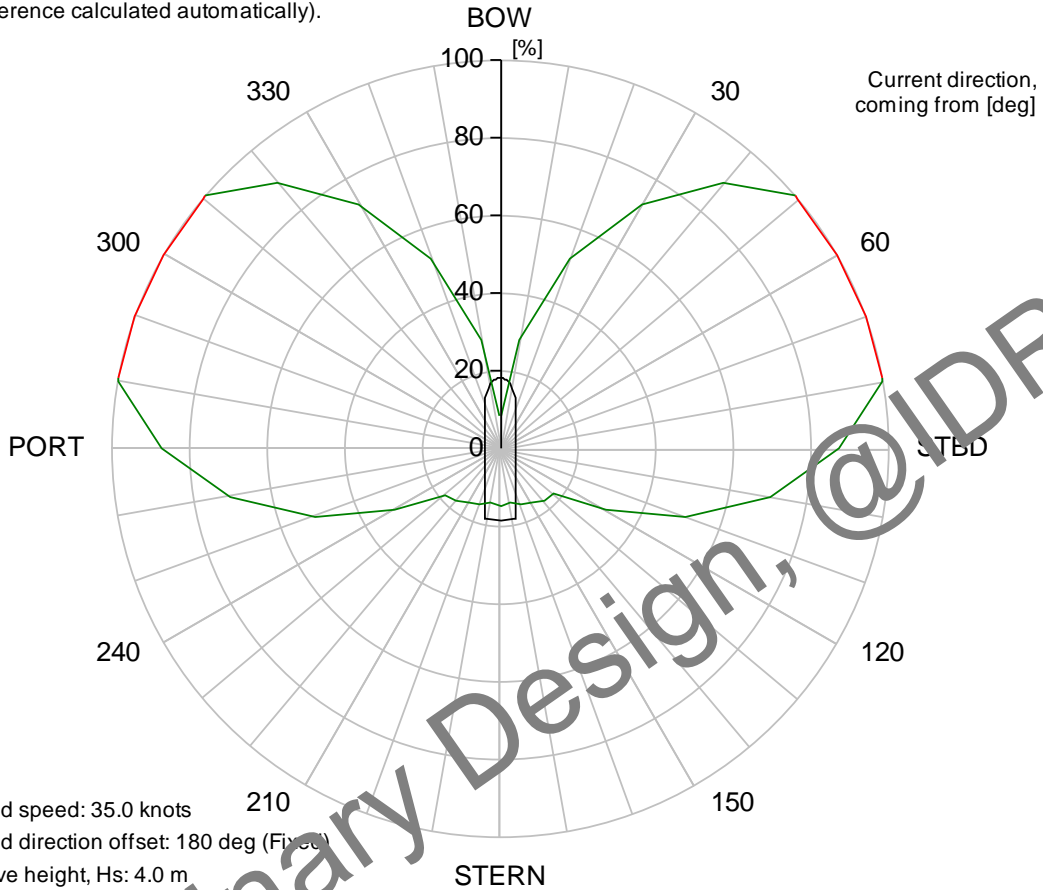
5.38 Case 38 - Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 5

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wind direction offset: 180 deg (Fixed)

Wave height, Hs: 4.0 m

Wave period, Tz: 6.7 s (Tp 9.4 s)

Wave direction offset: 180 deg (Fixed)

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 2.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
T1	T2	T3			Bus name	Connected thrusters	Available power [kW]
Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]				
100	112.2	0.0	9500.0				
100	112.2	0.0	9500.0				
63	20.0	-20.0	1063.1				

Figure 48: DP capability envelope for case 38.

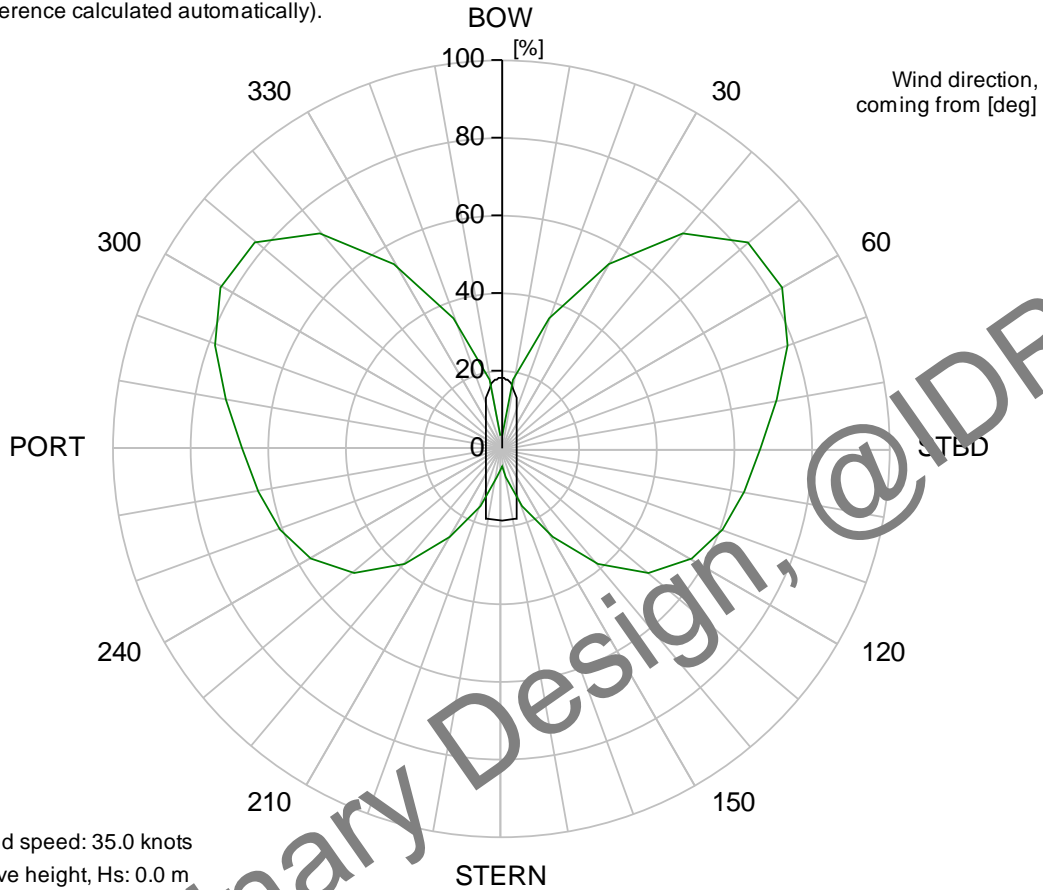
5.39 Case 39 - Thrust Utilization: 35 knots wind, 0 current, 0 waves

CONSTANT ENVIRONMENT (Thruster utilisation)

Thrusters active: T1-T3

Total thrust utilisation as a percentage of maximum available (reference calculated automatically).

Rudders active: None



Wind speed: 35.0 knots

Wave height, Hs: 0.0 m

Wave period, Tz: 0.0 s (T₀ 0.0 s)

Wave direction offset: 0 deg

Wave spectrum: Pierson-Moskowitz

Rotating tidal current: 0.00 knots

Rotating wind induced current: 0 % of wind speed

Available thrust					Power configuration		
Thruster ID	Max. rel. thrust [%]	Max. forward thrust [tf]	Max. reversed thrust [tf]	Max. power [kW]	Bus name	Connected thrusters	Available power [kW]
T1	100	112.2	0.0	9500.0			
T2	100	112.2	0.0	9500.0			
T3	63	20.0	-20.0	1063.1			

Figure 49: DP capability envelope for case 39.

6 Simulation printouts

6.1 Case 1 - Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 4

6.1.1 Environment and thrust utilisation

Case 1 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	0.0	0.0	0.0	35.0	2.5	6.0	8.5	2.00	7.4
10.0	0.0	0.0	10.0	35.0	2.5	6.0	8.5	2.00	26.7
20.0	0.0	0.0	20.0	35.0	2.5	6.0	8.5	2.00	48.6
30.0	0.0	0.0	30.0	35.0	2.5	6.0	8.5	2.00	67.9
40.0	0.0	0.0	40.0	35.0	2.5	6.0	8.5	2.00	92.6
50.0	0.0	0.0	50.0	35.0	2.5	6.0	8.5	2.00	99.6
60.0	0.0	0.0	60.0	35.0	2.5	6.0	8.5	2.00	96.0
70.0	0.0	0.0	70.0	35.0	2.5	6.0	8.5	2.00	95.5
80.0	0.0	0.0	80.0	35.0	2.5	6.0	8.5	2.00	89.9
90.0	0.0	0.0	90.0	35.0	2.5	6.0	8.5	2.00	78.2
100.0	0.0	0.0	100.0	35.0	2.5	6.0	8.5	2.00	62.0
110.0	0.0	0.0	110.0	35.0	2.5	6.0	8.5	2.00	43.8
120.0	0.0	0.0	120.0	35.0	2.5	6.0	8.5	2.00	26.4
130.0	0.0	0.0	130.0	35.0	2.5	6.0	8.5	2.00	16.9
140.0	0.0	0.0	140.0	35.0	2.5	6.0	8.5	2.00	12.2
150.0	0.0	0.0	150.0	35.0	2.5	6.0	8.5	2.00	10.8
160.0	0.0	0.0	160.0	35.0	2.5	6.0	8.5	2.00	10.2
170.0	0.0	0.0	170.0	35.0	2.5	6.0	8.5	2.00	6.8
180.0	0.0	0.0	180.0	35.0	2.5	6.0	8.5	2.00	3.1
190.0	0.0	0.0	190.0	35.0	2.5	6.0	8.5	2.00	6.8
200.0	0.0	0.0	200.0	35.0	2.5	6.0	8.5	2.00	10.2
210.0	0.0	0.0	210.0	35.0	2.5	6.0	8.5	2.00	10.8
220.0	0.0	0.0	220.0	35.0	2.5	6.0	8.5	2.00	12.2
230.0	0.0	0.0	230.0	35.0	2.5	6.0	8.5	2.00	16.9
240.0	0.0	0.0	240.0	35.0	2.5	6.0	8.5	2.00	26.4
250.0	0.0	0.0	250.0	35.0	2.5	6.0	8.5	2.00	43.8
260.0	0.0	0.0	260.0	35.0	2.5	6.0	8.5	2.00	62.0
270.0	0.0	0.0	270.0	35.0	2.5	6.0	8.5	2.00	78.2
280.0	0.0	0.0	280.0	35.0	2.5	6.0	8.5	2.00	89.9
290.0	0.0	0.0	290.0	35.0	2.5	6.0	8.5	2.00	95.5
300.0	0.0	0.0	300.0	35.0	2.5	6.0	8.5	2.00	96.0
310.0	0.0	0.0	310.0	35.0	2.5	6.0	8.5	2.00	92.6
320.0	0.0	0.0	320.0	35.0	2.5	6.0	8.5	2.00	82.9
330.0	0.0	0.0	330.0	35.0	2.5	6.0	8.5	2.00	67.9
340.0	0.0	0.0	340.0	35.0	2.5	6.0	8.5	2.00	48.6
350.0	0.0	0.0	350.0	35.0	2.5	6.0	8.5	2.00	26.7
360.0	0.0	0.0	360.0	35.0	2.5	6.0	8.5	2.00	7.4

6.1.2 Relative contributions of force components

Case 1 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	45.8	15.5	24.4	0.0	14.3	100.0
10.0	41.3	14.0	31.8	0.0	12.9	100.0
20.0	31.5	10.7	48.1	0.0	9.8	100.0
30.0	21.5	7.3	64.5	0.0	6.7	100.0
40.0	14.1	4.8	76.7	0.0	4.4	100.0
50.0	9.4	3.2	84.5	0.0	2.9	100.0
60.0	6.6	2.2	89.2	0.0	2.1	100.0
70.0	4.9	1.7	91.8	0.0	1.5	100.0
80.0	4.0	1.4	93.4	0.0	1.3	100.0
90.0	3.6	1.2	94.1	0.0	1.1	100.0
100.0	3.5	1.2	94.2	0.0	1.1	100.0
110.0	3.8	1.3	93.7	0.0	1.2	100.0
120.0	4.5	1.5	92.5	0.0	1.4	100.0
130.0	6.1	2.1	89.9	0.0	1.9	100.0
140.0	9.2	3.1	84.8	0.0	2.9	100.0
150.0	15.8	5.4	73.8	0.0	5.0	100.0
160.0	31.2	10.6	48.4	0.0	9.8	100.0
170.0	66.2	22.4	-9.3	0.0	20.7	100.0
180.0	98.9	33.5	-63.3	0.0	30.9	100.0
190.0	66.2	22.4	-9.3	0.0	20.7	100.0
200.0	31.2	10.6	48.4	0.0	9.8	100.0
210.0	15.8	5.4	73.8	0.0	5.0	100.0
220.0	9.2	3.1	84.8	0.0	2.9	100.0
230.0	6.1	2.1	89.9	0.0	1.9	100.0
240.0	4.5	1.5	92.5	0.0	1.4	100.0
250.0	3.8	1.3	93.7	0.0	1.2	100.0
260.0	3.5	1.2	94.2	0.0	1.1	100.0
270.0	3.6	1.2	94.1	0.0	1.1	100.0
280.0	4.0	1.4	93.4	0.0	1.3	100.0
290.0	4.9	1.7	91.8	0.0	1.5	100.0
300.0	6.6	2.2	89.2	0.0	2.1	100.0
310.0	9.4	3.2	84.5	0.0	2.9	100.0
320.0	14.1	4.8	76.7	0.0	4.4	100.0
330.0	21.5	7.3	64.5	0.0	6.7	100.0
340.0	31.5	10.7	48.1	0.0	9.8	100.0
350.0	41.3	14.0	31.8	0.0	12.9	100.0
360.0	45.8	15.5	24.4	0.0	14.3	100.0

6.1.3 Environment forces

Case 1 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	-2.3	-3.6	0.0	-2.1	-14.7
10.0	-6.7	-2.3	-3.6	0.0	-2.1	-14.7
20.0	-6.7	-2.3	-3.5	0.0	-2.1	-14.6
30.0	-6.7	-2.3	-3.2	0.0	-2.1	-14.3
40.0	-6.7	-2.3	-2.8	0.0	-2.1	-13.9
50.0	-6.7	-2.3	-2.3	0.0	-2.1	-13.4
60.0	-6.7	-2.3	-1.6	0.0	-2.1	-12.7
70.0	-6.7	-2.3	-0.9	0.0	-2.1	-12.0
80.0	-6.7	-2.3	-0.1	0.0	-2.1	-11.2
90.0	-6.7	-2.3	0.7	0.0	-2.1	-10.4
100.0	-6.7	-2.3	1.5	0.0	-2.1	-9.6
110.0	-6.7	-2.3	2.3	0.0	-2.1	-8.8
120.0	-6.7	-2.3	3.0	0.0	-2.1	-8.2
130.0	-6.7	-2.3	3.5	0.0	-2.1	-7.6
140.0	-6.7	-2.3	4.0	0.0	-2.1	-7.2
150.0	-6.7	-2.3	4.3	0.0	-2.1	-6.9
160.0	-6.7	-2.3	4.4	0.0	-2.1	-6.7
170.0	-6.7	-2.3	4.4	0.0	-2.1	-6.7
180.0	-6.7	-2.3	4.3	0.0	-2.1	-6.8
190.0	-6.7	-2.3	4.4	0.0	-2.1	-6.7
200.0	-6.7	-2.3	4.4	0.0	-2.1	-6.7
210.0	-6.7	-2.3	4.3	0.0	-2.1	-6.9
220.0	-6.7	-2.3	4.0	0.0	-2.1	-7.2
230.0	-6.7	-2.3	3.5	0.0	-2.1	-7.6
240.0	-6.7	-2.3	3.0	0.0	-2.1	-8.2
250.0	-6.7	-2.3	2.3	0.0	-2.1	-8.8
260.0	-6.7	-2.3	1.5	0.0	-2.1	-9.6
270.0	-6.7	-2.3	0.7	0.0	-2.1	-10.4
280.0	-6.7	-2.3	-0.1	0.0	-2.1	-11.2
290.0	-6.7	-2.3	-0.9	0.0	-2.1	-12.0
300.0	-6.7	-2.3	-1.6	0.0	-2.1	-12.7
310.0	-6.7	-2.3	-2.3	0.0	-2.1	-13.4
320.0	-6.7	-2.3	-2.8	0.0	-2.1	-13.9
330.0	-6.7	-2.3	-3.2	0.0	-2.1	-14.3
340.0	-6.7	-2.3	-3.5	0.0	-2.1	-14.6
350.0	-6.7	-2.3	-3.6	0.0	-2.1	-14.7
360.0	-6.7	-2.3	-3.6	0.0	-2.1	-14.7

Case 1 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-4.8	0.0	0.0	-4.8
20.0	0.0	0.0	-10.0	0.0	0.0	-10.0
30.0	0.0	0.0	-15.6	0.0	0.0	-15.6
40.0	0.0	0.0	-21.7	0.0	0.0	-21.7
50.0	0.0	0.0	-28.0	0.0	0.0	-28.0
60.0	0.0	0.0	-33.8	0.0	0.0	-33.8
70.0	0.0	0.0	-38.7	0.0	0.0	-38.7
80.0	0.0	0.0	-41.9	0.0	0.0	-41.9
90.0	0.0	0.0	-43.0	0.0	0.0	-43.0
100.0	0.0	0.0	-41.9	0.0	0.0	-41.9
110.0	0.0	0.0	-38.7	0.0	0.0	-38.7
120.0	0.0	0.0	-33.8	0.0	0.0	-33.8
130.0	0.0	0.0	-28.0	0.0	0.0	-28.0
140.0	0.0	0.0	-21.7	0.0	0.0	-21.7
150.0	0.0	0.0	-15.6	0.0	0.0	-15.6
160.0	0.0	0.0	-10.0	0.0	0.0	-10.0
170.0	0.0	0.0	-4.8	0.0	0.0	-4.8
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	4.8	0.0	0.0	4.8
200.0	0.0	0.0	10.0	0.0	0.0	10.0
210.0	0.0	0.0	15.6	0.0	0.0	15.6
220.0	0.0	0.0	21.7	0.0	0.0	21.7
230.0	0.0	0.0	28.0	0.0	0.0	28.0
240.0	0.0	0.0	33.8	0.0	0.0	33.8
250.0	0.0	0.0	38.7	0.0	0.0	38.7
260.0	0.0	0.0	41.9	0.0	0.0	41.9
270.0	0.0	0.0	43.0	0.0	0.0	43.0
280.0	0.0	0.0	41.9	0.0	0.0	41.9
290.0	0.0	0.0	38.7	0.0	0.0	38.7
300.0	0.0	0.0	33.8	0.0	0.0	33.8
310.0	0.0	0.0	28.0	0.0	0.0	28.0
320.0	0.0	0.0	21.7	0.0	0.0	21.7
330.0	0.0	0.0	15.6	0.0	0.0	15.6
340.0	0.0	0.0	10.0	0.0	0.0	10.0
350.0	0.0	0.0	4.8	0.0	0.0	4.8
360.0	0.0	0.0	0.0	0.0	0.0	0.0

Preliminary Design, @DR5

Case 1 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-316.6	0.0	0.0	-316.6
20.0	0.0	0.0	-593.0	0.0	0.0	-593.0
30.0	0.0	0.0	-793.7	0.0	0.0	-793.7
40.0	0.0	0.0	-892.8	0.0	0.0	-892.8
50.0	0.0	0.0	-876.4	0.0	0.0	-876.4
60.0	0.0	0.0	-745.2	0.0	0.0	-745.2
70.0	0.0	0.0	-513.8	0.0	0.0	-513.8
80.0	0.0	0.0	-209.2	0.0	0.0	-209.2
90.0	0.0	0.0	132.4	0.0	0.0	132.4
100.0	0.0	0.0	470.0	0.0	0.0	470.0
110.0	0.0	0.0	762.6	0.0	0.0	762.6
120.0	0.0	0.0	974.5	0.0	0.0	974.5
130.0	0.0	0.0	1079.2	0.0	0.0	1079.2
140.0	0.0	0.0	1063.0	0.0	0.0	1063.0
150.0	0.0	0.0	926.1	0.0	0.0	926.1
160.0	0.0	0.0	683.5	0.0	0.0	683.5
170.0	0.0	0.0	362.6	0.0	0.0	362.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	-362.6	0.0	0.0	-362.6
200.0	0.0	0.0	-683.5	0.0	0.0	-683.5
210.0	0.0	0.0	-926.1	0.0	0.0	-926.1
220.0	0.0	0.0	-1063.0	0.0	0.0	-1063.0
230.0	0.0	0.0	-1079.2	0.0	0.0	-1079.2
240.0	0.0	0.0	-974.5	0.0	0.0	-974.5
250.0	0.0	0.0	-762.6	0.0	0.0	-762.6
260.0	0.0	0.0	-470.0	0.0	0.0	-470.0
270.0	0.0	0.0	-132.4	0.0	0.0	-132.4
280.0	0.0	0.0	209.2	0.0	0.0	209.2
290.0	0.0	0.0	513.8	0.0	0.0	513.8
300.0	0.0	0.0	745.2	0.0	0.0	745.2
310.0	0.0	0.0	876.4	0.0	0.0	876.4
320.0	0.0	0.0	892.8	0.0	0.0	892.8
330.0	0.0	0.0	793.7	0.0	0.0	793.7
340.0	0.0	0.0	593.0	0.0	0.0	593.0
350.0	0.0	0.0	316.6	0.0	0.0	316.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.1.4 Thruster use

Case 1 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	7.4	0.0	7.4	0.0	0.0	90.0	14.7	360.0
10.0	10.3	355.0	4.6	348.6	6.6	90.0	15.5	18.2
20.0	12.9	353.5	2.3	318.6	13.0	90.0	17.7	34.4
30.0	31.2	359.3	16.9	181.2	16.4	90.0	21.2	47.5
40.0	64.2	2.4	50.3	177.2	16.6	90.0	25.8	57.4
50.0	86.5	3.8	73.1	175.9	17.0	90.0	31.0	64.4
60.0	95.8	5.1	83.0	174.6	17.5	90.0	36.2	69.4
70.0	96.8	6.7	84.8	173.1	17.3	90.0	40.5	72.7
80.0	84.1	8.9	72.8	170.7	17.1	90.0	43.3	75.0
90.0	59.0	13.4	48.6	165.3	16.9	90.0	44.2	76.4
100.0	25.0	31.4	16.7	134.6	17.0	90.0	43.0	77.1
110.0	22.3	50.5	10.7	119.8	12.2	90.0	39.7	77.1
120.0	15.5	81.7	12.0	60.2	8.1	90.0	34.8	76.4
130.0	14.1	84.0	12.3	60.2	3.3	90.0	29.0	74.8
140.0	11.9	83.7	11.8	60.2	-0.3	90.0	22.9	71.8
150.0	9.3	78.9	10.2	60.2	-2.3	90.0	17.1	66.3
160.0	6.7	73.4	7.8	52.2	-2.6	90.0	12.0	56.1
170.0	4.2	52.9	5.3	37.3	-1.7	90.0	8.3	35.8
180.0	3.4	0.0	3.4	0.0	0.0	90.0	6.7	360.0
190.0	5.3	322.7	4.2	307.1	1.7	90.0	8.3	324.2
200.0	7.8	307.8	6.7	286.6	2.6	90.0	12.0	303.9
210.0	10.2	299.8	9.3	281.1	2.3	90.0	17.1	293.7
220.0	11.8	299.8	11.9	275.3	0.3	90.0	22.9	288.2
230.0	12.3	299.8	14.1	275.0	-3.3	90.0	29.0	285.2
240.0	12.0	299.8	15.5	278.3	-8.1	90.0	34.8	283.6
250.0	10.7	299.8	16.1	282.7	-13.7	90.0	39.7	282.9
260.0	16.7	227.4	25.0	328.6	-17.0	90.0	43.0	282.9
270.0	13.6	194.7	59.0	346.6	-16.9	90.0	44.2	283.6
280.0	72.0	189.3	84.1	351.1	-17.1	90.0	43.3	285.0
290.0	84.8	186.9	96.8	353.3	-17.3	90.0	40.5	287.3
300.0	83.0	185.4	95.8	354.9	-17.5	90.0	36.2	290.6
310.0	73.1	184.1	86.5	356.2	-17.0	90.0	31.0	295.6
320.0	50.3	182.8	64.2	357.6	-16.6	90.0	25.8	302.6
330.0	16.9	178.8	31.2	0.7	-16.4	90.0	21.2	312.5
340.0	2.3	41.4	12.9	6.5	-13.0	90.0	17.7	325.6
350.0	4.6	11.4	10.3	5.0	-6.6	90.0	15.5	341.8
360.0	7.4	0.0	7.4	0.0	0.0	90.0	14.7	360.0

6.1.5 Thruster loss

Case 1 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.87	1.00
10.0	0.85	0.86	0.81
20.0	0.86	0.89	0.81
30.0	0.88	0.79	0.82
40.0	0.88	0.80	0.83
50.0	0.89	0.80	0.85
60.0	0.90	0.81	0.87
70.0	0.91	0.82	0.86
80.0	0.91	0.83	0.85
90.0	0.92	0.83	0.84
100.0	0.90	0.82	0.85
110.0	0.89	0.81	0.85
120.0	0.87	0.85	0.86
130.0	0.87	0.86	0.86
140.0	0.89	0.88	0.92
150.0	0.90	0.89	0.92
160.0	0.93	0.89	0.91
170.0	0.94	0.90	0.91
180.0	0.97	0.97	1.00
190.0	0.90	0.94	0.91
200.0	0.89	0.93	0.91
210.0	0.89	0.90	0.92
220.0	0.88	0.89	0.92
230.0	0.86	0.87	0.86
240.0	0.85	0.87	0.86
250.0	0.84	0.86	0.85
260.0	0.82	0.90	0.85
270.0	0.83	0.92	0.84
280.0	0.83	0.91	0.85
290.0	0.82	0.91	0.86
300.0	0.81	0.90	0.87
310.0	0.80	0.89	0.85
320.0	0.80	0.88	0.83
330.0	0.79	0.88	0.82
340.0	0.89	0.86	0.81
350.0	0.86	0.85	0.81
360.0	0.87	0.87	1.00

Preliminary Design, @IDR5

6.2 Case 2 - Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 4

6.2.1 Environment and thrust utilisation

Case 2 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	10.0	10.0	0.0	35.0	2.5	6.0	8.5	2.00	29.3
10.0	10.0	10.0	10.0	35.0	2.5	6.0	8.5	2.00	52.7
20.0	10.0	10.0	20.0	35.0	2.5	6.0	8.5	2.00	74.5
30.0	10.0	10.0	30.0	35.0	2.5	6.0	8.5	2.00	93.6
40.0	10.0	10.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	10.0	10.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	10.0	10.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	10.0	10.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	10.0	10.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	10.0	10.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	10.0	10.0	100.0	35.0	2.5	6.0	8.5	2.00	84.8
110.0	10.0	10.0	110.0	35.0	2.5	6.0	8.5	2.00	66.4
120.0	10.0	10.0	120.0	35.0	2.5	6.0	8.5	2.00	48.2
130.0	10.0	10.0	130.0	35.0	2.5	6.0	8.5	2.00	32.9
140.0	10.0	10.0	140.0	35.0	2.5	6.0	8.5	2.00	21.9
150.0	10.0	10.0	150.0	35.0	2.5	6.0	8.5	2.00	16.1
160.0	10.0	10.0	160.0	35.0	2.5	6.0	8.5	2.00	14.3
170.0	10.0	10.0	170.0	35.0	2.5	6.0	8.5	2.00	17.1
180.0	10.0	10.0	180.0	35.0	2.5	6.0	8.5	2.00	24.6
190.0	10.0	10.0	190.0	35.0	2.5	6.0	8.5	2.00	30.8
200.0	10.0	10.0	200.0	35.0	2.5	6.0	8.5	2.00	29.5
210.0	10.0	10.0	210.0	35.0	2.5	6.0	8.5	2.00	28.7
220.0	10.0	10.0	220.0	35.0	2.5	6.0	8.5	2.00	23.1
230.0	10.0	10.0	230.0	35.0	2.5	6.0	8.5	2.00	14.7
240.0	10.0	10.0	240.0	35.0	2.5	6.0	8.5	2.00	14.7
250.0	10.0	10.0	250.0	35.0	2.5	6.0	8.5	2.00	24.5
260.0	10.0	10.0	260.0	35.0	2.5	6.0	8.5	2.00	41.9
270.0	10.0	10.0	270.0	35.0	2.5	6.0	8.5	2.00	57.9
280.0	10.0	10.0	280.0	35.0	2.5	6.0	8.5	2.00	71.4
290.0	10.0	10.0	290.0	35.0	2.5	6.0	8.5	2.00	78.1
300.0	10.0	10.0	300.0	35.0	2.5	6.0	8.5	2.00	78.7
310.0	10.0	10.0	310.0	35.0	2.5	6.0	8.5	2.00	74.9
320.0	10.0	10.0	320.0	35.0	2.5	6.0	8.5	2.00	64.9
330.0	10.0	10.0	330.0	35.0	2.5	6.0	8.5	2.00	49.6
340.0	10.0	10.0	340.0	35.0	2.5	6.0	8.5	2.00	30.2
350.0	10.0	10.0	350.0	35.0	2.5	6.0	8.5	2.00	7.8
360.0	10.0	10.0	360.0	35.0	2.5	6.0	8.5	2.00	29.3

6.2.2 Relative contributions of force components

Case 2 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	50.4	16.3	18.8	0.0	14.5	100.0
10.0	43.9	13.8	30.0	0.0	12.3	100.0
20.0	36.2	11.2	42.7	0.0	9.9	100.0
30.0	29.1	8.9	54.2	0.0	7.8	100.0
40.0	23.4	7.0	63.5	0.0	6.1	100.0
50.0	19.1	5.7	70.3	0.0	4.9	100.0
60.0	16.1	4.7	75.1	0.0	4.1	100.0
70.0	14.1	4.1	78.2	0.0	3.6	100.0
80.0	13.0	3.8	80.0	0.0	3.3	100.0
90.0	12.6	3.6	80.7	0.0	3.1	100.0
100.0	12.8	3.7	80.4	0.0	3.2	100.0
110.0	13.6	3.9	79.1	0.0	3.4	100.0
120.0	15.2	4.4	76.6	0.0	3.8	100.0
130.0	17.9	5.2	72.5	0.0	4.5	100.0
140.0	22.1	6.4	66.0	0.0	5.5	100.0
150.0	28.4	8.3	56.0	0.0	7.3	100.0
160.0	38.4	11.4	40.4	0.0	9.9	100.0
170.0	54.3	16.4	14.9	0.0	14.4	100.0
180.0	80.2	24.9	-27.1	0.0	22.0	100.0
190.0	111.6	36.3	-80.3	0.0	32.5	100.0
200.0	34.3	14.2	2.7	0.0	29.8	100.0
210.0	-3.6	1.2	84.5	0.0	17.9	100.0
220.0	-11.2	2.1	102.0	0.0	11.1	100.0
230.0	-17.5	-2.5	106.3	0.0	7.7	100.0
240.0	-21.6	-2.4	107.0	0.0	6.0	100.0
250.0	-23.9	-2.3	106.8	0.0	5.0	100.0
260.0	-25.0	-2.1	106.3	0.0	4.6	100.0
270.0	-25.2	-1.9	105.7	0.0	4.5	100.0
280.0	-24.5	-1.8	104.9	0.0	4.7	100.0
290.0	-23.0	-1.5	103.6	0.0	5.3	100.0
300.0	-20.7	-1.1	101.0	0.0	6.4	100.0
310.0	-17.8	-0.1	95.7	0.0	8.1	100.0
320.0	-14.5	2.1	84.9	0.0	10.7	100.0
330.0	-10.9	6.2	65.5	0.0	13.8	100.0
340.0	-7.2	11.8	40.4	0.0	15.5	100.0
350.0	-3.3	17.0	16.7	0.0	15.3	100.0
360.0	50.4	16.3	18.8	0.0	14.5	100.0

6.2.3 Environment forces

Case 2 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.8	-2.3	-3.6	0.0	-2.1	-14.9
10.0	-6.8	-2.3	-3.6	0.0	-2.1	-14.9
20.0	-6.8	-2.3	-3.5	0.0	-2.1	-14.8
30.0	-6.8	-2.3	-3.2	0.0	-2.1	-14.5
40.0	-6.8	-2.3	-2.8	0.0	-2.1	-14.1
50.0	-6.8	-2.3	-2.3	0.0	-2.1	-13.5
60.0	-6.8	-2.3	-1.6	0.0	-2.1	-12.9
70.0	-6.8	-2.3	-0.9	0.0	-2.1	-12.2
80.0	-6.8	-2.3	-0.1	0.0	-2.1	-11.4
90.0	-6.8	-2.3	0.7	0.0	-2.1	-10.6
100.0	-6.8	-2.3	1.5	0.0	-2.1	-9.8
110.0	-6.8	-2.3	2.3	0.0	-2.1	-9.0
120.0	-6.8	-2.3	3.0	0.0	-2.1	-8.3
130.0	-6.8	-2.3	3.5	0.0	-2.1	-7.8
140.0	-6.8	-2.3	4.0	0.0	-2.1	-7.3
150.0	-6.8	-2.3	4.3	0.0	-2.1	-7.0
160.0	-6.8	-2.3	4.4	0.0	-2.1	-6.9
170.0	-6.8	-2.3	4.4	0.0	-2.1	-6.8
180.0	-6.8	-2.3	4.3	0.0	-2.1	-7.0
190.0	-6.8	-2.3	4.4	0.0	-2.1	-6.8
200.0	-6.8	-2.3	4.4	0.0	-2.1	-6.9
210.0	-6.8	-2.3	4.3	0.0	-2.1	-7.0
220.0	-6.8	-2.3	4.0	0.0	-2.1	-7.3
230.0	-6.8	-2.3	3.5	0.0	-2.1	-7.8
240.0	-6.8	-2.3	3.0	0.0	-2.1	-8.3
250.0	-6.8	-2.3	2.3	0.0	-2.1	-9.0
260.0	-6.8	-2.3	1.5	0.0	-2.1	-9.8
270.0	-6.8	-2.3	0.7	0.0	-2.1	-10.6
280.0	-6.8	-2.3	-0.1	0.0	-2.1	-11.4
290.0	-6.8	-2.3	-0.9	0.0	-2.1	-12.2
300.0	-6.8	-2.3	-1.6	0.0	-2.1	-12.9
310.0	-6.8	-2.3	-2.3	0.0	-2.1	-13.5
320.0	-6.8	-2.3	-2.8	0.0	-2.1	-14.1
330.0	-6.8	-2.3	-3.2	0.0	-2.1	-14.5
340.0	-6.8	-2.3	-3.5	0.0	-2.1	-14.8
350.0	-6.8	-2.3	-3.6	0.0	-2.1	-14.9
360.0	-6.8	-2.3	-3.6	0.0	-2.1	-14.9

Case 2 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.3	-1.4	0.0	0.0	-1.2	-7.9
10.0	-5.3	-1.4	-4.8	0.0	-1.2	-12.7
20.0	-5.3	-1.4	-10.0	0.0	-1.2	-17.9
30.0	-5.3	-1.4	-15.6	0.0	-1.2	-23.5
40.0	-5.3	-1.4	-21.7	0.0	-1.2	-29.6
50.0	-5.3	-1.4	-28.0	0.0	-1.2	-35.9
60.0	-5.3	-1.4	-33.8	0.0	-1.2	-41.8
70.0	-5.3	-1.4	-38.7	0.0	-1.2	-46.6
80.0	-5.3	-1.4	-41.9	0.0	-1.2	-49.8
90.0	-5.3	-1.4	-43.0	0.0	-1.2	-50.9
100.0	-5.3	-1.4	-41.9	0.0	-1.2	-49.8
110.0	-5.3	-1.4	-38.7	0.0	-1.2	-46.6
120.0	-5.3	-1.4	-33.8	0.0	-1.2	-41.8
130.0	-5.3	-1.4	-28.0	0.0	-1.2	-35.9
140.0	-5.3	-1.4	-21.7	0.0	-1.2	-29.6
150.0	-5.3	-1.4	-15.6	0.0	-1.2	-23.5
160.0	-5.3	-1.4	-10.0	0.0	-1.2	-17.9
170.0	-5.3	-1.4	-4.8	0.0	-1.2	-12.7
180.0	-5.3	-1.4	0.0	0.0	-1.2	-7.9
190.0	-5.3	-1.4	4.8	0.0	-1.2	-3.1
200.0	-5.3	-1.4	10.0	0.0	1.2	4.5
210.0	-5.3	-1.4	15.6	0.0	1.2	10.2
220.0	-5.3	-1.4	21.7	0.0	1.2	16.3
230.0	-5.3	-1.4	28.0	0.0	1.2	22.5
240.0	-5.3	-1.4	33.8	0.0	1.2	28.4
250.0	-5.3	-1.4	38.7	0.0	1.2	33.2
260.0	-5.3	-1.4	41.9	0.0	1.2	36.4
270.0	-5.3	-1.4	43.0	0.0	1.2	37.5
280.0	-5.3	-1.4	41.9	0.0	1.2	36.4
290.0	-5.3	-1.4	38.7	0.0	1.2	33.2
300.0	-5.3	-1.4	33.8	0.0	1.2	28.4
310.0	-5.3	-1.4	28.0	0.0	1.2	22.5
320.0	-5.3	-1.4	21.7	0.0	1.2	16.3
330.0	-5.3	-1.4	15.6	0.0	1.2	10.2
340.0	-5.3	-1.4	10.0	0.0	1.2	4.5
350.0	-5.3	-1.4	4.8	0.0	-1.2	-3.1
360.0	-5.3	-1.4	0.0	0.0	-1.2	-7.9

Case 2 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-184.0	-23.8	0.0	0.0	-30.6	-238.4
10.0	-184.0	-23.8	-316.6	0.0	-30.6	-555.0
20.0	-184.0	-23.8	-593.0	0.0	-30.6	-831.4
30.0	-184.0	-23.8	-793.7	0.0	-30.6	-1032.1
40.0	-184.0	-23.8	-892.8	0.0	-30.6	-1131.2
50.0	-184.0	-23.8	-876.4	0.0	-30.6	-1114.8
60.0	-184.0	-23.8	-745.2	0.0	-30.6	-983.6
70.0	-184.0	-23.8	-513.8	0.0	-30.6	-752.2
80.0	-184.0	-23.8	-209.2	0.0	-30.6	-447.6
90.0	-184.0	-23.8	132.4	0.0	-30.6	-106.0
100.0	-184.0	-23.8	470.0	0.0	30.6	292.8
110.0	-184.0	-23.8	762.6	0.0	30.6	585.4
120.0	-184.0	-23.8	974.5	0.0	30.6	797.3
130.0	-184.0	-23.8	1079.2	0.0	30.6	902.0
140.0	-184.0	-23.8	1063.0	0.0	30.6	885.7
150.0	-184.0	-23.8	926.1	0.0	30.6	748.9
160.0	-184.0	-23.8	683.5	0.0	30.6	506.3
170.0	-184.0	-23.8	362.6	0.0	30.6	185.4
180.0	-184.0	-23.8	0.0	0.0	-30.6	-238.4
190.0	-184.0	-23.8	-362.6	0.0	-30.6	-601.0
200.0	-184.0	-23.8	-683.5	0.0	-30.6	-921.9
210.0	-184.0	-23.8	-926.1	0.0	-30.6	-1164.5
220.0	-184.0	-23.8	-1079.2	0.0	-30.6	-1301.4
230.0	-184.0	-23.8	-1079.2	0.0	-30.6	-1317.6
240.0	-184.0	-23.8	-974.5	0.0	-30.6	-1212.9
250.0	-184.0	-23.8	-762.6	0.0	-30.6	-1001.0
260.0	-184.0	-23.8	-470.0	0.0	-30.6	-708.4
270.0	-184.0	-23.8	-132.4	0.0	-30.6	-370.8
280.0	-184.0	-23.8	209.2	0.0	30.6	32.0
290.0	-184.0	-23.8	513.8	0.0	30.6	336.6
300.0	-184.0	-23.8	745.2	0.0	30.6	568.0
310.0	-184.0	-23.8	876.4	0.0	30.6	699.2
320.0	-184.0	-23.8	892.8	0.0	30.6	715.6
330.0	-184.0	-23.8	793.7	0.0	30.6	616.5
340.0	-184.0	-23.8	593.0	0.0	30.6	415.7
350.0	-184.0	-23.8	316.6	0.0	30.6	139.4
360.0	-184.0	-23.8	0.0	0.0	-30.6	-238.4

6.2.4 Thruster use

Case 2 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	10.6	1.2	4.3	3.1	7.5	90.0	16.9	28.0
10.0	13.5	357.2	1.5	334.1	14.1	90.0	19.6	40.6
20.0	45.4	1.1	30.6	178.5	16.2	90.0	23.2	50.5
30.0	86.6	2.5	72.1	177.3	16.4	90.0	27.6	58.4
40.0	99.3	0.1	87.6	174.5	16.6	90.0	27.9	64.3
50.0	100.4	0.1	90.8	174.1	17.0	90.0	28.4	69.2
60.0	97.5	7.0	87.5	180.0	17.5	90.0	30.9	72.5
70.0	97.8	9.8	87.3	180.0	17.3	90.0	35.2	75.1
80.0	99.3	13.5	87.2	180.0	17.1	90.0	41.2	76.9
90.0	101.8	17.4	87.2	180.0	16.9	90.0	48.4	78.1
100.0	73.2	13.9	63.2	166.0	17.0	90.0	50.7	78.9
110.0	33.8	27.6	25.1	146.5	17.0	90.0	47.5	79.1
120.0	22.9	51.9	11.7	119.8	13.6	90.0	42.6	78.7
130.0	15.8	82.4	11.4	60.2	10.3	90.0	36.7	77.8
140.0	13.7	81.8	10.8	60.2	6.7	90.0	30.5	76.1
150.0	11.1	77.4	9.2	60.2	4.7	90.0	24.6	73.4
160.0	8.4	65.7	6.8	60.2	4.3	90.0	19.2	69.0
170.0	6.4	40.6	4.0	60.2	5.1	90.0	14.5	61.8
180.0	6.6	2.0	0.4	33.9	7.5	90.0	10.7	48.6
190.0	7.9	337.4	3.0	261.4	9.1	90.0	7.5	24.2
200.0	9.9	318.0	6.6	266.0	8.7	90.0	8.2	326.7
210.0	11.9	308.7	9.3	267.3	8.4	90.0	12.3	304.6
220.0	13.4	301.5	11.4	271.7	6.6	90.0	17.8	294.2
230.0	14.0	299.8	13.4	273.5	3.0	90.0	23.8	289.0
240.0	13.6	299.8	14.3	276.1	-1.8	90.0	29.6	286.4
250.0	12.3	299.3	15.4	280.8	-7.4	90.0	34.4	285.2
260.0	10.3	291.8	15.2	287.7	-12.9	90.0	37.7	285.0
270.0	9.1	240.2	20.0	319.1	-16.6	90.0	39.0	285.7
280.0	8.3	196.1	44.9	347.1	-17.1	90.0	38.1	287.4
290.0	45.4	189.7	57.5	351.7	-17.3	90.0	35.4	290.1
300.0	43.6	186.8	56.4	354.2	-17.5	90.0	31.2	294.5
310.0	33.6	184.5	47.1	356.5	-17.0	90.0	26.3	301.0
320.0	10.8	179.1	24.9	0.4	-16.6	90.0	21.5	310.9
330.0	2.2	47.3	13.1	6.9	-13.4	90.0	17.7	325.0
340.0	4.4	21.4	10.8	8.3	-7.7	90.0	15.4	343.0
350.0	7.6	11.6	7.6	11.4	0.1	90.0	15.2	11.7
360.0	10.6	1.2	4.3	3.1	7.5	90.0	16.9	28.0

6.2.5 Thruster loss

Case 2 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.86	0.82
10.0	0.86	0.87	0.81
20.0	0.87	0.79	0.81
30.0	0.87	0.80	0.82
40.0	0.88	0.81	0.83
50.0	0.89	0.81	0.85
60.0	0.89	0.78	0.87
70.0	0.90	0.78	0.86
80.0	0.91	0.78	0.85
90.0	0.91	0.78	0.84
100.0	0.94	0.81	0.85
110.0	0.92	0.82	0.85
120.0	0.90	0.81	0.86
130.0	0.88	0.86	0.86
140.0	0.89	0.88	0.86
150.0	0.91	0.89	0.87
160.0	0.93	0.89	0.88
170.0	0.94	0.89	0.89
180.0	0.96	0.90	0.91
190.0	0.91	0.91	0.91
200.0	0.90	0.90	0.91
210.0	0.89	0.89	0.92
220.0	0.88	0.88	0.92
230.0	0.86	0.87	0.93
240.0	0.85	0.86	0.86
250.0	0.84	0.86	0.85
260.0	0.83	0.86	0.85
270.0	0.82	0.88	0.84
280.0	0.84	0.91	0.85
290.0	0.83	0.90	0.86
300.0	0.82	0.90	0.87
310.0	0.81	0.89	0.85
320.0	0.79	0.88	0.83
330.0	0.91	0.86	0.82
340.0	0.87	0.85	0.81
350.0	0.86	0.84	0.82
360.0	0.87	0.86	0.82

6.3 Case 3 - Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 4

6.3.1 Environment and thrust utilisation

Case 3 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	20.0	20.0	0.0	35.0	2.5	6.0	8.5	2.00	56.5
10.0	20.0	20.0	10.0	35.0	2.5	6.0	8.5	2.00	79.9
20.0	20.0	20.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	20.0	20.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	20.0	20.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	20.0	20.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	20.0	20.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	20.0	20.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	20.0	20.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	20.0	20.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	20.0	20.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	20.0	20.0	110.0	35.0	2.5	6.0	8.5	2.00	91.9
120.0	20.0	20.0	120.0	35.0	2.5	6.0	8.5	2.00	72.5
130.0	20.0	20.0	130.0	35.0	2.5	6.0	8.5	2.00	56.6
140.0	20.0	20.0	140.0	35.0	2.5	6.0	8.5	2.00	45.2
150.0	20.0	20.0	150.0	35.0	2.5	6.0	8.5	2.00	38.8
160.0	20.0	20.0	160.0	35.0	2.5	6.0	8.5	2.00	37.5
170.0	20.0	20.0	170.0	35.0	2.5	6.0	8.5	2.00	46.7
180.0	20.0	20.0	180.0	35.0	2.5	6.0	8.5	2.00	52.4
190.0	20.0	20.0	190.0	35.0	2.5	6.0	8.5	2.00	58.6
200.0	20.0	20.0	200.0	35.0	2.5	6.0	8.5	2.00	62.2
210.0	20.0	20.0	210.0	35.0	2.5	6.0	8.5	2.00	49.5
220.0	20.0	20.0	220.0	35.0	2.5	6.0	8.5	2.00	43.0
230.0	20.0	20.0	230.0	35.0	2.5	6.0	8.5	2.00	32.1
240.0	20.0	20.0	240.0	35.0	2.5	6.0	8.5	2.00	18.5
250.0	20.0	20.0	250.0	35.0	2.5	6.0	8.5	2.00	14.5
260.0	20.0	20.0	260.0	35.0	2.5	6.0	8.5	2.00	22.0
270.0	20.0	20.0	270.0	35.0	2.5	6.0	8.5	2.00	37.3
280.0	20.0	20.0	280.0	35.0	2.5	6.0	8.5	2.00	48.6
290.0	20.0	20.0	290.0	35.0	2.5	6.0	8.5	2.00	60.0
300.0	20.0	20.0	300.0	35.0	2.5	6.0	8.5	2.00	60.5
310.0	20.0	20.0	310.0	35.0	2.5	6.0	8.5	2.00	56.3
320.0	20.0	20.0	320.0	35.0	2.5	6.0	8.5	2.00	46.1
330.0	20.0	20.0	330.0	35.0	2.5	6.0	8.5	2.00	30.6
340.0	20.0	20.0	340.0	35.0	2.5	6.0	8.5	2.00	8.3
350.0	20.0	20.0	350.0	35.0	2.5	6.0	8.5	2.00	33.2
360.0	20.0	20.0	360.0	35.0	2.5	6.0	8.5	2.00	56.5

6.3.2 Relative contributions of force components

Case 3 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	57.1	17.5	10.6	0.0	14.9	100.0
10.0	49.6	15.0	22.7	0.0	12.7	100.0
20.0	42.7	12.8	33.7	0.0	10.8	100.0
30.0	36.5	10.8	43.5	0.0	9.2	100.0
40.0	31.3	9.2	51.7	0.0	7.8	100.0
50.0	27.1	7.9	58.3	0.0	6.7	100.0
60.0	23.9	7.0	63.2	0.0	5.9	100.0
70.0	21.8	6.3	66.6	0.0	5.3	100.0
80.0	20.5	6.0	68.5	0.0	5.0	100.0
90.0	20.1	5.8	69.2	0.0	4.9	100.0
100.0	20.4	5.9	68.7	0.0	4.9	100.0
110.0	21.6	6.2	67.0	0.0	5.2	100.0
120.0	23.6	6.8	63.8	0.0	5.7	100.0
130.0	26.8	7.8	59.0	0.0	6.5	100.0
140.0	31.2	9.1	52.2	0.0	7.6	100.0
150.0	37.2	10.8	42.9	0.0	9.1	100.0
160.0	45.2	13.2	30.5	0.0	11.1	100.0
170.0	55.8	16.4	14.0	0.0	13.8	100.0
180.0	70.7	20.9	-9.3	0.0	17.7	100.0
190.0	93.7	28.1	-45.7	0.0	23.8	100.0
200.0	128.2	39.4	-10.4	0.0	33.8	100.0
210.0	10.9	7.0	43.5	0.0	37.8	100.0
220.0	-36.3	8.1	118.2	0.0	26.9	100.0
230.0	-37.3	-9.6	129.3	0.0	18.2	100.0
240.0	-33.0	-8.7	128.1	0.0	13.5	100.0
250.0	-28.9	-7.7	125.5	0.0	11.1	100.0
260.0	-26.3	-7.0	123.3	0.0	9.9	100.0
270.0	-24.8	-6.6	121.8	0.0	9.6	100.0
280.0	-24.3	-6.4	120.7	0.0	9.9	100.0
290.0	-24.1	-6.2	119.3	0.0	11.0	100.0
300.0	-23.2	-5.7	115.9	0.0	13.0	100.0
310.0	-18.4	-3.9	106.5	0.0	15.9	100.0
320.0	-3.5	1.1	83.9	0.0	18.6	100.0
330.0	25.6	10.0	46.4	0.0	18.0	100.0
340.0	66.5	21.2	-6.2	0.0	18.4	100.0
350.0	64.0	19.9	-1.0	0.0	17.1	100.0
360.0	57.1	17.5	10.6	0.0	14.9	100.0

6.3.3 Environment forces

Case 3 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-7.0	-2.4	-3.6	0.0	-2.2	-15.2
10.0	-7.0	-2.4	-3.6	0.0	-2.2	-15.2
20.0	-7.0	-2.4	-3.5	0.0	-2.2	-15.1
30.0	-7.0	-2.4	-3.2	0.0	-2.2	-14.8
40.0	-7.0	-2.4	-2.8	0.0	-2.2	-14.4
50.0	-7.0	-2.4	-2.3	0.0	-2.2	-13.9
60.0	-7.0	-2.4	-1.6	0.0	-2.2	-13.2
70.0	-7.0	-2.4	-0.9	0.0	-2.2	-12.5
80.0	-7.0	-2.4	-0.1	0.0	-2.2	-11.7
90.0	-7.0	-2.4	0.7	0.0	-2.2	-10.9
100.0	-7.0	-2.4	1.5	0.0	-2.2	-10.1
110.0	-7.0	-2.4	2.3	0.0	-2.2	-9.3
120.0	-7.0	-2.4	3.0	0.0	-2.2	-8.6
130.0	-7.0	-2.4	3.5	0.0	-2.2	-8.1
140.0	-7.0	-2.4	4.0	0.0	-2.2	-7.6
150.0	-7.0	-2.4	4.3	0.0	-2.2	-7.3
160.0	-7.0	-2.4	4.4	0.0	-2.2	-7.2
170.0	-7.0	-2.4	4.4	0.0	-2.2	-7.2
180.0	-7.0	-2.4	4.3	0.0	-2.2	-7.3
190.0	-7.0	-2.4	4.4	0.0	-2.2	-7.2
200.0	-7.0	-2.4	4.4	0.0	-2.2	-7.2
210.0	-7.0	-2.4	4.3	0.0	-2.2	-7.3
220.0	-7.0	-2.4	4.0	0.0	-2.2	-7.6
230.0	-7.0	-2.4	3.5	0.0	-2.2	-8.1
240.0	-7.0	-2.4	3.0	0.0	-2.2	-8.6
250.0	-7.0	-2.4	2.3	0.0	-2.2	-9.3
260.0	-7.0	-2.4	1.5	0.0	-2.2	-10.1
270.0	-7.0	-2.4	0.7	0.0	-2.2	-10.9
280.0	-7.0	-2.4	-0.1	0.0	-2.2	-11.7
290.0	-7.0	-2.4	-0.9	0.0	-2.2	-12.5
300.0	-7.0	-2.4	-1.6	0.0	-2.2	-13.2
310.0	-7.0	-2.4	-2.3	0.0	-2.2	-13.9
320.0	-7.0	-2.4	-2.8	0.0	-2.2	-14.4
330.0	-7.0	-2.4	-3.2	0.0	-2.2	-14.8
340.0	-7.0	-2.4	-3.5	0.0	-2.2	-15.1
350.0	-7.0	-2.4	-3.6	0.0	-2.2	-15.2
360.0	-7.0	-2.4	-3.6	0.0	-2.2	-15.2

Case 3 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-11.2	-3.2	0.0	0.0	-2.6	-16.9
10.0	-11.2	-3.2	-4.8	0.0	-2.6	-21.8
20.0	-11.2	-3.2	-10.0	0.0	-2.6	-26.9
30.0	-11.2	-3.2	-15.6	0.0	-2.6	-32.6
40.0	-11.2	-3.2	-21.7	0.0	-2.6	-38.7
50.0	-11.2	-3.2	-28.0	0.0	-2.6	-44.9
60.0	-11.2	-3.2	-33.8	0.0	-2.6	-50.8
70.0	-11.2	-3.2	-38.7	0.0	-2.6	-55.6
80.0	-11.2	-3.2	-41.9	0.0	-2.6	-58.8
90.0	-11.2	-3.2	-43.0	0.0	-2.6	-59.9
100.0	-11.2	-3.2	-41.9	0.0	-2.6	-58.8
110.0	-11.2	-3.2	-38.7	0.0	-2.6	-55.6
120.0	-11.2	-3.2	-33.8	0.0	-2.6	-50.8
130.0	-11.2	-3.2	-28.0	0.0	-2.6	-44.9
140.0	-11.2	-3.2	-21.7	0.0	-2.6	-38.7
150.0	-11.2	-3.2	-15.6	0.0	-2.6	-32.6
160.0	-11.2	-3.2	-10.0	0.0	-2.6	-26.9
170.0	-11.2	-3.2	-4.8	0.0	-2.6	-21.8
180.0	-11.2	-3.2	0.0	0.0	-2.6	-16.9
190.0	-11.2	-3.2	4.8	0.0	-2.6	-12.1
200.0	-11.2	-3.2	10.0	0.0	-2.6	-6.9
210.0	-11.2	-3.2	15.6	0.0	2.6	3.9
220.0	-11.2	-3.2	21.7	0.0	2.6	10.0
230.0	-11.2	-3.2	28.0	0.0	2.6	16.3
240.0	-11.2	-3.2	33.8	0.0	2.6	22.1
250.0	-11.2	-3.2	38.7	0.0	2.6	27.0
260.0	-11.2	-3.2	41.9	0.0	2.6	30.2
270.0	-11.2	-3.2	43.0	0.0	2.6	31.3
280.0	-11.2	-3.2	41.9	0.0	2.6	30.2
290.0	-11.2	-3.2	38.7	0.0	2.6	27.0
300.0	-11.2	-3.2	33.8	0.0	2.6	22.1
310.0	-11.2	-3.2	28.0	0.0	2.6	16.3
320.0	-11.2	-3.2	21.7	0.0	2.6	10.0
330.0	-11.2	-3.2	15.6	0.0	2.6	3.9
340.0	-11.2	-3.2	10.0	0.0	-2.6	-6.9
350.0	-11.2	-3.2	4.8	0.0	-2.6	-12.1
360.0	-11.2	-3.2	0.0	0.0	-2.6	-16.9

Case 3 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-351.6	-45.7	0.0	0.0	-58.5	-455.8
10.0	-351.6	-45.7	-316.6	0.0	-58.5	-772.4
20.0	-351.6	-45.7	-593.0	0.0	-58.5	-1048.8
30.0	-351.6	-45.7	-793.7	0.0	-58.5	-1249.5
40.0	-351.6	-45.7	-892.8	0.0	-58.5	-1348.6
50.0	-351.6	-45.7	-876.4	0.0	-58.5	-1332.2
60.0	-351.6	-45.7	-745.2	0.0	-58.5	-1201.0
70.0	-351.6	-45.7	-513.8	0.0	-58.5	-969.6
80.0	-351.6	-45.7	-209.2	0.0	-58.5	-665.0
90.0	-351.6	-45.7	132.4	0.0	-58.5	-323.4
100.0	-351.6	-45.7	470.0	0.0	58.5	131.2
110.0	-351.6	-45.7	762.6	0.0	58.5	423.8
120.0	-351.6	-45.7	974.5	0.0	58.5	635.7
130.0	-351.6	-45.7	1079.2	0.0	58.5	740.4
140.0	-351.6	-45.7	1063.0	0.0	58.5	721.1
150.0	-351.6	-45.7	926.1	0.0	58.5	537.2
160.0	-351.6	-45.7	683.5	0.0	58.5	244.7
170.0	-351.6	-45.7	362.6	0.0	-58.5	-93.2
180.0	-351.6	-45.7	0.0	0.0	-58.5	-455.8
190.0	-351.6	-45.7	-362.6	0.0	-58.5	-818.4
200.0	-351.6	-45.7	-683.5	0.0	-58.5	-1139.3
210.0	-351.6	-45.7	-926.1	0.0	-58.5	-1381.9
220.0	-351.6	-45.7	-1063.0	0.0	-58.5	-1518.8
230.0	-351.6	-45.7	-1079.2	0.0	-58.5	-1535.0
240.0	-351.6	-45.7	-974.5	0.0	-58.5	-1430.3
250.0	-351.6	-45.7	-762.6	0.0	-58.5	-1218.4
260.0	-351.6	-45.7	-470.0	0.0	-58.5	-925.8
270.0	-351.6	-45.7	-132.4	0.0	-58.5	-588.2
280.0	-351.6	-45.7	209.2	0.0	-58.5	-246.6
290.0	-351.6	-45.7	513.8	0.0	58.5	175.0
300.0	-351.6	-45.7	745.2	0.0	58.5	406.4
310.0	-351.6	-45.7	876.4	0.0	58.5	537.6
320.0	-351.6	-45.7	892.8	0.0	58.5	554.0
330.0	-351.6	-45.7	793.7	0.0	58.5	454.9
340.0	-351.6	-45.7	593.0	0.0	58.5	254.1
350.0	-351.6	-45.7	316.6	0.0	-58.5	-139.2
360.0	-351.6	-45.7	0.0	0.0	-58.5	-455.8

6.3.4 Thruster use

Case 3 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	14.1	3.4	1.4	34.6	15.3	90.0	22.7	48.1
10.0	57.1	2.9	41.9	176.3	16.2	90.0	26.5	55.1
20.0	97.7	0.1	83.6	173.7	16.2	90.0	29.5	60.3
30.0	98.4	0.1	88.3	176.3	16.4	90.0	24.4	65.2
40.0	95.5	2.0	87.9	180.0	16.6	90.0	21.5	69.3
50.0	94.3	2.4	87.7	180.0	17.0	90.0	21.9	72.6
60.0	94.2	4.2	87.5	180.0	17.5	90.0	25.3	75.2
70.0	94.7	7.1	87.3	180.0	17.3	90.0	29.8	77.1
80.0	96.1	10.9	87.2	180.0	17.1	90.0	36.0	78.6
90.0	98.4	15.0	87.2	180.0	16.9	90.0	43.1	79.5
100.0	101.0	20.3	85.7	180.0	17.0	90.0	52.8	80.1
110.0	85.6	14.1	75.9	166.5	17.0	90.0	56.4	80.5
120.0	45.7	23.3	36.8	155.0	17.2	90.0	51.5	80.3
130.0	22.9	51.5	12.5	119.8	16.2	90.0	45.6	79.8
140.0	21.1	52.0	10.7	119.8	12.8	90.0	39.4	78.8
150.0	18.2	50.0	8.8	119.8	11.0	90.0	33.4	77.3
160.0	14.7	44.3	6.7	119.8	10.9	90.0	27.8	75.1
170.0	10.3	26.0	4.2	119.8	13.6	90.0	22.9	71.8
180.0	9.8	5.2	2.6	163.9	15.3	90.0	18.1	66.7
190.0	10.8	346.4	4.1	214.8	17.0	90.0	14.1	59.4
200.0	12.4	332.9	6.6	234.3	18.0	90.0	10.0	44.1
210.0	13.8	316.8	9.6	253.5	14.7	90.0	8.3	331.8
220.0	15.0	309.6	11.5	260.2	12.8	90.0	12.6	307.2
230.0	15.4	303.4	12.3	265.2	9.4	90.0	18.2	296.4
240.0	15.0	299.8	12.9	274.9	4.7	90.0	23.8	291.3
250.0	13.8	299.3	11.4	279.9	-0.9	90.0	28.5	289.1
260.0	11.8	291.8	14.2	287.3	-6.4	90.0	31.8	288.5
270.0	9.3	299.8	13.5	297.6	-11.2	90.0	33.1	289.2
280.0	6.9	299.8	12.7	311.2	-14.8	90.0	32.4	291.2
290.0	5.8	234.1	16.7	342.7	-17.3	90.0	29.7	294.8
300.0	3.0	229.3	15.4	351.2	-17.5	90.0	25.8	300.8
310.0	0.3	322.1	13.6	359.2	-15.9	90.0	21.4	310.4
320.0	2.3	34.4	12.6	5.6	-12.5	90.0	17.6	325.1
330.0	4.5	26.0	10.9	10.1	-7.8	90.0	15.3	345.1
340.0	8.4	21.6	7.8	22.3	0.9	90.0	16.6	24.7
350.0	11.3	8.9	4.4	22.9	8.6	90.0	19.4	38.5
360.0	14.1	3.4	1.4	34.6	15.3	90.0	22.7	48.1

6.3.5 Thruster loss

Case 3 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.83	0.82
10.0	0.86	0.81	0.81
20.0	0.87	0.82	0.81
30.0	0.88	0.81	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.90	0.78	0.87
70.0	0.90	0.78	0.86
80.0	0.91	0.78	0.85
90.0	0.92	0.78	0.84
100.0	0.92	0.76	0.85
110.0	0.94	0.80	0.85
120.0	0.94	0.81	0.86
130.0	0.92	0.81	0.86
140.0	0.93	0.81	0.86
150.0	0.94	0.82	0.87
160.0	0.94	0.83	0.88
170.0	0.95	0.84	0.89
180.0	0.96	0.78	0.91
190.0	0.93	0.85	0.91
200.0	0.90	0.86	0.91
210.0	0.89	0.87	0.92
220.0	0.89	0.87	0.92
230.0	0.87	0.87	0.93
240.0	0.85	0.86	0.94
250.0	0.84	0.86	0.85
260.0	0.83	0.86	0.85
270.0	0.82	0.86	0.84
280.0	0.81	0.86	0.85
290.0	0.84	0.89	0.86
300.0	0.86	0.89	0.87
310.0	0.81	0.89	0.85
320.0	0.91	0.87	0.83
330.0	0.89	0.86	0.82
340.0	0.87	0.84	0.84
350.0	0.86	0.83	0.82
360.0	0.86	0.83	0.82

Preliminary Design, @IDR5

6.4 Case 4 - Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 4

6.4.1 Environment and thrust utilisation

Case 4 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	30.0	30.0	0.0	35.0	2.5	6.0	8.5	2.00	85.3
10.0	30.0	30.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	30.0	30.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	30.0	30.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	30.0	30.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	30.0	30.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	30.0	30.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	30.0	30.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	30.0	30.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	30.0	30.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	30.0	30.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	30.0	30.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	30.0	30.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	30.0	30.0	130.0	35.0	2.5	6.0	8.5	2.00	84.1
140.0	30.0	30.0	140.0	35.0	2.5	6.0	8.5	2.00	72.6
150.0	30.0	30.0	150.0	35.0	2.5	6.0	8.5	2.00	66.6
160.0	30.0	30.0	160.0	35.0	2.5	6.0	8.5	2.00	65.6
170.0	30.0	30.0	170.0	35.0	2.5	6.0	8.5	2.00	76.3
180.0	30.0	30.0	180.0	35.0	2.5	6.0	8.5	2.00	81.7
190.0	30.0	30.0	190.0	35.0	2.5	6.0	8.5	2.00	88.0
200.0	30.0	30.0	200.0	35.0	2.5	6.0	8.5	2.00	91.7
210.0	30.0	30.0	210.0	35.0	2.5	6.0	8.5	2.00	90.2
220.0	30.0	30.0	220.0	35.0	2.5	6.0	8.5	2.00	82.5
230.0	30.0	30.0	230.0	35.0	2.5	6.0	8.5	2.00	52.9
240.0	30.0	30.0	240.0	35.0	2.5	6.0	8.5	2.00	37.8
250.0	30.0	30.0	250.0	35.0	2.5	6.0	8.5	2.00	21.5
260.0	30.0	30.0	260.0	35.0	2.5	6.0	8.5	2.00	13.5
270.0	30.0	30.0	270.0	35.0	2.5	6.0	8.5	2.00	21.5
280.0	30.0	30.0	280.0	35.0	2.5	6.0	8.5	2.00	28.0
290.0	30.0	30.0	290.0	35.0	2.5	6.0	8.5	2.00	34.1
300.0	30.0	30.0	300.0	35.0	2.5	6.0	8.5	2.00	41.6
310.0	30.0	30.0	310.0	35.0	2.5	6.0	8.5	2.00	36.9
320.0	30.0	30.0	320.0	35.0	2.5	6.0	8.5	2.00	9.9
330.0	30.0	30.0	330.0	35.0	2.5	6.0	8.5	2.00	12.9
340.0	30.0	30.0	340.0	35.0	2.5	6.0	8.5	2.00	32.2
350.0	30.0	30.0	350.0	35.0	2.5	6.0	8.5	2.00	61.9
360.0	30.0	30.0	360.0	35.0	2.5	6.0	8.5	2.00	85.3

6.4.2 Relative contributions of force components

Case 4 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	60.8	18.3	5.7	0.0	15.2	100.0
10.0	53.9	16.2	16.6	0.0	13.4	100.0
20.0	47.8	14.3	26.2	0.0	11.8	100.0
30.0	42.3	12.6	34.8	0.0	10.4	100.0
40.0	37.5	11.1	42.3	0.0	9.1	100.0
50.0	33.5	9.9	48.5	0.0	8.1	100.0
60.0	30.4	8.9	53.4	0.0	7.3	100.0
70.0	28.2	8.3	56.8	0.0	6.8	100.0
80.0	26.8	7.9	58.8	0.0	6.5	100.0
90.0	26.4	7.7	59.5	0.0	6.3	100.0
100.0	26.8	7.8	58.9	0.0	6.4	100.0
110.0	28.1	8.2	57.0	0.0	6.7	100.0
120.0	30.3	8.9	53.5	0.0	7.3	100.0
130.0	33.5	9.8	48.6	0.0	8.1	100.0
140.0	37.9	11.1	42.0	0.0	9.1	100.0
150.0	43.3	12.7	33.6	0.0	10.1	100.0
160.0	49.8	14.6	23.5	0.0	12.0	100.0
170.0	57.8	17.0	11.3	0.0	14.0	100.0
180.0	67.6	20.0	-4.1	0.0	16.4	100.0
190.0	81.3	24.1	-25.3	0.0	19.9	100.0
200.0	102.3	30.5	-58.1	0.0	25.2	100.0
210.0	135.9	41.2	-111.2	0.0	34.1	100.0
220.0	167.2	52.1	-163.7	0.0	44.0	100.0
230.0	189.5	63.5	-148.3	0.0	37.2	100.0
240.0	167.5	17.0	148.3	0.0	37.2	100.0
250.0	67.5	-18.0	158.3	0.0	27.2	100.0
260.0	-59.2	-16.1	153.7	0.0	21.6	100.0
270.0	-53.2	-14.5	148.9	0.0	18.8	100.0
280.0	-49.9	-13.6	145.7	0.0	17.9	100.0
290.0	-48.6	-13.1	143.4	0.0	18.3	100.0
300.0	-47.6	-12.6	140.1	0.0	20.1	100.0
310.0	-42.6	-10.6	130.3	0.0	22.9	100.0
320.0	-22.5	-4.0	101.9	0.0	24.7	100.0
330.0	82.8	26.9	-32.4	0.0	22.7	100.0
340.0	87.1	27.2	-37.0	0.0	22.7	100.0
350.0	78.4	24.0	-22.4	0.0	20.0	100.0
360.0	68.9	20.9	-7.1	0.0	17.3	100.0
360.0	60.8	18.3	5.7	0.0	15.2	100.0

6.4.3 Environment forces

Case 4 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-7.1	-2.5	-3.6	0.0	-2.2	-15.4
10.0	-7.1	-2.5	-3.6	0.0	-2.2	-15.4
20.0	-7.1	-2.5	-3.5	0.0	-2.2	-15.3
30.0	-7.1	-2.5	-3.2	0.0	-2.2	-15.0
40.0	-7.1	-2.5	-2.8	0.0	-2.2	-14.6
50.0	-7.1	-2.5	-2.3	0.0	-2.2	-14.1
60.0	-7.1	-2.5	-1.6	0.0	-2.2	-13.5
70.0	-7.1	-2.5	-0.9	0.0	-2.2	-12.7
80.0	-7.1	-2.5	-0.1	0.0	-2.2	-11.9
90.0	-7.1	-2.5	0.7	0.0	-2.2	-11.1
100.0	-7.1	-2.5	1.5	0.0	-2.2	-10.3
110.0	-7.1	-2.5	2.3	0.0	-2.2	-9.6
120.0	-7.1	-2.5	3.0	0.0	-2.2	-8.9
130.0	-7.1	-2.5	3.5	0.0	-2.2	-8.3
140.0	-7.1	-2.5	4.0	0.0	-2.2	-7.9
150.0	-7.1	-2.5	4.3	0.0	-2.2	-7.6
160.0	-7.1	-2.5	4.4	0.0	-2.2	-7.4
170.0	-7.1	-2.5	4.4	0.0	-2.2	-7.4
180.0	-7.1	-2.5	4.3	0.0	-2.2	-7.5
190.0	-7.1	-2.5	4.4	0.0	-2.2	-7.4
200.0	-7.1	-2.5	4.4	0.0	-2.2	-7.4
210.0	-7.1	-2.5	4.3	0.0	-2.2	-7.6
220.0	-7.1	-2.5	4.0	0.0	-2.2	-7.9
230.0	-7.1	-2.5	3.5	0.0	-2.2	-8.3
240.0	-7.1	-2.5	3.0	0.0	-2.2	-8.9
250.0	-7.1	-2.5	2.3	0.0	-2.2	-9.6
260.0	-7.1	-2.5	1.5	0.0	-2.2	-10.3
270.0	-7.1	-2.5	0.7	0.0	-2.2	-11.1
280.0	-7.1	-2.5	-0.1	0.0	-2.2	-11.9
290.0	-7.1	-2.5	-0.9	0.0	-2.2	-12.7
300.0	-7.1	-2.5	-1.6	0.0	-2.2	-13.5
310.0	-7.1	-2.5	-2.3	0.0	-2.2	-14.1
320.0	-7.1	-2.5	-2.8	0.0	-2.2	-14.6
330.0	-7.1	-2.5	-3.2	0.0	-2.2	-15.0
340.0	-7.1	-2.5	-3.5	0.0	-2.2	-15.3
350.0	-7.1	-2.5	-3.6	0.0	-2.2	-15.4
360.0	-7.1	-2.5	-3.6	0.0	-2.2	-15.4

Case 4 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-17.9	-5.2	0.0	0.0	-4.2	-27.3
10.0	-17.9	-5.2	-4.8	0.0	-4.2	-32.1
20.0	-17.9	-5.2	-10.0	0.0	-4.2	-37.2
30.0	-17.9	-5.2	-15.6	0.0	-4.2	-42.9
40.0	-17.9	-5.2	-21.7	0.0	-4.2	-49.0
50.0	-17.9	-5.2	-28.0	0.0	-4.2	-55.2
60.0	-17.9	-5.2	-33.8	0.0	-4.2	-61.1
70.0	-17.9	-5.2	-38.7	0.0	-4.2	-65.9
80.0	-17.9	-5.2	-41.9	0.0	-4.2	-69.1
90.0	-17.9	-5.2	-43.0	0.0	-4.2	-70.3
100.0	-17.9	-5.2	-41.9	0.0	-4.2	-69.1
110.0	-17.9	-5.2	-38.7	0.0	-4.2	-65.9
120.0	-17.9	-5.2	-33.8	0.0	-4.2	-61.1
130.0	-17.9	-5.2	-28.0	0.0	-4.2	-55.2
140.0	-17.9	-5.2	-21.7	0.0	-4.2	-49.0
150.0	-17.9	-5.2	-15.6	0.0	-4.2	-42.9
160.0	-17.9	-5.2	-10.0	0.0	-4.2	-37.2
170.0	-17.9	-5.2	-4.8	0.0	-4.2	-32.1
180.0	-17.9	-5.2	0.0	0.0	-4.2	-27.3
190.0	-17.9	-5.2	4.8	0.0	-4.2	-22.4
200.0	-17.9	-5.2	10.0	0.0	-4.2	-17.3
210.0	-17.9	-5.2	15.6	0.0	-4.2	-11.6
220.0	-17.9	-5.2	21.7	0.0	-4.2	-5.5
230.0	-17.9	-5.2	28.0	0.0	4.2	9.2
240.0	-17.9	-5.2	33.8	0.0	4.2	15.0
250.0	-17.9	-5.2	38.7	0.0	4.2	19.8
260.0	-17.9	-5.2	41.9	0.0	4.2	23.0
270.0	-17.9	-5.2	43.0	0.0	4.2	24.2
280.0	-17.9	-5.2	41.9	0.0	4.2	23.0
290.0	-17.9	-5.2	38.7	0.0	4.2	19.8
300.0	-17.9	-5.2	33.8	0.0	4.2	15.0
310.0	-17.9	-5.2	28.0	0.0	4.2	9.2
320.0	-17.9	-5.2	21.7	0.0	-4.2	-5.5
330.0	-17.9	-5.2	15.6	0.0	-4.2	-11.6
340.0	-17.9	-5.2	10.0	0.0	-4.2	-17.3
350.0	-17.9	-5.2	4.8	0.0	-4.2	-22.4
360.0	-17.9	-5.2	0.0	0.0	-4.2	-27.3

Case 4 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-501.2	-65.8	0.0	0.0	-84.6	-651.6
10.0	-501.2	-65.8	-316.6	0.0	-84.6	-968.2
20.0	-501.2	-65.8	-593.0	0.0	-84.6	-1244.6
30.0	-501.2	-65.8	-793.7	0.0	-84.6	-1445.3
40.0	-501.2	-65.8	-892.8	0.0	-84.6	-1544.4
50.0	-501.2	-65.8	-876.4	0.0	-84.6	-1528.1
60.0	-501.2	-65.8	-745.2	0.0	-84.6	-1396.9
70.0	-501.2	-65.8	-513.8	0.0	-84.6	-1165.5
80.0	-501.2	-65.8	-209.2	0.0	-84.6	-860.9
90.0	-501.2	-65.8	132.4	0.0	-84.6	-519.2
100.0	-501.2	-65.8	470.0	0.0	-84.6	-181.7
110.0	-501.2	-65.8	762.6	0.0	84.6	280.3
120.0	-501.2	-65.8	974.5	0.0	84.6	492.1
130.0	-501.2	-65.8	1079.2	0.0	84.6	589.9
140.0	-501.2	-65.8	1063.0	0.0	84.6	580.6
150.0	-501.2	-65.8	926.1	0.0	84.6	443.7
160.0	-501.2	-65.8	683.5	0.0	84.6	201.2
170.0	-501.2	-65.8	362.6	0.0	-84.6	-289.0
180.0	-501.2	-65.8	0.0	0.0	-84.6	-651.6
190.0	-501.2	-65.8	-362.6	0.0	-84.6	-1014.2
200.0	-501.2	-65.8	-683.5	0.0	-84.6	-1335.2
210.0	-501.2	-65.8	-926.1	0.0	-84.6	-1577.7
220.0	-501.2	-65.8	-1063.0	0.0	-84.6	-1714.6
230.0	-501.2	-65.8	-1079.2	0.0	-84.6	-1730.9
240.0	-501.2	-65.8	-974.5	0.0	-84.6	-1626.2
250.0	-501.2	-65.8	-762.6	0.0	-84.6	-1414.3
260.0	-501.2	-65.8	-470.0	0.0	-84.6	-1121.6
270.0	-501.2	-65.8	-132.4	0.0	-84.6	-784.0
280.0	-501.2	-65.8	209.2	0.0	-84.6	-442.4
290.0	-501.2	-65.8	513.8	0.0	-84.6	-137.8
300.0	-501.2	-65.8	745.2	0.0	84.6	262.8
310.0	-501.2	-65.8	876.4	0.0	84.6	394.0
320.0	-501.2	-65.8	892.8	0.0	84.6	410.4
330.0	-501.2	-65.8	793.7	0.0	84.6	311.3
340.0	-501.2	-65.8	593.0	0.0	84.6	110.6
350.0	-501.2	-65.8	316.6	0.0	-84.6	-335.0
360.0	-501.2	-65.8	0.0	0.0	-84.6	-651.6

6.4.4 Thruster use

Case 4 thruster use: Thrusters 1 to 3									
Dir	Thruster 1		Thruster 2		Thruster 3		Total		
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	
0.0	68.5	4.7	53.1	174.3	16.4	90.0	31.3	60.5	
10.0	97.3	0.1	84.6	172.6	16.2	90.0	30.4	63.9	
20.0	97.7	0.1	88.7	176.3	16.2	90.0	23.9	67.3	
30.0	94.3	0.7	88.1	180.0	16.4	90.0	18.6	70.4	
40.0	92.6	359.4	87.9	180.0	16.6	90.0	16.3	73.1	
50.0	92.0	359.7	87.7	180.0	17.0	90.0	17.0	75.4	
60.0	92.0	1.6	87.5	180.0	17.5	90.0	20.6	77.4	
70.0	92.5	4.6	87.3	180.0	17.3	90.0	25.1	78.9	
80.0	93.7	8.5	87.2	180.0	17.1	90.0	31.3	80.1	
90.0	95.7	12.7	87.2	180.0	16.9	90.0	38.5	80.8	
100.0	96.7	16.9	85.7	180.0	17.0	90.0	45.5	81.3	
110.0	99.8	22.3	84.3	180.0	17.0	90.0	55.4	81.6	
120.0	101.0	24.7	83.0	180.0	17.2	90.0	60.0	81.6	
130.0	67.6	17.8	58.6	162.8	17.2	90.0	55.9	81.4	
140.0	42.2	24.0	33.9	154.6	17.3	90.0	49.6	80.9	
150.0	27.6	29.8	20.2	144.3	17.4	90.0	43.6	80.0	
160.0	23.0	27.4	15.9	145.2	17.6	90.0	38.0	78.7	
170.0	41.8	10.9	34.2	169.4	17.9	90.0	32.9	77.0	
180.0	51.5	5.7	43.9	174.9	18.2	90.0	28.2	74.6	
190.0	63.7	2.2	56.3	178.2	18.2	90.0	23.6	71.7	
200.0	70.8	359.5	63.4	180.4	18.3	90.0	18.8	66.8	
210.0	68.5	356.8	60.9	182.7	18.3	90.0	13.9	56.9	
220.0	54.5	352.5	46.6	187.2	18.5	90.0	9.6	35.1	
230.0	16.8	311.1	12.7	237.5	16.0	90.0	12.4	312.2	
240.0	16.2	305.9	12.2	267.3	11.3	90.0	17.4	300.6	
250.0	14.9	301.4	6.2	277.8	5.9	90.0	22.0	295.7	
260.0	13.0	291.8	12.8	287.6	0.4	90.0	25.2	294.1	
270.0	0.5	299.8	12.1	299.1	-4.4	90.0	26.6	294.7	
280.0	8.0	299.8	11.4	314.3	-8.0	90.0	26.0	297.4	
290.0	5.6	299.8	11.3	332.1	-9.7	90.0	23.6	302.7	
300.0	2.5	321.8	11.7	351.9	-11.8	90.0	20.2	311.9	
310.0	2.8	9.4	11.3	2.3	-10.1	90.0	16.8	327.0	
320.0	7.5	30.4	9.0	23.7	-1.9	90.0	15.6	20.7	
330.0	9.6	27.7	7.8	33.4	2.9	90.0	19.0	37.7	
340.0	11.8	21.8	6.1	44.7	8.6	90.0	23.1	48.5	
350.0	18.4	9.1	4.1	131.7	16.5	90.0	27.2	55.5	
360.0	68.5	4.7	53.1	174.3	16.4	90.0	31.3	60.5	

6.4.5 Thruster loss

Case 4 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.82	0.82
10.0	0.87	0.83	0.81
20.0	0.87	0.81	0.81
30.0	0.88	0.79	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.90	0.78	0.87
70.0	0.91	0.78	0.86
80.0	0.92	0.78	0.85
90.0	0.92	0.78	0.84
100.0	0.93	0.76	0.85
110.0	0.93	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.79	0.86
140.0	0.94	0.80	0.86
150.0	0.94	0.81	0.87
160.0	0.94	0.81	0.88
170.0	0.95	0.76	0.89
180.0	0.96	0.73	0.91
190.0	0.96	0.72	0.91
200.0	0.96	0.71	0.91
210.0	0.95	0.73	0.92
220.0	0.94	0.77	0.92
230.0	0.88	0.86	0.93
240.0	0.86	0.86	0.94
250.0	0.84	0.86	0.94
260.0	0.83	0.86	0.94
270.0	0.82	0.86	0.84
280.0	0.81	0.86	0.85
290.0	0.81	0.87	0.86
300.0	0.82	0.89	0.87
310.0	0.90	0.89	0.85
320.0	0.91	0.86	0.83
330.0	0.89	0.86	0.86
340.0	0.87	0.86	0.84
350.0	0.86	0.90	0.82
360.0	0.86	0.82	0.82

Preliminary Design, @IDR5

6.5 Case 5 - Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 4

6.5.1 Environment and thrust utilisation

Case 5 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	40.0	40.0	0.0	35.0	2.5	6.0	8.5	2.00	> 100.0
10.0	40.0	40.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	40.0	40.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	40.0	40.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	40.0	40.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	40.0	40.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	40.0	40.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	40.0	40.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	40.0	40.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	40.0	40.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	40.0	40.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	40.0	40.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	40.0	40.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	40.0	40.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	40.0	40.0	140.0	35.0	2.5	6.0	8.5	2.00	99.3
150.0	40.0	40.0	150.0	35.0	2.5	6.0	8.5	2.00	92.9
160.0	40.0	40.0	160.0	35.0	2.5	6.0	8.5	2.00	> 100.0
170.0	40.0	40.0	170.0	35.0	2.5	6.0	8.5	2.00	> 100.0
180.0	40.0	40.0	180.0	35.0	2.5	6.0	8.5	2.00	> 100.0
190.0	40.0	40.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	40.0	40.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	40.0	40.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	40.0	40.0	220.0	35.0	2.5	6.0	8.5	2.00	> 100.0
230.0	40.0	40.0	230.0	35.0	2.5	6.0	8.5	2.00	97.6
240.0	40.0	40.0	240.0	35.0	2.5	6.0	8.5	2.00	55.9
250.0	40.0	40.0	250.0	35.0	2.5	6.0	8.5	2.00	38.7
260.0	40.0	40.0	260.0	35.0	2.5	6.0	8.5	2.00	22.2
270.0	40.0	40.0	270.0	35.0	2.5	6.0	8.5	2.00	11.4
280.0	40.0	40.0	280.0	35.0	2.5	6.0	8.5	2.00	10.1
290.0	40.0	40.0	290.0	35.0	2.5	6.0	8.5	2.00	15.9
300.0	40.0	40.0	300.0	35.0	2.5	6.0	8.5	2.00	24.1
310.0	40.0	40.0	310.0	35.0	2.5	6.0	8.5	2.00	9.1
320.0	40.0	40.0	320.0	35.0	2.5	6.0	8.5	2.00	20.5
330.0	40.0	40.0	330.0	35.0	2.5	6.0	8.5	2.00	36.6
340.0	40.0	40.0	340.0	35.0	2.5	6.0	8.5	2.00	65.4
350.0	40.0	40.0	350.0	35.0	2.5	6.0	8.5	2.00	88.2
360.0	40.0	40.0	360.0	35.0	2.5	6.0	8.5	2.00	> 100.0

6.5.2 Relative contributions of force components

Case 5 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	62.3	18.9	3.3	0.0	15.5	100.0
10.0	56.2	17.1	12.8	0.0	13.9	100.0
20.0	50.9	15.4	21.1	0.0	12.6	100.0
30.0	46.0	13.9	28.8	0.0	11.3	100.0
40.0	41.6	12.5	35.6	0.0	10.2	100.0
50.0	37.9	11.4	41.5	0.0	9.3	100.0
60.0	34.9	10.4	46.2	0.0	8.5	100.0
70.0	32.7	9.8	49.5	0.0	8.0	100.0
80.0	31.4	9.4	51.6	0.0	7.6	100.0
90.0	31.0	9.2	52.2	0.0	7.5	100.0
100.0	31.4	9.4	51.6	0.0	7.6	100.0
110.0	32.7	9.7	49.6	0.0	7.9	100.0
120.0	34.9	10.4	46.2	0.0	8.5	100.0
130.0	38.1	11.3	41.4	0.0	9.2	100.0
140.0	42.1	12.5	35.2	0.0	10.2	100.0
150.0	46.9	14.0	27.7	0.0	11.1	100.0
160.0	52.4	15.7	19.1	0.0	12.3	100.0
170.0	58.7	17.6	9.4	0.0	14.3	100.0
180.0	66.1	19.8	-2.1	0.0	16.2	100.0
190.0	75.6	22.7	-16.9	0.0	18.5	100.0
200.0	89.0	26.8	-31.7	0.0	21.9	100.0
210.0	109.5	33.1	-69.7	0.0	27.1	100.0
220.0	142.0	33.1	-120.9	0.0	35.6	100.0
230.0	187.3	57.6	-189.3	0.0	47.4	100.0
240.0	-100.5	-25.5	177.9	0.0	48.1	100.0
250.0	-101.0	-27.3	189.8	0.0	38.5	100.0
260.0	-91.4	-25.1	183.7	0.0	32.7	100.0
270.0	-84.8	-23.2	177.5	0.0	30.5	100.0
280.0	-80.4	-21.7	171.4	0.0	30.7	100.0
290.0	-72.5	-18.8	158.9	0.0	32.4	100.0
300.0	-45.2	-9.7	122.7	0.0	32.2	100.0
310.0	116.1	37.4	-84.3	0.0	30.8	100.0
320.0	106.0	33.3	-66.6	0.0	27.4	100.0
330.0	91.0	28.2	-42.3	0.0	23.1	100.0
340.0	78.6	24.2	-22.6	0.0	19.8	100.0
350.0	69.4	21.2	-8.0	0.0	17.4	100.0
360.0	62.3	18.9	3.3	0.0	15.5	100.0

6.5.3 Environment forces

Case 5 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	-2.6	-3.6	0.0	-2.2	-15.1
10.0	-6.7	-2.6	-3.6	0.0	-2.2	-15.1
20.0	-6.7	-2.6	-3.5	0.0	-2.2	-15.0
30.0	-6.7	-2.6	-3.2	0.0	-2.2	-14.7
40.0	-6.7	-2.6	-2.8	0.0	-2.2	-14.3
50.0	-6.7	-2.6	-2.3	0.0	-2.2	-13.8
60.0	-6.7	-2.6	-1.6	0.0	-2.2	-13.2
70.0	-6.7	-2.6	-0.9	0.0	-2.2	-12.4
80.0	-6.7	-2.6	-0.1	0.0	-2.2	-11.6
90.0	-6.7	-2.6	0.7	0.0	-2.2	-10.8
100.0	-6.7	-2.6	1.5	0.0	-2.2	-10.0
110.0	-6.7	-2.6	2.3	0.0	-2.2	-9.3
120.0	-6.7	-2.6	3.0	0.0	-2.2	-8.6
130.0	-6.7	-2.6	3.5	0.0	-2.2	-8.0
140.0	-6.7	-2.6	4.0	0.0	-2.2	-7.6
150.0	-6.7	-2.6	4.3	0.0	-2.2	-7.3
160.0	-6.7	-2.6	4.4	0.0	-2.2	-7.1
170.0	-6.7	-2.6	4.4	0.0	-2.2	-7.1
180.0	-6.7	-2.6	4.3	0.0	-2.2	-7.2
190.0	-6.7	-2.6	4.4	0.0	-2.2	-7.1
200.0	-6.7	-2.6	4.4	0.0	-2.2	-7.1
210.0	-6.7	-2.6	4.3	0.0	-2.2	-7.3
220.0	-6.7	-2.6	4.0	0.0	-2.2	-7.6
230.0	-6.7	-2.6	3.5	0.0	-2.2	-8.0
240.0	-6.7	-2.6	3.0	0.0	-2.2	-8.6
250.0	-6.7	-2.6	2.3	0.0	-2.2	-9.3
260.0	-6.7	-2.6	1.5	0.0	-2.2	-10.0
270.0	-6.7	-2.6	0.7	0.0	-2.2	-10.8
280.0	-6.7	-2.6	-0.1	0.0	-2.2	-11.6
290.0	-6.7	-2.6	-0.9	0.0	-2.2	-12.4
300.0	-6.7	-2.6	-1.6	0.0	-2.2	-13.2
310.0	-6.7	-2.6	-2.3	0.0	-2.2	-13.8
320.0	-6.7	-2.6	-2.8	0.0	-2.2	-14.3
330.0	-6.7	-2.6	-3.2	0.0	-2.2	-14.7
340.0	-6.7	-2.6	-3.5	0.0	-2.2	-15.0
350.0	-6.7	-2.6	-3.6	0.0	-2.2	-15.1
360.0	-6.7	-2.6	-3.6	0.0	-2.2	-15.1

Case 5 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-24.5	-7.2	0.0	0.0	-5.9	-37.7
10.0	-24.5	-7.2	-4.8	0.0	-5.9	-42.5
20.0	-24.5	-7.2	-10.0	0.0	-5.9	-47.7
30.0	-24.5	-7.2	-15.6	0.0	-5.9	-53.3
40.0	-24.5	-7.2	-21.7	0.0	-5.9	-59.4
50.0	-24.5	-7.2	-28.0	0.0	-5.9	-65.7
60.0	-24.5	-7.2	-33.8	0.0	-5.9	-71.5
70.0	-24.5	-7.2	-38.7	0.0	-5.9	-76.3
80.0	-24.5	-7.2	-41.9	0.0	-5.9	-79.5
90.0	-24.5	-7.2	-43.0	0.0	-5.9	-80.7
100.0	-24.5	-7.2	-41.9	0.0	-5.9	-79.5
110.0	-24.5	-7.2	-38.7	0.0	-5.9	-76.3
120.0	-24.5	-7.2	-33.8	0.0	-5.9	-71.5
130.0	-24.5	-7.2	-28.0	0.0	-5.9	-65.7
140.0	-24.5	-7.2	-21.7	0.0	-5.9	-59.4
150.0	-24.5	-7.2	-15.6	0.0	-5.9	-53.3
160.0	-24.5	-7.2	-10.0	0.0	-5.9	-47.7
170.0	-24.5	-7.2	-4.8	0.0	-5.9	-42.5
180.0	-24.5	-7.2	0.0	0.0	-5.9	-37.7
190.0	-24.5	-7.2	4.8	0.0	-5.9	-32.8
200.0	-24.5	-7.2	10.0	0.0	-5.9	-27.7
210.0	-24.5	-7.2	15.6	0.0	-5.9	-22.0
220.0	-24.5	-7.2	21.7	0.0	-5.9	-15.9
230.0	-24.5	-7.2	28.0	0.0	-5.9	-9.7
240.0	-24.5	-7.2	33.8	0.0	5.9	8.0
250.0	-24.5	-7.2	38.7	0.0	5.9	12.8
260.0	-24.5	-7.2	41.9	0.0	5.9	16.0
270.0	-24.5	-7.2	43.0	0.0	5.9	17.1
280.0	-24.5	-7.2	41.9	0.0	5.9	16.0
290.0	-24.5	-7.2	38.7	0.0	5.9	12.8
300.0	-24.5	-7.2	33.8	0.0	5.9	8.0
310.0	-24.5	-7.2	28.0	0.0	-5.9	-9.7
320.0	-24.5	-7.2	21.7	0.0	-5.9	-15.9
330.0	-24.5	-7.2	15.6	0.0	-5.9	-22.0
340.0	-24.5	-7.2	10.0	0.0	-5.9	-27.7
350.0	-24.5	-7.2	4.8	0.0	-5.9	-32.8
360.0	-24.5	-7.2	0.0	0.0	-5.9	-37.7

Case 5 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-601.9	-87.7	0.0	0.0	-102.8	-792.4
10.0	-601.9	-87.7	-316.6	0.0	-102.8	-1109.0
20.0	-601.9	-87.7	-593.0	0.0	-102.8	-1385.4
30.0	-601.9	-87.7	-793.7	0.0	-102.8	-1586.1
40.0	-601.9	-87.7	-892.8	0.0	-102.8	-1685.2
50.0	-601.9	-87.7	-876.4	0.0	-102.8	-1668.8
60.0	-601.9	-87.7	-745.2	0.0	-102.8	-1537.6
70.0	-601.9	-87.7	-513.8	0.0	-102.8	-1306.2
80.0	-601.9	-87.7	-209.2	0.0	-102.8	-1001.6
90.0	-601.9	-87.7	132.4	0.0	-102.8	-660.0
100.0	-601.9	-87.7	470.0	0.0	-102.8	-322.4
110.0	-601.9	-87.7	762.6	0.0	102.8	175.7
120.0	-601.9	-87.7	974.5	0.0	102.8	387.6
130.0	-601.9	-87.7	1079.2	0.0	102.8	482.4
140.0	-601.9	-87.7	1063.0	0.0	102.8	475.1
150.0	-601.9	-87.7	926.1	0.0	102.8	339.2
160.0	-601.9	-87.7	683.5	0.0	-102.8	-108.9
170.0	-601.9	-87.7	362.6	0.0	-102.8	-429.8
180.0	-601.9	-87.7	0.0	0.0	-102.8	-792.4
190.0	-601.9	-87.7	-362.6	0.0	-102.8	-1155.0
200.0	-601.9	-87.7	-683.5	0.0	-102.8	-1475.9
210.0	-601.9	-87.7	-926.1	0.0	-102.8	-1718.5
220.0	-601.9	-87.7	-1063.0	0.0	-102.8	-1855.4
230.0	-601.9	-87.7	-1079.2	0.0	-102.8	-1871.6
240.0	-601.9	-87.7	-974.5	0.0	-102.8	-1766.9
250.0	-601.9	-87.7	-762.6	0.0	-102.8	-1555.0
260.0	-601.9	-87.7	-470.0	0.0	-102.8	-1262.4
270.0	-601.9	-87.7	-132.4	0.0	-102.8	-924.8
280.0	-601.9	-87.7	209.2	0.0	-102.8	-583.2
290.0	-601.9	-87.7	513.8	0.0	-102.8	-278.6
300.0	-601.9	-87.7	745.2	0.0	102.8	158.3
310.0	-601.9	-87.7	876.4	0.0	102.8	289.5
320.0	-601.9	-87.7	892.8	0.0	102.8	305.9
330.0	-601.9	-87.7	793.7	0.0	102.8	206.8
340.0	-601.9	-87.7	593.0	0.0	-102.8	-199.4
350.0	-601.9	-87.7	316.6	0.0	-102.8	-475.8
360.0	-601.9	-87.7	0.0	0.0	-102.8	-792.4

6.5.4 Thruster use

Case 5 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	97.2	0.2	85.7	170.1	16.4	90.0	33.9	67.8
10.0	97.3	0.1	88.7	174.5	16.2	90.0	26.4	70.1
20.0	94.2	1.4	88.2	180.0	16.2	90.0	19.5	72.3
30.0	92.1	358.7	88.1	180.0	16.4	90.0	14.9	74.3
40.0	91.0	357.3	87.9	180.0	16.6	90.0	12.7	76.1
50.0	90.6	357.7	87.7	180.0	17.0	90.0	13.7	77.9
60.0	90.7	359.6	87.5	180.0	17.5	90.0	17.2	79.4
70.0	91.0	2.6	87.4	180.0	17.3	90.0	21.8	80.6
80.0	92.0	6.6	87.2	180.0	17.1	90.0	28.0	81.5
90.0	93.7	11.0	87.2	180.0	16.9	90.0	35.2	82.3
100.0	94.4	15.3	85.7	180.0	17.0	90.0	42.2	82.7
110.0	97.4	21.3	84.3	180.0	17.0	90.0	52.8	83.0
120.0	98.4	23.9	83.0	180.0	17.2	90.0	57.4	83.0
130.0	98.5	25.1	81.9	180.0	17.2	90.0	59.4	82.9
140.0	97.7	25.0	81.0	180.0	17.3	90.0	59.1	82.6
150.0	80.0	14.3	72.0	167.1	17.4	90.0	53.8	82.2
160.0	91.3	18.3	79.7	180.0	17.6	90.0	46.8	81.4
170.0	88.9	14.2	79.4	180.0	17.9	90.0	46.4	80.3
180.0	86.8	9.4	79.3	180.0	18.2	90.0	33.2	79.0
190.0	85.1	4.3	79.4	179.9	18.2	90.0	25.2	77.5
200.0	84.3	359.7	79.7	180.0	18.3	90.0	18.4	75.4
210.0	84.7	356.3	80.2	180.0	18.3	90.0	13.5	71.5
220.0	86.3	354.6	81.0	180.0	18.5	90.0	11.5	64.2
230.0	85.0	356.6	76.5	180.0	18.7	90.0	12.6	50.4
240.0	17.1	312.3	12.3	256.9	17.1	90.0	11.7	317.2
250.0	15.6	308.5	12.3	267.8	11.7	90.0	15.8	305.9
260.0	13.6	307.1	11.4	280.2	6.3	90.0	18.9	302.1
270.0	1.2	305.5	10.4	294.5	1.5	90.0	20.2	302.4
280.0	8.7	308.3	9.5	311.4	-2.1	90.0	19.8	306.1
290.0	6.5	318.2	8.9	329.2	-3.9	90.0	17.8	314.2
300.0	4.0	349.6	9.3	355.5	-6.5	90.0	15.4	328.9
310.0	8.5	27.3	7.3	31.0	2.0	90.0	16.9	35.0
320.0	10.5	30.4	7.4	44.5	5.4	90.0	21.4	48.0
330.0	12.6	28.1	6.9	58.8	10.2	90.0	26.5	56.2
340.0	26.1	11.9	11.8	152.4	16.8	90.0	31.5	61.5
350.0	75.4	6.3	60.4	172.4	16.5	90.0	36.2	65.2
360.0	97.2	0.2	85.7	170.1	16.4	90.0	33.9	67.8

6.5.5 Thruster loss

Case 5 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.85	0.82
10.0	0.87	0.82	0.81
20.0	0.87	0.79	0.81
30.0	0.87	0.79	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.91	0.78	0.87
70.0	0.91	0.78	0.86
80.0	0.92	0.78	0.85
90.0	0.93	0.78	0.84
100.0	0.93	0.76	0.85
110.0	0.94	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.72	0.86
150.0	0.95	0.77	0.87
160.0	0.95	0.71	0.88
170.0	0.95	0.71	0.89
180.0	0.96	0.71	0.91
190.0	0.96	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.95	0.72	0.92
220.0	0.94	0.72	0.92
230.0	0.95	0.75	0.93
240.0	0.87	0.85	0.94
250.0	0.85	0.85	0.94
260.0	0.83	0.85	0.94
270.0	0.82	0.86	0.94
280.0	0.82	0.86	0.85
290.0	0.82	0.87	0.86
300.0	0.86	0.90	0.87
310.0	0.92	0.88	0.92
320.0	0.91	0.88	0.89
330.0	0.89	0.89	0.86
340.0	0.87	0.89	0.84
350.0	0.86	0.83	0.82
360.0	0.87	0.85	0.82

Preliminary Design, @IDR5

6.6 Case 6 - Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 4

6.6.1 Environment and thrust utilisation

Case 6 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	50.0	50.0	0.0	35.0	2.5	6.0	8.5	2.00	> 100.0
10.0	50.0	50.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	50.0	50.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	50.0	50.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	50.0	50.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	50.0	50.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	50.0	50.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	50.0	50.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	50.0	50.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	50.0	50.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	50.0	50.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	50.0	50.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	50.0	50.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	50.0	50.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	50.0	50.0	140.0	35.0	2.5	6.0	8.5	2.00	> 100.0
150.0	50.0	50.0	150.0	35.0	2.5	6.0	8.5	2.00	> 100.0
160.0	50.0	50.0	160.0	35.0	2.5	6.0	8.5	2.00	> 100.0
170.0	50.0	50.0	170.0	35.0	2.5	6.0	8.5	2.00	> 100.0
180.0	50.0	50.0	180.0	35.0	2.5	6.0	8.5	2.00	> 100.0
190.0	50.0	50.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	50.0	50.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	50.0	50.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	50.0	50.0	220.0	35.0	2.5	6.0	8.5	2.00	> 100.0
230.0	50.0	50.0	230.0	35.0	2.5	6.0	8.5	2.00	> 100.0
240.0	50.0	50.0	240.0	35.0	2.5	6.0	8.5	2.00	97.7
250.0	50.0	50.0	250.0	35.0	2.5	6.0	8.5	2.00	49.3
260.0	50.0	50.0	260.0	35.0	2.5	6.0	8.5	2.00	32.1
270.0	50.0	50.0	270.0	35.0	2.5	6.0	8.5	2.00	17.7
280.0	50.0	50.0	280.0	35.0	2.5	6.0	8.5	2.00	8.5
290.0	50.0	50.0	290.0	35.0	2.5	6.0	8.5	2.00	6.9
300.0	50.0	50.0	300.0	35.0	2.5	6.0	8.5	2.00	18.2
310.0	50.0	50.0	310.0	35.0	2.5	6.0	8.5	2.00	24.3
320.0	50.0	50.0	320.0	35.0	2.5	6.0	8.5	2.00	36.0
330.0	50.0	50.0	330.0	35.0	2.5	6.0	8.5	2.00	52.6
340.0	50.0	50.0	340.0	35.0	2.5	6.0	8.5	2.00	82.0
350.0	50.0	50.0	350.0	35.0	2.5	6.0	8.5	2.00	> 100.0
360.0	50.0	50.0	360.0	35.0	2.5	6.0	8.5	2.00	> 100.0

6.6.2 Relative contributions of force components

Case 6 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	61.9	19.9	2.2	0.0	16.0	100.0
10.0	56.6	18.2	10.7	0.0	14.6	100.0
20.0	51.8	16.6	18.3	0.0	13.3	100.0
30.0	47.4	15.1	25.4	0.0	12.1	100.0
40.0	43.3	13.8	31.8	0.0	11.1	100.0
50.0	39.8	12.7	37.4	0.0	10.2	100.0
60.0	37.0	11.7	41.9	0.0	9.4	100.0
70.0	34.9	11.1	45.1	0.0	8.9	100.0
80.0	33.7	10.7	47.1	0.0	8.5	100.0
90.0	33.3	10.5	47.8	0.0	8.4	100.0
100.0	33.7	10.7	47.1	0.0	8.5	100.0
110.0	35.0	11.1	45.1	0.0	8.9	100.0
120.0	37.1	11.7	41.8	0.0	9.4	100.0
130.0	40.0	12.7	37.2	0.0	10.1	100.0
140.0	43.7	13.8	31.4	0.0	11.1	100.0
150.0	48.1	15.2	24.5	0.0	12.2	100.0
160.0	53.0	16.8	16.9	0.0	13.4	100.0
170.0	58.3	18.5	8.4	0.0	14.8	100.0
180.0	64.4	20.4	-1.2	0.0	16.4	100.0
190.0	72.0	22.9	-13.1	0.0	18.3	100.0
200.0	82.1	26.1	-23.2	0.0	20.9	100.0
210.0	96.9	30.9	-52.5	0.0	24.8	100.0
220.0	119.4	38.1	-88.5	0.0	30.7	100.0
230.0	150.6	49.8	-143.4	0.0	40.0	100.0
240.0	197.1	65.2	-214.6	0.0	52.3	100.0
250.0	-141.3	-38.3	220.6	0.0	58.9	100.0
260.0	-135.1	-38.1	223.1	0.0	50.2	100.0
270.0	-124.0	-35.1	213.2	0.0	45.8	100.0
280.0	-112.4	-31.0	198.6	0.0	44.8	100.0
290.0	-84.9	-21.0	162.8	0.0	43.1	100.0
300.0	144.6	49.1	-133.2	0.0	39.5	100.0
310.0	123.8	41.2	-98.1	0.0	33.1	100.0
320.0	103.3	33.9	-64.4	0.0	27.2	100.0
330.0	87.6	28.6	-39.1	0.0	22.9	100.0
340.0	76.3	24.8	-21.0	0.0	19.9	100.0
350.0	68.2	22.0	-7.9	0.0	17.7	100.0
360.0	61.9	19.9	2.2	0.0	16.0	100.0

6.6.3 Environment forces

Case 6 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.6	-2.7	-3.6	0.0	-2.2	-14.1
10.0	-5.6	-2.7	-3.6	0.0	-2.2	-14.1
20.0	-5.6	-2.7	-3.5	0.0	-2.2	-13.9
30.0	-5.6	-2.7	-3.2	0.0	-2.2	-13.7
40.0	-5.6	-2.7	-2.8	0.0	-2.2	-13.3
50.0	-5.6	-2.7	-2.3	0.0	-2.2	-12.7
60.0	-5.6	-2.7	-1.6	0.0	-2.2	-12.1
70.0	-5.6	-2.7	-0.9	0.0	-2.2	-11.4
80.0	-5.6	-2.7	-0.1	0.0	-2.2	-10.6
90.0	-5.6	-2.7	0.7	0.0	-2.2	-9.7
100.0	-5.6	-2.7	1.5	0.0	-2.2	-8.9
110.0	-5.6	-2.7	2.3	0.0	-2.2	-8.2
120.0	-5.6	-2.7	3.0	0.0	-2.2	-7.5
130.0	-5.6	-2.7	3.5	0.0	-2.2	-6.9
140.0	-5.6	-2.7	4.0	0.0	-2.2	-6.5
150.0	-5.6	-2.7	4.3	0.0	-2.2	-6.2
160.0	-5.6	-2.7	4.4	0.0	-2.2	-6.0
170.0	-5.6	-2.7	4.4	0.0	-2.2	-6.0
180.0	-5.6	-2.7	4.3	0.0	-2.2	-6.2
190.0	-5.6	-2.7	4.4	0.0	-2.2	-6.0
200.0	-5.6	-2.7	4.4	0.0	-2.2	-6.0
210.0	-5.6	-2.7	4.3	0.0	-2.2	-6.2
220.0	-5.6	-2.7	4.0	0.0	-2.2	-6.5
230.0	-5.6	-2.7	3.5	0.0	-2.2	-6.9
240.0	-5.6	-2.7	3.0	0.0	-2.2	-7.5
250.0	-5.6	-2.7	2.3	0.0	-2.2	-8.2
260.0	-5.6	-2.7	1.5	0.0	-2.2	-8.9
270.0	-5.6	-2.7	0.7	0.0	-2.2	-9.7
280.0	-5.6	-2.7	-0.1	0.0	-2.2	-10.6
290.0	-5.6	-2.7	-0.9	0.0	-2.2	-11.4
300.0	-5.6	-2.7	-1.6	0.0	-2.2	-12.1
310.0	-5.6	-2.7	-2.3	0.0	-2.2	-12.7
320.0	-5.6	-2.7	-2.8	0.0	-2.2	-13.3
330.0	-5.6	-2.7	-3.2	0.0	-2.2	-13.7
340.0	-5.6	-2.7	-3.5	0.0	-2.2	-13.9
350.0	-5.6	-2.7	-3.6	0.0	-2.2	-14.1
360.0	-5.6	-2.7	-3.6	0.0	-2.2	-14.1

Case 6 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.3	-9.2	0.0	0.0	-7.3	-45.7
10.0	-29.3	-9.2	-4.8	0.0	-7.3	-50.6
20.0	-29.3	-9.2	-10.0	0.0	-7.3	-55.7
30.0	-29.3	-9.2	-15.6	0.0	-7.3	-61.4
40.0	-29.3	-9.2	-21.7	0.0	-7.3	-67.5
50.0	-29.3	-9.2	-28.0	0.0	-7.3	-73.7
60.0	-29.3	-9.2	-33.8	0.0	-7.3	-79.6
70.0	-29.3	-9.2	-38.7	0.0	-7.3	-84.4
80.0	-29.3	-9.2	-41.9	0.0	-7.3	-87.6
90.0	-29.3	-9.2	-43.0	0.0	-7.3	-88.7
100.0	-29.3	-9.2	-41.9	0.0	-7.3	-87.6
110.0	-29.3	-9.2	-38.7	0.0	-7.3	-84.4
120.0	-29.3	-9.2	-33.8	0.0	-7.3	-79.6
130.0	-29.3	-9.2	-28.0	0.0	-7.3	-73.7
140.0	-29.3	-9.2	-21.7	0.0	-7.3	-67.5
150.0	-29.3	-9.2	-15.6	0.0	-7.3	-61.4
160.0	-29.3	-9.2	-10.0	0.0	-7.3	-55.7
170.0	-29.3	-9.2	-4.8	0.0	-7.3	-50.6
180.0	-29.3	-9.2	0.0	0.0	-7.3	-45.7
190.0	-29.3	-9.2	4.8	0.0	-7.3	-40.9
200.0	-29.3	-9.2	10.0	0.0	-7.3	-35.8
210.0	-29.3	-9.2	15.6	0.0	-7.3	-30.1
220.0	-29.3	-9.2	21.7	0.0	-7.3	-24.0
230.0	-29.3	-9.2	28.0	0.0	-7.3	-17.8
240.0	-29.3	-9.2	33.8	0.0	-7.3	-11.9
250.0	-29.3	-9.2	38.7	0.0	7.3	7.6
260.0	-29.3	-9.2	41.9	0.0	7.3	10.8
270.0	-29.3	-9.2	43.0	0.0	7.3	11.9
280.0	-29.3	-9.2	41.9	0.0	7.3	10.8
290.0	-29.3	-9.2	38.7	0.0	7.3	7.6
300.0	-29.3	-9.2	33.8	0.0	-7.3	-11.9
310.0	-29.3	-9.2	28.0	0.0	-7.3	-17.8
320.0	-29.3	-9.2	21.7	0.0	-7.3	-24.0
330.0	-29.3	-9.2	15.6	0.0	-7.3	-30.1
340.0	-29.3	-9.2	10.0	0.0	-7.3	-35.8
350.0	-29.3	-9.2	4.8	0.0	-7.3	-40.9
360.0	-29.3	-9.2	0.0	0.0	-7.3	-45.7

Case 6 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-615.1	-98.9	0.0	0.0	-107.4	-821.4
10.0	-615.1	-98.9	-316.6	0.0	-107.4	-1138.0
20.0	-615.1	-98.9	-593.0	0.0	-107.4	-1414.3
30.0	-615.1	-98.9	-793.7	0.0	-107.4	-1615.0
40.0	-615.1	-98.9	-892.8	0.0	-107.4	-1714.1
50.0	-615.1	-98.9	-876.4	0.0	-107.4	-1697.8
60.0	-615.1	-98.9	-745.2	0.0	-107.4	-1566.6
70.0	-615.1	-98.9	-513.8	0.0	-107.4	-1335.2
80.0	-615.1	-98.9	-209.2	0.0	-107.4	-1030.6
90.0	-615.1	-98.9	132.4	0.0	-107.4	-689.0
100.0	-615.1	-98.9	470.0	0.0	-107.4	-351.4
110.0	-615.1	-98.9	762.6	0.0	107.4	156.0
120.0	-615.1	-98.9	974.5	0.0	107.4	367.9
130.0	-615.1	-98.9	1079.2	0.0	107.4	472.6
140.0	-615.1	-98.9	1063.0	0.0	107.4	455.3
150.0	-615.1	-98.9	926.1	0.0	107.4	319.4
160.0	-615.1	-98.9	683.5	0.0	-107.4	-137.8
170.0	-615.1	-98.9	362.6	0.0	-107.4	-458.8
180.0	-615.1	-98.9	0.0	0.0	-107.4	-821.4
190.0	-615.1	-98.9	-362.6	0.0	-107.4	-1183.9
200.0	-615.1	-98.9	-683.5	0.0	-107.4	-1504.9
210.0	-615.1	-98.9	-926.1	0.0	-107.4	-1747.4
220.0	-615.1	-98.9	-1063.0	0.0	-107.4	-1884.3
230.0	-615.1	-98.9	-1079.2	0.0	-107.4	-1900.6
240.0	-615.1	-98.9	-974.5	0.0	-107.4	-1795.9
250.0	-615.1	-98.9	-762.6	0.0	-107.4	-1584.0
260.0	-615.1	-98.9	-470.0	0.0	-107.4	-1291.3
270.0	-615.1	-98.9	-132.4	0.0	-107.4	-953.7
280.0	-615.1	-98.9	209.2	0.0	-107.4	-612.1
290.0	-615.1	-98.9	513.8	0.0	-107.4	-307.5
300.0	-615.1	-98.9	745.2	0.0	107.4	138.6
310.0	-615.1	-98.9	876.4	0.0	107.4	269.8
320.0	-615.1	-98.9	892.8	0.0	107.4	286.1
330.0	-615.1	-98.9	793.7	0.0	107.4	187.0
340.0	-615.1	-98.9	593.0	0.0	-107.4	-228.4
350.0	-615.1	-98.9	316.6	0.0	-107.4	-504.7
360.0	-615.1	-98.9	0.0	0.0	-107.4	-821.4

6.6.4 Thruster use

Case 6 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	97.2	0.2	88.7	170.6	16.4	90.0	32.6	72.7
10.0	97.3	0.1	90.9	174.9	16.2	90.0	25.4	74.4
20.0	92.8	0.9	88.2	180.0	16.2	90.0	18.3	75.7
30.0	91.2	358.2	88.1	180.0	16.4	90.0	13.9	77.3
40.0	90.4	356.9	87.9	180.0	16.6	90.0	12.0	78.7
50.0	90.0	357.2	87.7	180.0	17.0	90.0	12.9	80.1
60.0	90.0	359.2	87.5	180.0	17.5	90.0	16.4	81.2
70.0	90.3	2.2	87.3	180.0	17.3	90.0	21.0	82.2
80.0	91.1	6.2	87.2	180.0	17.1	90.0	27.2	83.0
90.0	92.6	10.7	87.2	180.0	16.9	90.0	34.3	83.6
100.0	93.1	15.0	85.7	180.0	17.0	90.0	41.3	84.1
110.0	95.9	21.3	84.3	180.0	17.0	90.0	52.1	84.4
120.0	96.7	23.9	83.0	180.0	17.2	90.0	56.6	84.5
130.0	96.7	25.2	81.9	180.0	17.2	90.0	58.6	84.5
140.0	95.7	25.1	81.0	180.0	17.3	90.0	58.2	84.4
150.0	93.8	23.7	80.2	180.0	17.4	90.0	55.3	84.1
160.0	89.1	18.2	79.7	180.0	17.6	90.0	45.7	83.7
170.0	86.7	14.0	79.4	180.0	17.9	90.0	39.2	83.1
180.0	84.7	9.1	79.3	180.0	18.2	90.0	31.9	82.2
190.0	83.2	3.8	79.4	179.9	18.2	90.0	24.1	81.5
200.0	82.6	359.1	79.7	180.0	18.3	90.0	17.2	80.2
210.0	83.0	355.6	80.2	180.0	18.3	90.0	12.2	78.2
220.0	84.0	353.8	81.0	180.0	18.5	90.0	9.8	74.7
230.0	86.2	354.1	81.5	180.0	18.7	90.0	10.5	68.4
240.0	85.8	357.4	79.3	182.3	18.9	90.0	14.1	57.8
250.0	15.4	312.4	7.5	259.1	15.1	90.0	11.2	317.1
260.0	13.3	317.4	10.3	271.7	9.6	90.0	14.0	309.7
270.0	0.9	310.8	8.9	287.1	4.8	90.0	15.4	309.3
280.0	8.5	315.7	7.6	306.1	1.3	90.0	15.1	314.4
290.0	6.5	328.4	6.8	328.3	-0.6	90.0	13.7	326.2
300.0	8.6	23.5	5.4	38.2	5.2	90.0	17.0	44.6
310.0	10.4	32.0	6.6	53.7	6.9	90.0	21.9	54.4
320.0	12.1	37.1	7.2	60.2	10.4	90.0	27.4	61.1
330.0	13.5	40.6	6.8	60.2	15.4	90.0	33.1	65.6
340.0	62.6	8.8	48.9	169.0	16.8	90.0	38.4	68.7
350.0	97.3	0.2	86.7	166.1	16.5	90.0	40.0	70.7
360.0	97.2	0.2	88.7	170.6	16.4	90.0	32.6	72.7

6.6.5 Thruster loss

Case 6 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.84	0.82
10.0	0.87	0.82	0.81
20.0	0.87	0.79	0.81
30.0	0.87	0.79	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.91	0.78	0.87
70.0	0.92	0.78	0.86
80.0	0.92	0.78	0.85
90.0	0.93	0.78	0.84
100.0	0.93	0.76	0.85
110.0	0.94	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.72	0.86
150.0	0.94	0.72	0.87
160.0	0.95	0.71	0.88
170.0	0.95	0.71	0.89
180.0	0.96	0.71	0.91
190.0	0.96	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.95	0.72	0.92
220.0	0.94	0.72	0.92
230.0	0.94	0.73	0.93
240.0	0.95	0.75	0.94
250.0	0.85	0.85	0.94
260.0	0.84	0.85	0.94
270.0	0.83	0.85	0.94
280.0	0.83	0.86	0.95
290.0	0.83	0.87	0.86
300.0	0.93	0.89	0.96
310.0	0.92	0.89	0.92
320.0	0.91	0.89	0.89
330.0	0.90	0.89	0.86
340.0	0.87	0.85	0.84
350.0	0.87	0.86	0.82
360.0	0.87	0.84	0.82

Preliminary Design, @IDR5

6.7 Case 7 - Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 4

6.7.1 Environment and thrust utilisation

Case 7 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	60.0	60.0	0.0	35.0	2.5	6.0	8.5	2.00	> 100.0
10.0	60.0	60.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	60.0	60.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	60.0	60.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	60.0	60.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	60.0	60.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	60.0	60.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	60.0	60.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	60.0	60.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	60.0	60.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	60.0	60.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	60.0	60.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	60.0	60.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	60.0	60.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	60.0	60.0	140.0	35.0	2.5	6.0	8.5	2.00	> 100.0
150.0	60.0	60.0	150.0	35.0	2.5	6.0	8.5	2.00	> 100.0
160.0	60.0	60.0	160.0	35.0	2.5	6.0	8.5	2.00	> 100.0
170.0	60.0	60.0	170.0	35.0	2.5	6.0	8.5	2.00	> 100.0
180.0	60.0	60.0	180.0	35.0	2.5	6.0	8.5	2.00	> 100.0
190.0	60.0	60.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	60.0	60.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	60.0	60.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	60.0	60.0	220.0	35.0	2.5	6.0	8.5	2.00	> 100.0
230.0	60.0	60.0	230.0	35.0	2.5	6.0	8.5	2.00	> 100.0
240.0	60.0	60.0	240.0	35.0	2.5	6.0	8.5	2.00	> 100.0
250.0	60.0	60.0	250.0	35.0	2.5	6.0	8.5	2.00	84.0
260.0	60.0	60.0	260.0	35.0	2.5	6.0	8.5	2.00	65.3
270.0	60.0	60.0	270.0	35.0	2.5	6.0	8.5	2.00	18.3
280.0	60.0	60.0	280.0	35.0	2.5	6.0	8.5	2.00	37.1
290.0	60.0	60.0	290.0	35.0	2.5	6.0	8.5	2.00	31.3
300.0	60.0	60.0	300.0	35.0	2.5	6.0	8.5	2.00	23.6
310.0	60.0	60.0	310.0	35.0	2.5	6.0	8.5	2.00	29.9
320.0	60.0	60.0	320.0	35.0	2.5	6.0	8.5	2.00	41.8
330.0	60.0	60.0	330.0	35.0	2.5	6.0	8.5	2.00	58.4
340.0	60.0	60.0	340.0	35.0	2.5	6.0	8.5	2.00	87.2
350.0	60.0	60.0	350.0	35.0	2.5	6.0	8.5	2.00	> 100.0
360.0	60.0	60.0	360.0	35.0	2.5	6.0	8.5	2.00	> 100.0

6.7.2 Relative contributions of force components

Case 7 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	59.8	21.7	1.7	0.0	16.8	100.0
10.0	55.0	19.9	9.7	0.0	15.4	100.0
20.0	50.6	18.3	17.0	0.0	14.1	100.0
30.0	46.5	16.8	23.8	0.0	13.0	100.0
40.0	42.8	15.4	30.0	0.0	11.9	100.0
50.0	39.5	14.2	35.4	0.0	11.0	100.0
60.0	36.8	13.2	39.8	0.0	10.2	100.0
70.0	34.9	12.5	43.0	0.0	9.6	100.0
80.0	33.7	12.0	45.0	0.0	9.3	100.0
90.0	33.3	11.9	45.6	0.0	9.2	100.0
100.0	33.7	12.0	45.0	0.0	9.3	100.0
110.0	34.9	12.4	43.0	0.0	9.6	100.0
120.0	36.9	13.1	39.7	0.0	10.2	100.0
130.0	39.7	14.1	35.2	0.0	10.9	100.0
140.0	43.1	15.4	29.6	0.0	11.9	100.0
150.0	47.1	16.8	23.1	0.0	13.0	100.0
160.0	51.5	18.3	15.9	0.0	14.2	100.0
170.0	56.3	20.1	8.1	0.0	15.5	100.0
180.0	61.7	22.0	-0.8	0.0	17.0	100.0
190.0	68.2	24.4	-11.4	0.0	18.9	100.0
200.0	76.9	27.5	-23.6	0.0	21.3	100.0
210.0	89.1	31.9	-45.3	0.0	24.7	100.0
220.0	107.4	38.1	-76.0	0.0	29.9	100.0
230.0	133.0	48.9	-121.7	0.0	37.9	100.0
240.0	171.9	63.8	-187.1	0.0	49.4	100.0
250.0	216.0	80.8	-259.3	0.0	62.5	100.0
260.0	232.6	89.3	-291.1	0.0	69.2	100.0
270.0	-166.7	-52.5	257.1	0.0	62.1	100.0
280.0	196.8	76.7	-232.9	0.0	59.4	100.0
290.0	173.5	66.5	-191.4	0.0	51.5	100.0
300.0	144.8	54.5	-141.6	0.0	42.2	100.0
310.0	118.2	43.9	-96.2	0.0	34.0	100.0
320.0	97.8	36.0	-61.7	0.0	27.9	100.0
330.0	83.2	30.5	-37.3	0.0	23.6	100.0
340.0	73.0	26.6	-20.2	0.0	20.6	100.0
350.0	65.6	23.8	-7.9	0.0	18.5	100.0
360.0	59.8	21.7	1.7	0.0	16.8	100.0

6.7.3 Environment forces

Case 7 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-4.1	-2.7	-3.6	0.0	-2.1	-12.5
10.0	-4.1	-2.7	-3.6	0.0	-2.1	-12.5
20.0	-4.1	-2.7	-3.5	0.0	-2.1	-12.3
30.0	-4.1	-2.7	-3.2	0.0	-2.1	-12.1
40.0	-4.1	-2.7	-2.8	0.0	-2.1	-11.7
50.0	-4.1	-2.7	-2.3	0.0	-2.1	-11.1
60.0	-4.1	-2.7	-1.6	0.0	-2.1	-10.5
70.0	-4.1	-2.7	-0.9	0.0	-2.1	-9.7
80.0	-4.1	-2.7	-0.1	0.0	-2.1	-9.0
90.0	-4.1	-2.7	0.7	0.0	-2.1	-8.1
100.0	-4.1	-2.7	1.5	0.0	-2.1	-7.3
110.0	-4.1	-2.7	2.3	0.0	-2.1	-6.6
120.0	-4.1	-2.7	3.0	0.0	-2.1	-5.9
130.0	-4.1	-2.7	3.5	0.0	-2.1	-5.3
140.0	-4.1	-2.7	4.0	0.0	-2.1	-4.9
150.0	-4.1	-2.7	4.3	0.0	-2.1	-4.6
160.0	-4.1	-2.7	4.4	0.0	-2.1	-4.4
170.0	-4.1	-2.7	4.4	0.0	-2.1	-4.4
180.0	-4.1	-2.7	4.3	0.0	-2.1	-4.5
190.0	-4.1	-2.7	4.4	0.0	-2.1	-4.4
200.0	-4.1	-2.7	4.4	0.0	-2.1	-4.4
210.0	-4.1	-2.7	4.3	0.0	-2.1	-4.6
220.0	-4.1	-2.7	4.0	0.0	-2.1	-4.9
230.0	-4.1	-2.7	3.5	0.0	-2.1	-5.3
240.0	-4.1	-2.7	3.0	0.0	-2.1	-5.9
250.0	-4.1	-2.7	2.3	0.0	-2.1	-6.6
260.0	-4.1	-2.7	1.5	0.0	-2.1	-7.3
270.0	-4.1	-2.7	0.7	0.0	-2.1	-8.1
280.0	-4.1	-2.7	-0.1	0.0	-2.1	-9.0
290.0	-4.1	-2.7	-0.9	0.0	-2.1	-9.7
300.0	-4.1	-2.7	-1.6	0.0	-2.1	-10.5
310.0	-4.1	-2.7	-2.3	0.0	-2.1	-11.1
320.0	-4.1	-2.7	-2.8	0.0	-2.1	-11.7
330.0	-4.1	-2.7	-3.2	0.0	-2.1	-12.1
340.0	-4.1	-2.7	-3.5	0.0	-2.1	-12.3
350.0	-4.1	-2.7	-3.6	0.0	-2.1	-12.5
360.0	-4.1	-2.7	-3.6	0.0	-2.1	-12.5

Case 7 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-31.0	-10.9	0.0	0.0	-8.5	-50.4
10.0	-31.0	-10.9	-4.8	0.0	-8.5	-55.2
20.0	-31.0	-10.9	-10.0	0.0	-8.5	-60.4
30.0	-31.0	-10.9	-15.6	0.0	-8.5	-66.0
40.0	-31.0	-10.9	-21.7	0.0	-8.5	-72.1
50.0	-31.0	-10.9	-28.0	0.0	-8.5	-78.4
60.0	-31.0	-10.9	-33.8	0.0	-8.5	-84.2
70.0	-31.0	-10.9	-38.7	0.0	-8.5	-89.1
80.0	-31.0	-10.9	-41.9	0.0	-8.5	-92.3
90.0	-31.0	-10.9	-43.0	0.0	-8.5	-93.4
100.0	-31.0	-10.9	-41.9	0.0	-8.5	-92.3
110.0	-31.0	-10.9	-38.7	0.0	-8.5	-89.1
120.0	-31.0	-10.9	-33.8	0.0	-8.5	-84.2
130.0	-31.0	-10.9	-28.0	0.0	-8.5	-78.4
140.0	-31.0	-10.9	-21.7	0.0	-8.5	-72.1
150.0	-31.0	-10.9	-15.6	0.0	-8.5	-66.0
160.0	-31.0	-10.9	-10.0	0.0	-8.5	-60.4
170.0	-31.0	-10.9	-4.8	0.0	-8.5	-55.2
180.0	-31.0	-10.9	0.0	0.0	-8.5	-50.4
190.0	-31.0	-10.9	4.8	0.0	-8.5	-45.6
200.0	-31.0	-10.9	10.0	0.0	-8.5	-40.4
210.0	-31.0	-10.9	15.6	0.0	-8.5	-34.8
220.0	-31.0	-10.9	21.7	0.0	-8.5	-28.7
230.0	-31.0	-10.9	28.0	0.0	-8.5	-22.4
240.0	-31.0	-10.9	33.8	0.0	-8.5	-16.5
250.0	-31.0	-10.9	38.7	0.0	-8.5	-11.7
260.0	-31.0	-10.9	41.9	0.0	-8.5	-8.5
270.0	-31.0	-10.9	43.0	0.0	8.5	9.5
280.0	-31.0	-10.9	41.9	0.0	-8.5	-8.5
290.0	-31.0	-10.9	38.7	0.0	-8.5	-11.7
300.0	-31.0	-10.9	33.8	0.0	-8.5	-16.5
310.0	-31.0	-10.9	28.0	0.0	-8.5	-22.4
320.0	-31.0	-10.9	21.7	0.0	-8.5	-28.7
330.0	-31.0	-10.9	15.6	0.0	-8.5	-34.8
340.0	-31.0	-10.9	10.0	0.0	-8.5	-40.4
350.0	-31.0	-10.9	4.8	0.0	-8.5	-45.6
360.0	-31.0	-10.9	0.0	0.0	-8.5	-50.4

Case 7 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-543.1	-99.5	0.0	0.0	-98.2	-740.8
10.0	-543.1	-99.5	-316.6	0.0	-98.2	-1057.4
20.0	-543.1	-99.5	-593.0	0.0	-98.2	-1333.7
30.0	-543.1	-99.5	-793.7	0.0	-98.2	-1534.4
40.0	-543.1	-99.5	-892.8	0.0	-98.2	-1633.5
50.0	-543.1	-99.5	-876.4	0.0	-98.2	-1617.2
60.0	-543.1	-99.5	-745.2	0.0	-98.2	-1486.0
70.0	-543.1	-99.5	-513.8	0.0	-98.2	-1254.6
80.0	-543.1	-99.5	-209.2	0.0	-98.2	-950.0
90.0	-543.1	-99.5	132.4	0.0	-98.2	-608.4
100.0	-543.1	-99.5	470.0	0.0	-98.2	-270.8
110.0	-543.1	-99.5	762.6	0.0	98.2	218.2
120.0	-543.1	-99.5	974.5	0.0	98.2	430.1
130.0	-543.1	-99.5	1079.2	0.0	98.2	524.8
140.0	-543.1	-99.5	1063.0	0.0	98.2	513.5
150.0	-543.1	-99.5	926.1	0.0	98.2	331.0
160.0	-543.1	-99.5	683.5	0.0	98.2	139.1
170.0	-543.1	-99.5	362.6	0.0	-98.2	-378.2
180.0	-543.1	-99.5	0.0	0.0	-98.2	-740.8
190.0	-543.1	-99.5	-362.6	0.0	-98.2	-1103.3
200.0	-543.1	-99.5	-683.5	0.0	-98.2	-1424.3
210.0	-543.1	-99.5	-926.1	0.0	-98.2	-1666.8
220.0	-543.1	-99.5	-1063.0	0.0	-98.2	-1803.7
230.0	-543.1	-99.5	-1079.2	0.0	-98.2	-1820.0
240.0	-543.1	-99.5	-974.5	0.0	-98.2	-1715.3
250.0	-543.1	-99.5	-762.6	0.0	-98.2	-1503.4
260.0	-543.1	-99.5	-470.0	0.0	-98.2	-1210.7
270.0	-543.1	-99.5	-132.4	0.0	-98.2	-873.1
280.0	-543.1	-99.5	209.2	0.0	-98.2	-531.5
290.0	-543.1	-99.5	513.8	0.0	-98.2	-226.9
300.0	-543.1	-99.5	745.2	0.0	98.2	200.8
310.0	-543.1	-99.5	876.4	0.0	98.2	332.0
320.0	-543.1	-99.5	892.8	0.0	98.2	348.4
330.0	-543.1	-99.5	793.7	0.0	98.2	249.3
340.0	-543.1	-99.5	593.0	0.0	-98.2	-147.8
350.0	-543.1	-99.5	316.6	0.0	-98.2	-424.1
360.0	-543.1	-99.5	0.0	0.0	-98.2	-740.8

6.7.4 Thruster use

Case 7 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	97.2	0.2	90.4	169.6	16.4	90.0	34.0	75.9
10.0	97.3	0.1	91.9	173.8	16.2	90.0	26.9	77.3
20.0	92.3	2.0	88.3	180.0	16.2	90.0	19.9	78.3
30.0	90.9	359.3	88.1	180.0	16.4	90.0	15.5	79.5
40.0	90.2	358.0	87.9	180.0	16.6	90.0	13.6	80.6
50.0	89.8	358.3	87.7	180.0	17.0	90.0	14.5	81.8
60.0	89.7	0.2	87.5	180.0	17.5	90.0	18.0	82.8
70.0	90.0	3.2	87.3	180.0	17.3	90.0	22.6	83.7
80.0	90.8	7.3	87.2	180.0	17.1	90.0	28.8	84.4
90.0	92.3	11.8	87.2	180.0	16.9	90.0	35.9	84.9
100.0	92.8	16.1	85.7	180.0	17.0	90.0	42.8	85.4
110.0	95.3	22.2	84.3	180.0	17.0	90.0	53.2	85.7
120.0	96.0	24.9	83.0	180.0	17.2	90.0	57.7	85.9
130.0	95.9	26.2	81.9	180.0	17.2	90.0	59.7	86.0
140.0	94.7	26.2	81.0	180.0	17.3	90.0	59.2	86.1
150.0	92.7	24.7	80.2	180.0	17.4	90.0	56.3	86.0
160.0	90.0	21.9	79.7	180.0	17.6	90.0	51.3	85.7
170.0	85.7	15.3	79.4	180.0	17.9	90.0	46.6	85.3
180.0	83.7	10.3	79.3	180.0	18.2	90.0	33.2	84.7
190.0	82.2	5.0	79.4	180.0	18.2	90.0	25.5	84.4
200.0	81.8	0.2	79.7	180.0	18.3	90.0	18.7	83.6
210.0	82.2	356.8	80.3	180.0	18.3	90.0	13.9	82.4
220.0	83.2	354.9	81.0	180.0	18.5	90.0	11.3	80.2
230.0	84.9	355.1	81.5	180.0	18.7	90.0	11.7	76.4
240.0	88.4	357.2	82.0	180.0	18.9	90.0	15.5	70.1
250.0	58.0	356.1	77.3	183.6	18.9	90.0	13.4	60.7
260.0	18.8	347.7	11.8	205.3	18.9	90.0	11.2	49.3
270.0	9.7	311.4	7.7	283.0	5.2	90.0	12.5	310.5
280.0	9.0	350.4	1.4	272.0	11.5	90.0	12.4	43.6
290.0	8.6	7.4	1.6	41.1	9.5	90.0	15.2	50.2
300.0	9.1	32.1	5.4	59.2	7.1	90.0	19.6	57.7
310.0	10.7	44.1	6.9	60.2	9.0	90.0	25.0	63.6
320.0	12.5	50.5	7.4	60.2	12.6	90.0	30.9	67.9
330.0	19.7	35.5	8.0	119.8	16.4	90.0	36.8	70.9
340.0	74.5	9.2	62.3	169.2	16.8	90.0	42.2	73.0
350.0	97.3	0.2	89.3	165.2	16.5	90.0	41.2	74.5
360.0	97.2	0.2	90.4	169.6	16.4	90.0	34.0	75.9

6.7.5 Thruster loss

Case 7 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.85	0.82
10.0	0.87	0.82	0.81
20.0	0.87	0.79	0.81
30.0	0.88	0.79	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.91	0.78	0.87
70.0	0.91	0.78	0.86
80.0	0.92	0.78	0.85
90.0	0.92	0.78	0.84
100.0	0.93	0.76	0.85
110.0	0.93	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.72	0.86
150.0	0.94	0.72	0.87
160.0	0.95	0.71	0.88
170.0	0.95	0.71	0.89
180.0	0.96	0.71	0.91
190.0	0.96	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.95	0.72	0.92
220.0	0.94	0.72	0.92
230.0	0.94	0.73	0.93
240.0	0.95	0.74	0.94
250.0	0.94	0.77	0.94
260.0	0.90	0.86	0.94
270.0	0.83	0.85	0.94
280.0	0.89	0.85	0.95
290.0	0.93	0.89	0.95
300.0	0.94	0.89	0.96
310.0	0.94	0.89	0.92
320.0	0.93	0.89	0.89
330.0	0.90	0.90	0.86
340.0	0.87	0.85	0.84
350.0	0.87	0.86	0.82
360.0	0.87	0.85	0.82

Preliminary Design, @IDR5

6.8 Case 8 - Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 4

6.8.1 Environment and thrust utilisation

Case 8 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	70.0	70.0	0.0	35.0	2.5	6.0	8.5	2.00	> 100.0
10.0	70.0	70.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	70.0	70.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	70.0	70.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	70.0	70.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	70.0	70.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	70.0	70.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	70.0	70.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	70.0	70.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	70.0	70.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	70.0	70.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	70.0	70.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	70.0	70.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	70.0	70.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	70.0	70.0	140.0	35.0	2.5	6.0	8.5	2.00	> 100.0
150.0	70.0	70.0	150.0	35.0	2.5	6.0	8.5	2.00	> 100.0
160.0	70.0	70.0	160.0	35.0	2.5	6.0	8.5	2.00	> 100.0
170.0	70.0	70.0	170.0	35.0	2.5	6.0	8.5	2.00	> 100.0
180.0	70.0	70.0	180.0	35.0	2.5	6.0	8.5	2.00	> 100.0
190.0	70.0	70.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	70.0	70.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	70.0	70.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	70.0	70.0	220.0	35.0	2.5	6.0	8.5	2.00	> 100.0
230.0	70.0	70.0	230.0	35.0	2.5	6.0	8.5	2.00	> 100.0
240.0	70.0	70.0	240.0	35.0	2.5	6.0	8.5	2.00	> 100.0
250.0	70.0	70.0	250.0	35.0	2.5	6.0	8.5	2.00	82.8
260.0	70.0	70.0	260.0	35.0	2.5	6.0	8.5	2.00	63.7
270.0	70.0	70.0	270.0	35.0	2.5	6.0	8.5	2.00	46.9
280.0	70.0	70.0	280.0	35.0	2.5	6.0	8.5	2.00	34.6
290.0	70.0	70.0	290.0	35.0	2.5	6.0	8.5	2.00	24.0
300.0	70.0	70.0	300.0	35.0	2.5	6.0	8.5	2.00	23.9
310.0	70.0	70.0	310.0	35.0	2.5	6.0	8.5	2.00	30.3
320.0	70.0	70.0	320.0	35.0	2.5	6.0	8.5	2.00	42.0
330.0	70.0	70.0	330.0	35.0	2.5	6.0	8.5	2.00	58.6
340.0	70.0	70.0	340.0	35.0	2.5	6.0	8.5	2.00	79.1
350.0	70.0	70.0	350.0	35.0	2.5	6.0	8.5	2.00	> 100.0
360.0	70.0	70.0	360.0	35.0	2.5	6.0	8.5	2.00	> 100.0

6.8.2 Relative contributions of force components

Case 8 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	56.0	24.4	1.2	0.0	18.4	100.0
10.0	51.6	22.5	9.0	0.0	16.9	100.0
20.0	47.6	20.7	16.1	0.0	15.6	100.0
30.0	43.9	19.1	22.7	0.0	14.3	100.0
40.0	40.4	17.6	28.8	0.0	13.2	100.0
50.0	37.4	16.2	34.2	0.0	12.2	100.0
60.0	35.0	15.1	38.5	0.0	11.4	100.0
70.0	33.2	14.4	41.7	0.0	10.8	100.0
80.0	32.1	13.9	43.6	0.0	10.4	100.0
90.0	31.7	13.7	44.2	0.0	10.3	100.0
100.0	32.1	13.9	43.6	0.0	10.4	100.0
110.0	33.2	14.3	41.7	0.0	10.8	100.0
120.0	35.1	15.1	38.5	0.0	11.4	100.0
130.0	37.6	16.2	34.0	0.0	12.2	100.0
140.0	40.7	17.5	28.6	0.0	13.2	100.0
150.0	44.3	19.1	22.3	0.0	14.3	100.0
160.0	48.2	20.8	15.4	0.0	15.5	100.0
170.0	52.4	22.6	8.0	0.0	17.0	100.0
180.0	57.1	24.6	-0.3	0.0	18.5	100.0
190.0	62.8	27.1	-10.2	0.0	20.4	100.0
200.0	70.2	30.3	-23.2	0.0	22.8	100.0
210.0	80.6	34.5	-41.5	0.0	26.2	100.0
220.0	95.0	41.1	-68.5	0.0	31.2	100.0
230.0	113.7	51.5	-108.9	0.0	38.7	100.0
240.0	151.7	66.2	-167.7	0.0	49.7	100.0
250.0	193.5	85.1	-242.6	0.0	63.9	100.0
260.0	228.1	101.5	-305.8	0.0	76.1	100.0
270.0	232.1	104.2	-314.4	0.0	78.1	100.0
280.0	207.3	93.2	-270.4	0.0	69.9	100.0
290.0	171.3	76.6	-205.4	0.0	57.5	100.0
300.0	136.9	60.8	-143.3	0.0	45.6	100.0
310.0	109.8	48.6	-94.9	0.0	36.5	100.0
320.0	90.6	39.9	-60.4	0.0	29.9	100.0
330.0	77.2	33.9	-36.6	0.0	25.5	100.0
340.0	67.9	29.7	-20.0	0.0	22.3	100.0
350.0	61.2	26.8	-8.0	0.0	20.1	100.0
360.0	56.0	24.4	1.2	0.0	18.4	100.0

6.8.3 Environment forces

Case 8 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-2.6	-2.3	-3.6	0.0	-1.6	-10.0
10.0	-2.6	-2.3	-3.6	0.0	-1.6	-10.0
20.0	-2.6	-2.3	-3.5	0.0	-1.6	-9.9
30.0	-2.6	-2.3	-3.2	0.0	-1.6	-9.6
40.0	-2.6	-2.3	-2.8	0.0	-1.6	-9.2
50.0	-2.6	-2.3	-2.3	0.0	-1.6	-8.7
60.0	-2.6	-2.3	-1.6	0.0	-1.6	-8.1
70.0	-2.6	-2.3	-0.9	0.0	-1.6	-7.3
80.0	-2.6	-2.3	-0.1	0.0	-1.6	-6.5
90.0	-2.6	-2.3	0.7	0.0	-1.6	-5.7
100.0	-2.6	-2.3	1.5	0.0	-1.6	-4.9
110.0	-2.6	-2.3	2.3	0.0	-1.6	-4.2
120.0	-2.6	-2.3	3.0	0.0	-1.6	-3.5
130.0	-2.6	-2.3	3.5	0.0	-1.6	-2.9
140.0	-2.6	-2.3	4.0	0.0	-1.6	-2.5
150.0	-2.6	-2.3	4.3	0.0	-1.6	-2.2
160.0	-2.6	-2.3	4.4	0.0	-1.6	-2.0
170.0	-2.6	-2.3	4.4	0.0	-1.6	-2.0
180.0	-2.6	-2.3	4.3	0.0	-1.6	-2.1
190.0	-2.6	-2.3	4.4	0.0	-1.6	-2.0
200.0	-2.6	-2.3	4.4	0.0	-1.6	-2.0
210.0	-2.6	-2.3	4.3	0.0	-1.6	-2.2
220.0	-2.6	-2.3	4.0	0.0	-1.6	-2.5
230.0	-2.6	-2.3	3.5	0.0	-1.6	-2.9
240.0	-2.6	-2.3	3.0	0.0	-1.6	-3.5
250.0	-2.6	-2.3	2.3	0.0	-1.6	-4.2
260.0	-2.6	-2.3	1.5	0.0	-1.6	-4.9
270.0	-2.6	-2.3	0.7	0.0	-1.6	-5.7
280.0	-2.6	-2.3	-0.1	0.0	-1.6	-6.5
290.0	-2.6	-2.3	-0.9	0.0	-1.6	-7.3
300.0	-2.6	-2.3	-1.6	0.0	-1.6	-8.1
310.0	-2.6	-2.3	-2.3	0.0	-1.6	-8.7
320.0	-2.6	-2.3	-2.8	0.0	-1.6	-9.2
330.0	-2.6	-2.3	-3.2	0.0	-1.6	-9.6
340.0	-2.6	-2.3	-3.5	0.0	-1.6	-9.9
350.0	-2.6	-2.3	-3.6	0.0	-1.6	-10.0
360.0	-2.6	-2.3	-3.6	0.0	-1.6	-10.0

Case 8 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.7	-13.2	0.0	0.0	-9.9	-53.7
10.0	-30.7	-13.2	-4.8	0.0	-9.9	-58.6
20.0	-30.7	-13.2	-10.0	0.0	-9.9	-63.7
30.0	-30.7	-13.2	-15.6	0.0	-9.9	-69.4
40.0	-30.7	-13.2	-21.7	0.0	-9.9	-75.5
50.0	-30.7	-13.2	-28.0	0.0	-9.9	-81.7
60.0	-30.7	-13.2	-33.8	0.0	-9.9	-87.6
70.0	-30.7	-13.2	-38.7	0.0	-9.9	-92.4
80.0	-30.7	-13.2	-41.9	0.0	-9.9	-95.6
90.0	-30.7	-13.2	-43.0	0.0	-9.9	-96.7
100.0	-30.7	-13.2	-41.9	0.0	-9.9	-95.6
110.0	-30.7	-13.2	-38.7	0.0	-9.9	-92.4
120.0	-30.7	-13.2	-33.8	0.0	-9.9	-87.6
130.0	-30.7	-13.2	-28.0	0.0	-9.9	-81.7
140.0	-30.7	-13.2	-21.7	0.0	-9.9	-75.5
150.0	-30.7	-13.2	-15.6	0.0	-9.9	-69.4
160.0	-30.7	-13.2	-10.0	0.0	-9.9	-63.7
170.0	-30.7	-13.2	-4.8	0.0	-9.9	-58.6
180.0	-30.7	-13.2	0.0	0.0	-9.9	-53.7
190.0	-30.7	-13.2	4.8	0.0	-9.9	-48.9
200.0	-30.7	-13.2	10.0	0.0	-9.9	-43.7
210.0	-30.7	-13.2	15.6	0.0	-9.9	-38.1
220.0	-30.7	-13.2	21.7	0.0	-9.9	-32.0
230.0	-30.7	-13.2	28.0	0.0	-9.9	-25.7
240.0	-30.7	-13.2	33.8	0.0	-9.9	-19.9
250.0	-30.7	-13.2	38.7	0.0	-9.9	-15.0
260.0	-30.7	-13.2	41.9	0.0	-9.9	-11.9
270.0	-30.7	-13.2	43.0	0.0	-9.9	-10.7
280.0	-30.7	-13.2	41.9	0.0	-9.9	-11.9
290.0	-30.7	-13.2	38.7	0.0	-9.9	-15.0
300.0	-30.7	-13.2	33.8	0.0	-9.9	-19.9
310.0	-30.7	-13.2	28.0	0.0	-9.9	-25.7
320.0	-30.7	-13.2	21.7	0.0	-9.9	-32.0
330.0	-30.7	-13.2	15.6	0.0	-9.9	-38.1
340.0	-30.7	-13.2	10.0	0.0	-9.9	-43.7
350.0	-30.7	-13.2	4.8	0.0	-9.9	-48.9
360.0	-30.7	-13.2	0.0	0.0	-9.9	-53.7

Case 8 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-430.1	-43.1	0.0	0.0	-62.8	-536.0
10.0	-430.1	-43.1	-316.6	0.0	-62.8	-852.6
20.0	-430.1	-43.1	-593.0	0.0	-62.8	-1129.0
30.0	-430.1	-43.1	-793.7	0.0	-62.8	-1329.7
40.0	-430.1	-43.1	-892.8	0.0	-62.8	-1428.8
50.0	-430.1	-43.1	-876.4	0.0	-62.8	-1412.5
60.0	-430.1	-43.1	-745.2	0.0	-62.8	-1281.3
70.0	-430.1	-43.1	-513.8	0.0	-62.8	-1049.9
80.0	-430.1	-43.1	-209.2	0.0	-62.8	-745.3
90.0	-430.1	-43.1	132.4	0.0	-62.8	-403.6
100.0	-430.1	-43.1	470.0	0.0	-62.8	-66.1
110.0	-430.1	-43.1	762.6	0.0	62.8	352.2
120.0	-430.1	-43.1	974.5	0.0	62.8	564.1
130.0	-430.1	-43.1	1079.2	0.0	62.8	668.8
140.0	-430.1	-43.1	1063.0	0.0	62.8	653.5
150.0	-430.1	-43.1	926.1	0.0	62.8	515.0
160.0	-430.1	-43.1	683.5	0.0	62.8	273.1
170.0	-430.1	-43.1	362.6	0.0	-62.8	-173.4
180.0	-430.1	-43.1	0.0	0.0	-62.8	-536.0
190.0	-430.1	-43.1	-362.6	0.0	-62.8	-898.6
200.0	-430.1	-43.1	-683.5	0.0	-62.8	-1219.6
210.0	-430.1	-43.1	-926.1	0.0	-62.8	-1462.1
220.0	-430.1	-43.1	-1063.0	0.0	-62.8	-1599.0
230.0	-430.1	-43.1	-1079.2	0.0	-62.8	-1615.3
240.0	-430.1	-43.1	-974.5	0.0	-62.8	-1510.6
250.0	-430.1	-43.1	-762.6	0.0	-62.8	-1298.7
260.0	-430.1	-43.1	-470.0	0.0	-62.8	-1006.0
270.0	-430.1	-43.1	-132.4	0.0	-62.8	-668.4
280.0	-430.1	-43.1	209.2	0.0	-62.8	-326.8
290.0	-430.1	-43.1	513.8	0.0	62.8	103.4
300.0	-430.1	-43.1	745.2	0.0	62.8	334.8
310.0	-430.1	-43.1	876.4	0.0	62.8	466.0
320.0	-430.1	-43.1	892.8	0.0	62.8	482.3
330.0	-430.1	-43.1	793.7	0.0	62.8	383.2
340.0	-430.1	-43.1	593.0	0.0	62.8	182.5
350.0	-430.1	-43.1	316.6	0.0	-62.8	-219.4
360.0	-430.1	-43.1	0.0	0.0	-62.8	-536.0

6.8.4 Thruster use

Case 8 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	97.2	0.2	92.4	167.0	16.4	90.0	38.2	79.2
10.0	97.3	0.2	93.1	171.2	16.2	90.0	31.2	80.1
20.0	92.3	4.7	88.2	180.0	16.2	90.0	24.1	81.0
30.0	90.9	2.0	88.1	180.0	16.4	90.0	19.8	81.9
40.0	90.1	0.7	87.9	180.0	16.6	90.0	17.9	82.9
50.0	89.7	1.0	87.7	180.0	17.0	90.0	18.8	83.8
60.0	89.7	3.0	87.5	180.0	17.5	90.0	22.3	84.7
70.0	90.0	6.1	87.3	180.0	17.3	90.0	26.9	85.4
80.0	90.9	10.1	87.2	180.0	17.1	90.0	33.0	86.0
90.0	92.5	14.5	87.2	180.0	16.9	90.0	40.1	86.5
100.0	93.1	18.8	85.7	180.0	17.0	90.0	47.0	87.0
110.0	95.1	24.0	84.3	180.0	17.0	90.0	55.8	87.4
120.0	95.6	26.7	83.0	180.0	17.2	90.0	60.2	87.7
130.0	95.4	28.1	81.9	180.0	17.2	90.0	62.2	87.9
140.0	94.2	28.2	81.0	180.0	17.3	90.0	61.7	88.1
150.0	91.9	26.8	80.2	180.0	17.4	90.0	58.8	88.2
160.0	89.1	24.0	79.7	180.0	17.6	90.0	53.9	88.2
170.0	85.2	18.3	79.4	180.0	17.9	90.0	44.7	88.0
180.0	83.0	13.3	79.3	180.0	18.2	90.0	37.1	87.7
190.0	81.4	8.0	79.4	180.0	18.2	90.0	29.7	87.6
200.0	80.9	3.2	79.7	180.0	18.3	90.0	22.9	87.3
210.0	81.3	359.7	80.2	180.0	18.3	90.0	17.9	86.7
220.0	82.2	357.9	81.0	180.0	18.5	90.0	15.5	85.5
230.0	83.8	358.0	81.5	180.0	18.7	90.0	15.8	83.4
240.0	86.3	359.9	82.0	180.0	18.9	90.0	18.9	79.9
250.0	52.2	357.7	80.0	182.0	18.9	90.0	15.6	74.5
260.0	12.9	347.8	8.2	204.7	18.9	90.0	12.8	67.4
270.0	3.7	347.6	3.3	213.5	14.4	90.0	12.2	61.9
280.0	7.5	4.0	1.1	153.0	10.8	90.0	13.5	61.1
290.0	7.0	38.1	3.7	60.2	7.5	90.0	16.7	64.0
300.0	8.8	54.4	6.0	60.2	7.6	90.0	21.5	67.9
310.0	11.0	62.9	7.5	60.2	9.5	90.0	27.2	71.3
320.0	13.1	66.3	8.0	60.2	13.1	90.0	33.3	73.9
330.0	19.4	41.2	9.9	119.8	16.8	90.0	39.3	75.8
340.0	58.0	13.4	48.4	163.9	16.8	90.0	44.9	77.2
350.0	97.3	0.3	92.2	162.8	16.5	90.0	45.2	78.2
360.0	97.2	0.2	92.4	167.0	16.4	90.0	38.2	79.2

6.8.5 Thruster loss

Case 8 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.86	0.82
10.0	0.87	0.84	0.81
20.0	0.87	0.79	0.81
30.0	0.87	0.78	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.90	0.78	0.87
70.0	0.91	0.78	0.86
80.0	0.91	0.78	0.85
90.0	0.92	0.78	0.84
100.0	0.92	0.76	0.85
110.0	0.93	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.72	0.86
150.0	0.94	0.72	0.87
160.0	0.94	0.71	0.88
170.0	0.95	0.71	0.89
180.0	0.95	0.71	0.91
190.0	0.96	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.95	0.72	0.92
230.0	0.95	0.73	0.93
240.0	0.96	0.74	0.94
250.0	0.95	0.76	0.94
260.0	0.90	0.86	0.94
270.0	0.90	0.88	0.94
280.0	0.94	0.88	0.95
290.0	0.94	0.90	0.95
300.0	0.94	0.89	0.96
310.0	0.94	0.89	0.92
320.0	0.94	0.89	0.89
330.0	0.91	0.90	0.86
340.0	0.87	0.87	0.84
350.0	0.87	0.87	0.82
360.0	0.87	0.86	0.82

Preliminary Design, @IDR5

6.9 Case 9 - Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 4

6.9.1 Environment and thrust utilisation

Case 9 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	80.0	80.0	0.0	35.0	2.5	6.0	8.5	2.00	> 100.0
10.0	80.0	80.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	80.0	80.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	80.0	80.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	80.0	80.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	80.0	80.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	80.0	80.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	80.0	80.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	80.0	80.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	80.0	80.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	80.0	80.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	80.0	80.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	80.0	80.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	80.0	80.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	80.0	80.0	140.0	35.0	2.5	6.0	8.5	2.00	> 100.0
150.0	80.0	80.0	150.0	35.0	2.5	6.0	8.5	2.00	> 100.0
160.0	80.0	80.0	160.0	35.0	2.5	6.0	8.5	2.00	> 100.0
170.0	80.0	80.0	170.0	35.0	2.5	6.0	8.5	2.00	> 100.0
180.0	80.0	80.0	180.0	35.0	2.5	6.0	8.5	2.00	> 100.0
190.0	80.0	80.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	80.0	80.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	80.0	80.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	80.0	80.0	220.0	35.0	2.5	6.0	8.5	2.00	> 100.0
230.0	80.0	80.0	230.0	35.0	2.5	6.0	8.5	2.00	> 100.0
240.0	80.0	80.0	240.0	35.0	2.5	6.0	8.5	2.00	99.8
250.0	80.0	80.0	250.0	35.0	2.5	6.0	8.5	2.00	80.4
260.0	80.0	80.0	260.0	35.0	2.5	6.0	8.5	2.00	61.3
270.0	80.0	80.0	270.0	35.0	2.5	6.0	8.5	2.00	44.5
280.0	80.0	80.0	280.0	35.0	2.5	6.0	8.5	2.00	31.6
290.0	80.0	80.0	290.0	35.0	2.5	6.0	8.5	2.00	22.2
300.0	80.0	80.0	300.0	35.0	2.5	6.0	8.5	2.00	22.2
310.0	80.0	80.0	310.0	35.0	2.5	6.0	8.5	2.00	28.5
320.0	80.0	80.0	320.0	35.0	2.5	6.0	8.5	2.00	40.3
330.0	80.0	80.0	330.0	35.0	2.5	6.0	8.5	2.00	56.9
340.0	80.0	80.0	340.0	35.0	2.5	6.0	8.5	2.00	77.1
350.0	80.0	80.0	350.0	35.0	2.5	6.0	8.5	2.00	> 100.0
360.0	80.0	80.0	360.0	35.0	2.5	6.0	8.5	2.00	> 100.0

6.9.2 Relative contributions of force components

Case 9 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	52.7	26.7	0.9	0.0	19.7	100.0
10.0	48.6	24.6	8.6	0.0	18.2	100.0
20.0	44.9	22.7	15.6	0.0	16.8	100.0
30.0	41.5	21.0	22.1	0.0	15.5	100.0
40.0	38.3	19.3	28.1	0.0	14.3	100.0
50.0	35.5	17.9	33.4	0.0	13.2	100.0
60.0	33.2	16.7	37.7	0.0	12.4	100.0
70.0	31.5	15.9	40.9	0.0	11.7	100.0
80.0	30.5	15.4	42.8	0.0	11.3	100.0
90.0	30.2	15.2	43.4	0.0	11.2	100.0
100.0	30.5	15.3	42.8	0.0	11.3	100.0
110.0	31.6	15.9	40.9	0.0	11.7	100.0
120.0	33.2	16.7	37.8	0.0	12.3	100.0
130.0	35.5	17.8	33.5	0.0	13.2	100.0
140.0	38.4	19.2	28.2	0.0	14.3	100.0
150.0	41.6	20.8	22.1	0.0	15.5	100.0
160.0	45.2	22.6	15.4	0.0	16.3	100.0
170.0	49.0	24.5	8.3	0.0	18.3	100.0
180.0	53.2	26.6	0.4	0.0	19.8	100.0
190.0	58.2	29.1	-9.0	0.0	21.7	100.0
200.0	64.7	32.3	-2.1	0.0	24.2	100.0
210.0	73.7	36.0	-38.1	0.0	27.6	100.0
220.0	86.0	43.1	-62.8	0.0	32.5	100.0
230.0	103.1	53.1	-99.4	0.0	39.8	100.0
240.0	135.0	67.4	-152.9	0.0	50.4	100.0
250.0	172.8	87.4	-224.6	0.0	64.5	100.0
260.0	208.3	105.9	-292.3	0.0	78.1	100.0
270.0	219.6	112.3	-314.7	0.0	82.8	100.0
280.0	198.4	101.8	-275.1	0.0	75.0	100.0
290.0	162.2	83.2	-206.6	0.0	61.3	100.0
300.0	128.4	65.7	-142.5	0.0	48.4	100.0
310.0	102.7	52.4	-93.8	0.0	38.6	100.0
320.0	84.7	43.1	-59.7	0.0	31.8	100.0
330.0	72.3	36.8	-36.3	0.0	27.1	100.0
340.0	63.7	32.4	-20.0	0.0	23.9	100.0
350.0	57.5	29.2	-8.2	0.0	21.5	100.0
360.0	52.7	26.7	0.9	0.0	19.7	100.0

6.9.3 Environment forces

Case 9 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-1.2	-1.7	-3.6	0.0	-1.2	-7.7
10.0	-1.2	-1.7	-3.6	0.0	-1.2	-7.7
20.0	-1.2	-1.7	-3.5	0.0	-1.2	-7.6
30.0	-1.2	-1.7	-3.2	0.0	-1.2	-7.3
40.0	-1.2	-1.7	-2.8	0.0	-1.2	-6.9
50.0	-1.2	-1.7	-2.3	0.0	-1.2	-6.4
60.0	-1.2	-1.7	-1.6	0.0	-1.2	-5.7
70.0	-1.2	-1.7	-0.9	0.0	-1.2	-5.0
80.0	-1.2	-1.7	-0.1	0.0	-1.2	-4.2
90.0	-1.2	-1.7	0.7	0.0	-1.2	-3.4
100.0	-1.2	-1.7	1.5	0.0	-1.2	-2.6
110.0	-1.2	-1.7	2.3	0.0	-1.2	-1.8
120.0	-1.2	-1.7	3.0	0.0	1.2	1.2
130.0	-1.2	-1.7	3.5	0.0	1.2	1.8
140.0	-1.2	-1.7	4.0	0.0	1.2	2.2
150.0	-1.2	-1.7	4.3	0.0	1.2	2.5
160.0	-1.2	-1.7	4.4	0.0	1.2	2.7
170.0	-1.2	-1.7	4.4	0.0	1.2	2.7
180.0	-1.2	-1.7	4.3	0.0	1.2	2.6
190.0	-1.2	-1.7	4.4	0.0	1.2	2.7
200.0	-1.2	-1.7	4.4	0.0	1.2	2.7
210.0	-1.2	-1.7	4.3	0.0	1.2	2.5
220.0	-1.2	-1.7	4.0	0.0	1.2	2.2
230.0	-1.2	-1.7	3.5	0.0	1.2	1.8
240.0	-1.2	-1.7	3.0	0.0	1.2	1.2
250.0	-1.2	-1.7	2.3	0.0	-1.2	-1.8
260.0	-1.2	-1.7	1.5	0.0	-1.2	-2.6
270.0	-1.2	-1.7	0.7	0.0	-1.2	-3.4
280.0	-1.2	-1.7	-0.1	0.0	-1.2	-4.2
290.0	-1.2	-1.7	-0.9	0.0	-1.2	-5.0
300.0	-1.2	-1.7	-1.6	0.0	-1.2	-5.7
310.0	-1.2	-1.7	-2.3	0.0	-1.2	-6.4
320.0	-1.2	-1.7	-2.8	0.0	-1.2	-6.9
330.0	-1.2	-1.7	-3.2	0.0	-1.2	-7.3
340.0	-1.2	-1.7	-3.5	0.0	-1.2	-7.6
350.0	-1.2	-1.7	-3.6	0.0	-1.2	-7.7
360.0	-1.2	-1.7	-3.6	0.0	-1.2	-7.7

Case 9 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.8	-15.0	0.0	0.0	-11.0	-55.8
10.0	-29.8	-15.0	-4.8	0.0	-11.0	-60.6
20.0	-29.8	-15.0	-10.0	0.0	-11.0	-65.8
30.0	-29.8	-15.0	-15.6	0.0	-11.0	-71.4
40.0	-29.8	-15.0	-21.7	0.0	-11.0	-77.5
50.0	-29.8	-15.0	-28.0	0.0	-11.0	-83.8
60.0	-29.8	-15.0	-33.8	0.0	-11.0	-89.7
70.0	-29.8	-15.0	-38.7	0.0	-11.0	-94.5
80.0	-29.8	-15.0	-41.9	0.0	-11.0	-97.7
90.0	-29.8	-15.0	-43.0	0.0	-11.0	-98.8
100.0	-29.8	-15.0	-41.9	0.0	-11.0	-97.7
110.0	-29.8	-15.0	-38.7	0.0	-11.0	-94.5
120.0	-29.8	-15.0	-33.8	0.0	-11.0	-89.7
130.0	-29.8	-15.0	-28.0	0.0	-11.0	-83.8
140.0	-29.8	-15.0	-21.7	0.0	-11.0	-77.5
150.0	-29.8	-15.0	-15.6	0.0	-11.0	-71.4
160.0	-29.8	-15.0	-10.0	0.0	-11.0	-65.8
170.0	-29.8	-15.0	-4.8	0.0	-11.0	-60.6
180.0	-29.8	-15.0	0.0	0.0	-11.0	-55.8
190.0	-29.8	-15.0	4.8	0.0	-11.0	-51.0
200.0	-29.8	-15.0	10.0	0.0	-11.0	-45.8
210.0	-29.8	-15.0	15.6	0.0	-11.0	-40.2
220.0	-29.8	-15.0	21.7	0.0	-11.0	-34.1
230.0	-29.8	-15.0	28.0	0.0	-11.0	-27.8
240.0	-29.8	-15.0	33.8	0.0	-11.0	-22.0
250.0	-29.8	-15.0	38.7	0.0	-11.0	-17.1
260.0	-29.8	-15.0	41.9	0.0	-11.0	-13.9
270.0	-29.8	-15.0	43.0	0.0	-11.0	-12.8
280.0	-29.8	-15.0	41.9	0.0	-11.0	-13.9
290.0	-29.8	-15.0	38.7	0.0	-11.0	-17.1
300.0	-29.8	-15.0	33.8	0.0	-11.0	-22.0
310.0	-29.8	-15.0	28.0	0.0	-11.0	-27.8
320.0	-29.8	-15.0	21.7	0.0	-11.0	-34.1
330.0	-29.8	-15.0	15.6	0.0	-11.0	-40.2
340.0	-29.8	-15.0	10.0	0.0	-11.0	-45.8
350.0	-29.8	-15.0	4.8	0.0	-11.0	-51.0
360.0	-29.8	-15.0	0.0	0.0	-11.0	-55.8

Case 9 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-314.1	-11.2	0.0	0.0	-45.3	-370.6
10.0	-314.1	-11.2	-316.6	0.0	-45.3	-687.2
20.0	-314.1	-11.2	-593.0	0.0	-45.3	-963.6
30.0	-314.1	-11.2	-793.7	0.0	-45.3	-1164.3
40.0	-314.1	-11.2	-892.8	0.0	-45.3	-1263.4
50.0	-314.1	-11.2	-876.4	0.0	-45.3	-1247.0
60.0	-314.1	-11.2	-745.2	0.0	-45.3	-1115.8
70.0	-314.1	-11.2	-513.8	0.0	-45.3	-884.4
80.0	-314.1	-11.2	-209.2	0.0	-45.3	-579.8
90.0	-314.1	-11.2	132.4	0.0	-45.3	-238.2
100.0	-314.1	-11.2	470.0	0.0	45.3	190.0
110.0	-314.1	-11.2	762.6	0.0	45.3	482.6
120.0	-314.1	-11.2	974.5	0.0	45.3	694.5
130.0	-314.1	-11.2	1079.2	0.0	45.3	799.2
140.0	-314.1	-11.2	1063.0	0.0	45.3	783.0
150.0	-314.1	-11.2	926.1	0.0	45.3	646.1
160.0	-314.1	-11.2	683.5	0.0	45.3	403.5
170.0	-314.1	-11.2	362.6	0.0	45.3	82.6
180.0	-314.1	-11.2	0.0	0.0	-45.3	-370.6
190.0	-314.1	-11.2	-362.6	0.0	-45.3	-733.2
200.0	-314.1	-11.2	-683.5	0.0	-45.3	-1054.1
210.0	-314.1	-11.2	-926.1	0.0	-45.3	-1296.7
220.0	-314.1	-11.2	-1063.0	0.0	-45.3	-1433.6
230.0	-314.1	-11.2	-1079.2	0.0	-45.3	-1449.8
240.0	-314.1	-11.2	-974.5	0.0	-45.3	-1345.1
250.0	-314.1	-11.2	-762.6	0.0	-45.3	-1133.2
260.0	-314.1	-11.2	-470.0	0.0	-45.3	-840.6
270.0	-314.1	-11.2	-132.4	0.0	-45.3	-503.0
280.0	-314.1	-11.2	209.2	0.0	-45.3	-161.4
290.0	-314.1	-11.2	513.8	0.0	45.3	233.8
300.0	-314.1	-11.2	745.2	0.0	45.3	465.2
310.0	-314.1	-11.2	876.4	0.0	45.3	596.4
320.0	-314.1	-11.2	892.8	0.0	45.3	612.8
330.0	-314.1	-11.2	793.7	0.0	45.3	513.7
340.0	-314.1	-11.2	593.0	0.0	45.3	313.0
350.0	-314.1	-11.2	316.6	0.0	-45.3	-54.0
360.0	-314.1	-11.2	0.0	0.0	-45.3	-370.6

6.9.4 Thruster use

Case 9 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	97.2	0.3	94.6	165.0	16.4	90.0	41.6	82.0
10.0	97.3	0.2	94.6	169.1	16.2	90.0	34.6	82.7
20.0	92.1	6.9	88.2	180.0	16.2	90.0	27.5	83.3
30.0	90.8	4.2	88.1	179.9	16.4	90.0	23.2	84.1
40.0	90.0	2.9	87.9	180.0	16.6	90.0	21.3	84.8
50.0	89.6	3.2	87.7	179.9	17.0	90.0	22.2	85.6
60.0	89.5	5.3	87.5	180.0	17.5	90.0	25.8	86.3
70.0	89.9	8.3	87.3	180.0	17.3	90.0	30.3	86.9
80.0	90.9	12.3	87.2	180.0	17.1	90.0	36.5	87.5
90.0	92.6	16.7	87.2	180.0	16.9	90.0	43.5	88.0
100.0	94.0	22.1	85.7	180.0	17.0	90.0	52.3	88.5
110.0	94.9	25.8	84.3	180.0	17.0	90.0	58.4	88.9
120.0	93.9	28.9	83.0	180.0	17.2	90.0	62.6	90.8
130.0	93.4	30.5	81.9	180.0	17.2	90.0	64.6	91.2
140.0	91.9	30.6	81.0	180.0	17.3	90.0	64.1	91.7
150.0	89.5	29.3	80.2	180.0	17.4	90.0	61.2	92.0
160.0	86.4	26.5	79.7	180.0	17.6	90.0	56.2	92.4
170.0	83.4	22.4	79.4	180.0	17.9	90.0	49.7	92.6
180.0	80.5	16.1	79.3	180.0	18.2	90.0	40.7	92.7
190.0	79.0	10.6	79.4	180.0	18.2	90.0	32.9	93.1
200.0	78.5	5.6	79.7	179.9	18.3	90.0	26.1	93.4
210.0	78.9	2.0	80.2	180.0	18.3	90.0	21.2	93.6
220.0	79.7	0.1	81.0	180.0	18.5	90.0	18.7	93.8
230.0	80.7	0.1	81.5	180.0	18.7	90.0	18.9	93.7
240.0	81.9	1.9	82.0	180.0	18.9	90.0	21.7	93.2
250.0	44.8	356.3	16.0	181.0	18.9	90.0	17.2	83.9
260.0	8.7	34.8	6.2	200.5	18.4	90.0	14.2	79.5
270.0	6.9	336.6	3.5	185.8	13.6	90.0	13.3	75.2
280.0	6.1	18.7	2.6	131.4	10.0	90.0	14.6	73.2
290.0	6.8	64.8	4.2	60.2	7.3	90.0	17.8	73.7
300.0	9.3	74.4	6.5	60.2	7.3	90.0	22.7	75.4
310.0	11.9	78.3	8.0	60.2	9.3	90.0	28.5	77.1
320.0	18.3	50.0	9.8	119.8	11.5	90.0	34.8	78.5
330.0	19.0	47.0	11.4	119.8	16.4	90.0	40.8	79.7
340.0	54.2	15.5	46.9	162.0	16.8	90.0	46.5	80.6
350.0	97.3	0.3	95.1	161.0	16.5	90.0	48.6	81.2
360.0	97.2	0.3	94.6	165.0	16.4	90.0	41.6	82.0

6.9.5 Thruster loss

Case 9 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.86	0.82
10.0	0.87	0.85	0.81
20.0	0.86	0.79	0.81
30.0	0.87	0.79	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.90	0.78	0.87
70.0	0.90	0.78	0.86
80.0	0.91	0.78	0.85
90.0	0.91	0.78	0.84
100.0	0.92	0.76	0.85
110.0	0.93	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.72	0.86
150.0	0.94	0.72	0.87
160.0	0.94	0.71	0.88
170.0	0.95	0.71	0.89
180.0	0.95	0.71	0.91
190.0	0.96	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.96	0.72	0.92
230.0	0.96	0.73	0.93
240.0	0.95	0.74	0.94
250.0	0.95	0.76	0.94
260.0	0.94	0.86	0.94
270.0	0.94	0.81	0.94
280.0	0.94	0.90	0.95
290.0	0.94	0.90	0.95
300.0	0.94	0.89	0.96
310.0	0.94	0.89	0.92
320.0	0.93	0.90	0.89
330.0	0.91	0.90	0.86
340.0	0.87	0.87	0.84
350.0	0.87	0.87	0.82
360.0	0.87	0.86	0.82

Preliminary Design, @IDR5

6.10 Case 10 - Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 4

6.10.1 Environment and thrust utilisation

Case 10 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	90.0	90.0	0.0	35.0	2.5	6.0	8.5	2.00	> 100.0
10.0	90.0	90.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	90.0	90.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	90.0	90.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	90.0	90.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	90.0	90.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	90.0	90.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	90.0	90.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	90.0	90.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	90.0	90.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	90.0	90.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	90.0	90.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	90.0	90.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	90.0	90.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	90.0	90.0	140.0	35.0	2.5	6.0	8.5	2.00	> 100.0
150.0	90.0	90.0	150.0	35.0	2.5	6.0	8.5	2.00	> 100.0
160.0	90.0	90.0	160.0	35.0	2.5	6.0	8.5	2.00	> 100.0
170.0	90.0	90.0	170.0	35.0	2.5	6.0	8.5	2.00	> 100.0
180.0	90.0	90.0	180.0	35.0	2.5	6.0	8.5	2.00	> 100.0
190.0	90.0	90.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	90.0	90.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	90.0	90.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	90.0	90.0	220.0	35.0	2.5	6.0	8.5	2.00	> 100.0
230.0	90.0	90.0	230.0	35.0	2.5	6.0	8.5	2.00	> 100.0
240.0	90.0	90.0	240.0	35.0	2.5	6.0	8.5	2.00	98.3
250.0	90.0	90.0	250.0	35.0	2.5	6.0	8.5	2.00	79.3
260.0	90.0	90.0	260.0	35.0	2.5	6.0	8.5	2.00	60.3
270.0	90.0	90.0	270.0	35.0	2.5	6.0	8.5	2.00	43.2
280.0	90.0	90.0	280.0	35.0	2.5	6.0	8.5	2.00	30.8
290.0	90.0	90.0	290.0	35.0	2.5	6.0	8.5	2.00	21.4
300.0	90.0	90.0	300.0	35.0	2.5	6.0	8.5	2.00	21.4
310.0	90.0	90.0	310.0	35.0	2.5	6.0	8.5	2.00	27.7
320.0	90.0	90.0	320.0	35.0	2.5	6.0	8.5	2.00	39.4
330.0	90.0	90.0	330.0	35.0	2.5	6.0	8.5	2.00	56.0
340.0	90.0	90.0	340.0	35.0	2.5	6.0	8.5	2.00	76.5
350.0	90.0	90.0	350.0	35.0	2.5	6.0	8.5	2.00	99.7
360.0	90.0	90.0	360.0	35.0	2.5	6.0	8.5	2.00	> 100.0

6.10.2 Relative contributions of force components

Case 10 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	50.6	28.2	0.6	0.0	20.6	100.0
10.0	46.7	26.0	8.2	0.0	19.0	100.0
20.0	43.2	24.1	15.1	0.0	17.6	100.0
30.0	40.0	22.2	21.5	0.0	16.3	100.0
40.0	36.9	20.5	27.5	0.0	15.0	100.0
50.0	34.3	19.0	32.7	0.0	13.9	100.0
60.0	32.1	17.8	37.0	0.0	13.0	100.0
70.0	30.5	16.9	40.1	0.0	12.4	100.0
80.0	29.6	16.4	42.1	0.0	12.0	100.0
90.0	29.2	16.2	42.7	0.0	11.9	100.0
100.0	29.6	16.4	42.1	0.0	12.0	100.0
110.0	30.5	16.9	40.2	0.0	12.4	100.0
120.0	32.1	17.8	37.1	0.0	13.0	100.0
130.0	34.3	19.0	32.8	0.0	13.9	100.0
140.0	37.0	20.4	27.6	0.0	15.0	100.0
150.0	40.0	22.1	21.6	0.0	16.3	100.0
160.0	43.4	23.9	15.1	0.0	17.6	100.0
170.0	46.9	25.9	8.2	0.0	19.1	100.0
180.0	50.8	28.0	0.5	0.0	20.7	100.0
190.0	55.4	30.5	-8.4	0.0	22.5	100.0
200.0	61.3	33.7	-20.0	0.0	25.0	100.0
210.0	69.4	38.2	-35.3	0.0	28.3	100.0
220.0	81.4	44.1	-58.8	0.0	33.1	100.0
230.0	93.1	53.9	-92.0	0.0	40.0	100.0
240.0	123.2	67.2	-139.2	0.0	49.8	100.0
250.0	153.6	84.5	-200.6	0.0	62.6	100.0
260.0	185.5	102.2	-263.2	0.0	75.5	100.0
270.0	199.6	111.1	-291.9	0.0	81.2	100.0
280.0	183.8	102.6	-261.4	0.0	75.0	100.0
290.0	152.0	85.0	-199.1	0.0	62.1	100.0
300.0	121.1	67.7	-138.3	0.0	49.5	100.0
310.0	97.3	54.4	-91.5	0.0	39.8	100.0
320.0	80.6	45.0	-58.5	0.0	32.9	100.0
330.0	69.1	38.5	-35.8	0.0	28.2	100.0
340.0	61.0	34.0	-19.9	0.0	24.9	100.0
350.0	55.1	30.7	-8.4	0.0	22.5	100.0
360.0	50.6	28.2	0.6	0.0	20.6	100.0

6.10.3 Environment forces

Case 10 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	-1.1	-3.6	0.0	-0.7	-5.4
10.0	0.0	-1.1	-3.6	0.0	-0.7	-5.4
20.0	0.0	-1.1	-3.5	0.0	-0.7	-5.3
30.0	0.0	-1.1	-3.2	0.0	-0.7	-5.0
40.0	0.0	-1.1	-2.8	0.0	-0.7	-4.6
50.0	0.0	-1.1	-2.3	0.0	-0.7	-4.1
60.0	0.0	-1.1	-1.6	0.0	-0.7	-3.5
70.0	0.0	-1.1	-0.9	0.0	-0.7	-2.7
80.0	0.0	-1.1	-0.1	0.0	-0.7	-1.9
90.0	0.0	-1.1	0.7	0.0	-0.7	-1.1
100.0	0.0	-1.1	1.5	0.0	0.7	1.2
110.0	0.0	-1.1	2.3	0.0	0.7	1.9
120.0	0.0	-1.1	3.0	0.0	0.7	2.6
130.0	0.0	-1.1	3.5	0.0	0.7	3.2
140.0	0.0	-1.1	4.0	0.0	0.7	3.6
150.0	0.0	-1.1	4.3	0.0	0.7	3.9
160.0	0.0	-1.1	4.4	0.0	0.7	4.1
170.0	0.0	-1.1	4.4	0.0	0.7	4.1
180.0	0.0	-1.1	4.3	0.0	0.7	3.9
190.0	0.0	-1.1	4.4	0.0	0.7	4.1
200.0	0.0	-1.1	4.4	0.0	0.7	4.1
210.0	0.0	-1.1	4.3	0.0	0.7	3.9
220.0	0.0	-1.1	4.0	0.0	0.7	3.6
230.0	0.0	-1.1	3.5	0.0	0.7	3.2
240.0	0.0	-1.1	3.0	0.0	0.7	2.6
250.0	0.0	-1.1	2.3	0.0	0.7	1.9
260.0	0.0	-1.1	1.5	0.0	0.7	1.2
270.0	0.0	-1.1	0.7	0.0	-0.7	-1.1
280.0	0.0	-1.1	-0.1	0.0	-0.7	-1.9
290.0	0.0	-1.1	-0.9	0.0	-0.7	-2.7
300.0	0.0	-1.1	-1.6	0.0	-0.7	-3.5
310.0	0.0	-1.1	-2.3	0.0	-0.7	-4.1
320.0	0.0	-1.1	-2.8	0.0	-0.7	-4.6
330.0	0.0	-1.1	-3.2	0.0	-0.7	-5.0
340.0	0.0	-1.1	-3.5	0.0	-0.7	-5.3
350.0	0.0	-1.1	-3.6	0.0	-0.7	-5.4
360.0	0.0	-1.1	-3.6	0.0	-0.7	-5.4

Case 10 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.4	-16.3	0.0	0.0	-11.9	-57.7
10.0	-29.4	-16.3	-4.8	0.0	-11.9	-62.5
20.0	-29.4	-16.3	-10.0	0.0	-11.9	-67.6
30.0	-29.4	-16.3	-15.6	0.0	-11.9	-73.3
40.0	-29.4	-16.3	-21.7	0.0	-11.9	-79.4
50.0	-29.4	-16.3	-28.0	0.0	-11.9	-85.6
60.0	-29.4	-16.3	-33.8	0.0	-11.9	-91.5
70.0	-29.4	-16.3	-38.7	0.0	-11.9	-96.3
80.0	-29.4	-16.3	-41.9	0.0	-11.9	-99.5
90.0	-29.4	-16.3	-43.0	0.0	-11.9	-100.6
100.0	-29.4	-16.3	-41.9	0.0	-11.9	-99.5
110.0	-29.4	-16.3	-38.7	0.0	-11.9	-96.3
120.0	-29.4	-16.3	-33.8	0.0	-11.9	-91.5
130.0	-29.4	-16.3	-28.0	0.0	-11.9	-85.6
140.0	-29.4	-16.3	-21.7	0.0	-11.9	-79.4
150.0	-29.4	-16.3	-15.6	0.0	-11.9	-73.3
160.0	-29.4	-16.3	-10.0	0.0	-11.9	-67.6
170.0	-29.4	-16.3	-4.8	0.0	-11.9	-62.5
180.0	-29.4	-16.3	0.0	0.0	-11.9	-57.7
190.0	-29.4	-16.3	4.8	0.0	-11.9	-52.8
200.0	-29.4	-16.3	10.0	0.0	-11.9	-47.7
210.0	-29.4	-16.3	15.6	0.0	-11.9	-42.0
220.0	-29.4	-16.3	21.7	0.0	-11.9	-35.9
230.0	-29.4	-16.3	28.0	0.0	-11.9	-29.7
240.0	-29.4	-16.3	33.8	0.0	-11.9	-23.8
250.0	-29.4	-16.3	38.7	0.0	-11.9	-19.0
260.0	-29.4	-16.3	41.9	0.0	-11.9	-15.8
270.0	-29.4	-16.3	43.0	0.0	-11.9	-14.7
280.0	-29.4	-16.3	41.9	0.0	-11.9	-15.8
290.0	-29.4	-16.3	38.7	0.0	-11.9	-19.0
300.0	-29.4	-16.3	33.8	0.0	-11.9	-23.8
310.0	-29.4	-16.3	28.0	0.0	-11.9	-29.7
320.0	-29.4	-16.3	21.7	0.0	-11.9	-35.9
330.0	-29.4	-16.3	15.6	0.0	-11.9	-42.0
340.0	-29.4	-16.3	10.0	0.0	-11.9	-47.7
350.0	-29.4	-16.3	4.8	0.0	-11.9	-52.8
360.0	-29.4	-16.3	0.0	0.0	-11.9	-57.7

Case 10 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-207.2	-3.8	0.0	0.0	-31.5	-242.5
10.0	-207.2	-3.8	-316.6	0.0	-31.5	-559.1
20.0	-207.2	-3.8	-593.0	0.0	-31.5	-835.5
30.0	-207.2	-3.8	-793.7	0.0	-31.5	-1036.2
40.0	-207.2	-3.8	-892.8	0.0	-31.5	-1135.3
50.0	-207.2	-3.8	-876.4	0.0	-31.5	-1118.9
60.0	-207.2	-3.8	-745.2	0.0	-31.5	-987.7
70.0	-207.2	-3.8	-513.8	0.0	-31.5	-756.3
80.0	-207.2	-3.8	-209.2	0.0	-31.5	-451.7
90.0	-207.2	-3.8	132.4	0.0	-31.5	-110.1
100.0	-207.2	-3.8	470.0	0.0	31.5	290.5
110.0	-207.2	-3.8	762.6	0.0	31.5	583.1
120.0	-207.2	-3.8	974.5	0.0	31.5	795.0
130.0	-207.2	-3.8	1079.2	0.0	31.5	889.8
140.0	-207.2	-3.8	1063.0	0.0	31.5	883.5
150.0	-207.2	-3.8	926.1	0.0	31.5	746.6
160.0	-207.2	-3.8	683.5	0.0	31.5	504.0
170.0	-207.2	-3.8	362.6	0.0	31.5	183.1
180.0	-207.2	-3.8	0.0	0.0	-31.5	-242.5
190.0	-207.2	-3.8	-362.6	0.0	-31.5	-605.1
200.0	-207.2	-3.8	-683.5	0.0	-31.5	-926.0
210.0	-207.2	-3.8	-926.1	0.0	-31.5	-1168.6
220.0	-207.2	-3.8	-1063.0	0.0	-31.5	-1305.5
230.0	-207.2	-3.8	-1079.2	0.0	-31.5	-1321.7
240.0	-207.2	-3.8	-974.5	0.0	-31.5	-1217.0
250.0	-207.2	-3.8	-762.6	0.0	-31.5	-1005.1
260.0	-207.2	-3.8	-470.0	0.0	-31.5	-712.5
270.0	-207.2	-3.8	-132.4	0.0	-31.5	-374.9
280.0	-207.2	-3.8	209.2	0.0	-31.5	-33.3
290.0	-207.2	-3.8	513.8	0.0	31.5	334.3
300.0	-207.2	-3.8	745.2	0.0	31.5	565.7
310.0	-207.2	-3.8	876.4	0.0	31.5	696.9
320.0	-207.2	-3.8	892.8	0.0	31.5	713.3
330.0	-207.2	-3.8	793.7	0.0	31.5	614.2
340.0	-207.2	-3.8	593.0	0.0	31.5	413.5
350.0	-207.2	-3.8	316.6	0.0	31.5	137.1
360.0	-207.2	-3.8	0.0	0.0	-31.5	-242.5

6.10.4 Thruster use

Case 10 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	97.2	0.3	96.9	163.6	16.4	90.0	44.4	84.5
10.0	95.2	6.3	92.0	173.8	16.2	90.0	36.7	85.0
20.0	91.6	8.6	88.2	180.0	16.2	90.0	30.0	85.4
30.0	90.4	5.9	88.1	180.0	16.4	90.0	25.8	86.0
40.0	89.6	4.7	87.9	180.0	16.6	90.0	24.0	86.6
50.0	89.2	5.0	87.7	180.0	17.0	90.0	24.9	87.2
60.0	89.2	7.0	87.5	180.0	17.5	90.0	28.4	87.8
70.0	89.7	10.1	87.3	180.0	17.3	90.0	32.9	88.4
80.0	90.7	14.0	87.2	180.0	17.1	90.0	39.1	88.9
90.0	92.4	18.4	87.2	180.0	16.9	90.0	46.1	89.4
100.0	92.8	23.7	85.7	180.0	17.0	90.0	54.2	90.7
110.0	93.6	27.5	84.3	180.0	17.0	90.0	60.3	91.2
120.0	94.0	30.3	83.0	180.0	17.2	90.0	64.7	91.6
130.0	93.5	31.9	81.9	180.0	17.2	90.0	66.6	92.1
140.0	91.9	32.1	81.0	180.0	17.3	90.0	66.1	92.6
150.0	89.4	30.8	80.2	180.0	17.4	90.0	63.2	93.1
160.0	86.3	28.0	79.7	180.0	17.6	90.0	58.3	93.5
170.0	83.1	24.0	79.4	180.0	17.9	90.0	51.8	93.8
180.0	80.2	18.1	79.3	180.0	18.2	90.0	43.2	94.0
190.0	78.5	12.7	79.4	180.0	18.2	90.0	35.6	94.5
200.0	77.9	7.7	79.7	180.0	18.3	90.0	28.8	95.0
210.0	78.2	4.0	80.3	179.9	18.3	90.0	23.9	95.4
220.0	78.9	2.0	81.0	180.0	18.5	90.0	21.4	95.8
230.0	79.6	2.0	81.5	180.0	18.7	90.0	21.6	96.2
240.0	78.6	2.0	82.2	178.5	18.9	90.0	23.9	96.2
250.0	39.1	0.1	77.0	179.9	18.9	90.0	19.1	95.8
260.0	6.1	34.4	7.3	187.9	17.9	90.0	15.8	94.2
270.0	5.5	8.8	4.4	170.3	13.1	90.0	14.7	85.6
280.0	5.3	35.7	4.0	129.4	9.5	90.0	15.9	83.0
290.0	9.3	53.8	5.6	119.8	6.6	90.0	19.2	81.8
300.0	13.2	57.1	7.4	119.8	6.3	90.0	24.1	81.7
310.0	16.1	57.2	9.3	119.8	8.0	90.0	29.9	82.1
320.0	18.0	55.6	11.1	119.8	11.4	90.0	36.2	82.6
330.0	18.6	52.4	12.7	119.8	16.3	90.0	42.3	83.2
340.0	52.1	17.2	47.1	160.8	16.8	90.0	48.0	83.6
350.0	97.3	0.4	98.4	159.0	16.5	90.0	52.7	84.1
360.0	97.2	0.3	96.9	163.6	16.4	90.0	44.4	84.5

6.10.5 Thruster loss

Case 10 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.87	0.82
10.0	0.86	0.82	0.81
20.0	0.86	0.79	0.81
30.0	0.87	0.78	0.82
40.0	0.88	0.78	0.83
50.0	0.89	0.78	0.85
60.0	0.89	0.78	0.87
70.0	0.90	0.78	0.86
80.0	0.90	0.78	0.85
90.0	0.91	0.78	0.84
100.0	0.92	0.76	0.85
110.0	0.92	0.75	0.85
120.0	0.94	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.72	0.86
150.0	0.94	0.72	0.87
160.0	0.94	0.71	0.88
170.0	0.95	0.71	0.89
180.0	0.95	0.71	0.91
190.0	0.96	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.96	0.72	0.92
230.0	0.96	0.73	0.93
240.0	0.95	0.75	0.94
250.0	0.95	0.75	0.94
260.0	0.92	0.81	0.94
270.0	0.95	0.83	0.94
280.0	0.94	0.90	0.95
290.0	0.94	0.90	0.95
300.0	0.94	0.90	0.96
310.0	0.94	0.90	0.92
320.0	0.94	0.90	0.89
330.0	0.92	0.90	0.86
340.0	0.87	0.88	0.84
350.0	0.87	0.88	0.82
360.0	0.87	0.87	0.82

Preliminary Design, @IDR5

6.11 Case 11 - Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 4

6.11.1 Environment and thrust utilisation

Case 11 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	100.0	100.0	0.0	35.0	2.5	6.0	8.5	2.00	> 100.0
10.0	100.0	100.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	100.0	100.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	100.0	100.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	100.0	100.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	100.0	100.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	100.0	100.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	100.0	100.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	100.0	100.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	100.0	100.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	100.0	100.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	100.0	100.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	100.0	100.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	100.0	100.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	100.0	100.0	140.0	35.0	2.5	6.0	8.5	2.00	> 100.0
150.0	100.0	100.0	150.0	35.0	2.5	6.0	8.5	2.00	> 100.0
160.0	100.0	100.0	160.0	35.0	2.5	6.0	8.5	2.00	> 100.0
170.0	100.0	100.0	170.0	35.0	2.5	6.0	8.5	2.00	> 100.0
180.0	100.0	100.0	180.0	35.0	2.5	6.0	8.5	2.00	> 100.0
190.0	100.0	100.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	100.0	100.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	100.0	100.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	100.0	100.0	220.0	35.0	2.5	6.0	8.5	2.00	> 100.0
230.0	100.0	100.0	230.0	35.0	2.5	6.0	8.5	2.00	> 100.0
240.0	100.0	100.0	240.0	35.0	2.5	6.0	8.5	2.00	89.2
250.0	100.0	100.0	250.0	35.0	2.5	6.0	8.5	2.00	70.2
260.0	100.0	100.0	260.0	35.0	2.5	6.0	8.5	2.00	51.2
270.0	100.0	100.0	270.0	35.0	2.5	6.0	8.5	2.00	34.5
280.0	100.0	100.0	280.0	35.0	2.5	6.0	8.5	2.00	19.5
290.0	100.0	100.0	290.0	35.0	2.5	6.0	8.5	2.00	12.7
300.0	100.0	100.0	300.0	35.0	2.5	6.0	8.5	2.00	13.0
310.0	100.0	100.0	310.0	35.0	2.5	6.0	8.5	2.00	18.8
320.0	100.0	100.0	320.0	35.0	2.5	6.0	8.5	2.00	30.0
330.0	100.0	100.0	330.0	35.0	2.5	6.0	8.5	2.00	46.2
340.0	100.0	100.0	340.0	35.0	2.5	6.0	8.5	2.00	66.4
350.0	100.0	100.0	350.0	35.0	2.5	6.0	8.5	2.00	89.4
360.0	100.0	100.0	360.0	35.0	2.5	6.0	8.5	2.00	> 100.0

6.11.2 Relative contributions of force components

Case 11 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	53.4	26.6	0.3	0.0	19.7	100.0
10.0	49.1	24.5	8.2	0.0	18.1	100.0
20.0	45.3	22.6	15.4	0.0	16.7	100.0
30.0	41.7	20.8	22.1	0.0	15.4	100.0
40.0	38.4	19.2	28.2	0.0	14.2	100.0
50.0	35.6	17.8	33.5	0.0	13.1	100.0
60.0	33.3	16.6	37.8	0.0	12.3	100.0
70.0	31.6	15.8	41.0	0.0	11.6	100.0
80.0	30.6	15.2	42.9	0.0	11.3	100.0
90.0	30.2	15.1	43.6	0.0	11.1	100.0
100.0	30.6	15.2	43.0	0.0	11.3	100.0
110.0	31.6	15.7	41.1	0.0	11.6	100.0
120.0	33.3	16.6	37.9	0.0	12.2	100.0
130.0	35.6	17.7	33.6	0.0	13.1	100.0
140.0	38.4	19.1	28.3	0.0	14.1	100.0
150.0	41.6	20.7	22.3	0.0	15.3	100.0
160.0	45.1	22.5	15.8	0.0	16.5	100.0
170.0	48.9	24.3	8.7	0.0	18.0	100.0
180.0	53.1	26.4	0.9	0.0	19.6	100.0
190.0	58.0	28.9	-8.2	0.0	21.4	100.0
200.0	64.3	32.0	-20.0	0.0	23.7	100.0
210.0	73.1	36.5	-36.4	0.0	26.9	100.0
220.0	85.7	42.1	-59.9	0.0	31.6	100.0
230.0	107.2	51.8	-94.4	0.0	38.4	100.0
240.0	130.7	64.9	-143.8	0.0	48.2	100.0
250.0	165.9	82.3	-209.4	0.0	61.1	100.0
260.0	203.8	101.0	-279.9	0.0	75.1	100.0
270.0	225.7	112.0	-320.9	0.0	83.2	100.0
280.0	213.1	105.9	-297.5	0.0	78.5	100.0
290.0	175.5	87.4	-227.6	0.0	64.6	100.0
300.0	137.0	68.3	-155.8	0.0	50.5	100.0
310.0	107.5	53.7	-101.0	0.0	39.7	100.0
320.0	87.6	43.7	-63.7	0.0	32.4	100.0
330.0	74.2	37.0	-38.7	0.0	27.4	100.0
340.0	65.0	32.5	-21.5	0.0	24.0	100.0
350.0	58.4	29.2	-9.2	0.0	21.6	100.0
360.0	53.4	26.6	0.3	0.0	19.7	100.0

6.11.3 Environment forces

Case 11 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	1.4	0.4	-3.6	0.0	-0.6	-2.3
10.0	1.4	0.4	-3.6	0.0	-0.6	-2.3
20.0	1.4	0.4	-3.5	0.0	-0.6	-2.2
30.0	1.4	0.4	-3.2	0.0	-0.6	-1.9
40.0	1.4	0.4	-2.8	0.0	-0.6	-1.5
50.0	1.4	0.4	-2.3	0.0	-0.6	-1.0
60.0	1.4	0.4	-1.6	0.0	0.6	0.7
70.0	1.4	0.4	-0.9	0.0	0.6	1.5
80.0	1.4	0.4	-0.1	0.0	0.6	2.3
90.0	1.4	0.4	0.7	0.0	0.6	3.1
100.0	1.4	0.4	1.5	0.0	0.6	3.9
110.0	1.4	0.4	2.3	0.0	0.6	4.6
120.0	1.4	0.4	3.0	0.0	0.6	5.3
130.0	1.4	0.4	3.5	0.0	0.6	5.9
140.0	1.4	0.4	4.0	0.0	0.6	6.3
150.0	1.4	0.4	4.3	0.0	0.6	6.6
160.0	1.4	0.4	4.4	0.0	0.6	6.8
170.0	1.4	0.4	4.4	0.0	0.6	6.8
180.0	1.4	0.4	4.3	0.0	0.6	6.7
190.0	1.4	0.4	4.4	0.0	0.6	6.8
200.0	1.4	0.4	4.4	0.0	0.6	6.8
210.0	1.4	0.4	4.3	0.0	0.6	6.6
220.0	1.4	0.4	4.0	0.0	0.6	6.3
230.0	1.4	0.4	3.5	0.0	0.6	5.9
240.0	1.4	0.4	3.0	0.0	0.6	5.3
250.0	1.4	0.4	2.3	0.0	0.6	4.6
260.0	1.4	0.4	1.5	0.0	0.6	3.9
270.0	1.4	0.4	0.7	0.0	0.6	3.1
280.0	1.4	0.4	-0.1	0.0	0.6	2.3
290.0	1.4	0.4	-0.9	0.0	0.6	1.5
300.0	1.4	0.4	-1.6	0.0	0.6	0.7
310.0	1.4	0.4	-2.3	0.0	-0.6	-1.0
320.0	1.4	0.4	-2.8	0.0	-0.6	-1.5
330.0	1.4	0.4	-3.2	0.0	-0.6	-1.9
340.0	1.4	0.4	-3.5	0.0	-0.6	-2.2
350.0	1.4	0.4	-3.6	0.0	-0.6	-2.3
360.0	1.4	0.4	-3.6	0.0	-0.6	-2.3

Case 11 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.8	-14.9	0.0	0.0	-11.0	-55.6
10.0	-29.8	-14.9	-4.8	0.0	-11.0	-60.4
20.0	-29.8	-14.9	-10.0	0.0	-11.0	-65.6
30.0	-29.8	-14.9	-15.6	0.0	-11.0	-71.2
40.0	-29.8	-14.9	-21.7	0.0	-11.0	-77.3
50.0	-29.8	-14.9	-28.0	0.0	-11.0	-83.6
60.0	-29.8	-14.9	-33.8	0.0	-11.0	-89.4
70.0	-29.8	-14.9	-38.7	0.0	-11.0	-94.3
80.0	-29.8	-14.9	-41.9	0.0	-11.0	-97.5
90.0	-29.8	-14.9	-43.0	0.0	-11.0	-98.6
100.0	-29.8	-14.9	-41.9	0.0	-11.0	-97.5
110.0	-29.8	-14.9	-38.7	0.0	-11.0	-94.3
120.0	-29.8	-14.9	-33.8	0.0	-11.0	-89.4
130.0	-29.8	-14.9	-28.0	0.0	-11.0	-83.6
140.0	-29.8	-14.9	-21.7	0.0	-11.0	-77.3
150.0	-29.8	-14.9	-15.6	0.0	-11.0	-71.2
160.0	-29.8	-14.9	-10.0	0.0	-11.0	-65.6
170.0	-29.8	-14.9	-4.8	0.0	-11.0	-60.4
180.0	-29.8	-14.9	0.0	0.0	-11.0	-55.6
190.0	-29.8	-14.9	4.8	0.0	-11.0	-50.7
200.0	-29.8	-14.9	10.0	0.0	-11.0	-45.6
210.0	-29.8	-14.9	15.6	0.0	-11.0	-39.9
220.0	-29.8	-14.9	21.7	0.0	-11.0	-33.8
230.0	-29.8	-14.9	28.0	0.0	-11.0	-27.6
240.0	-29.8	-14.9	33.8	0.0	-11.0	-21.7
250.0	-29.8	-14.9	38.7	0.0	-11.0	-16.9
260.0	-29.8	-14.9	41.9	0.0	-11.0	-13.7
270.0	-29.8	-14.9	43.0	0.0	-11.0	-12.6
280.0	-29.8	-14.9	41.9	0.0	-11.0	-13.7
290.0	-29.8	-14.9	38.7	0.0	-11.0	-16.9
300.0	-29.8	-14.9	33.8	0.0	-11.0	-21.7
310.0	-29.8	-14.9	28.0	0.0	-11.0	-27.6
320.0	-29.8	-14.9	21.7	0.0	-11.0	-33.8
330.0	-29.8	-14.9	15.6	0.0	-11.0	-39.9
340.0	-29.8	-14.9	10.0	0.0	-11.0	-45.6
350.0	-29.8	-14.9	4.8	0.0	-11.0	-50.7
360.0	-29.8	-14.9	0.0	0.0	-11.0	-55.6

Case 11 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-105.5	31.3	0.0	0.0	-32.0	-106.2
10.0	-105.5	31.3	-316.6	0.0	-32.0	-422.8
20.0	-105.5	31.3	-593.0	0.0	-32.0	-699.2
30.0	-105.5	31.3	-793.7	0.0	-32.0	-899.9
40.0	-105.5	31.3	-892.8	0.0	-32.0	-999.0
50.0	-105.5	31.3	-876.4	0.0	-32.0	-982.6
60.0	-105.5	31.3	-745.2	0.0	-32.0	-851.4
70.0	-105.5	31.3	-513.8	0.0	-32.0	-620.0
80.0	-105.5	31.3	-209.2	0.0	-32.0	-315.4
90.0	-105.5	31.3	132.4	0.0	32.0	90.1
100.0	-105.5	31.3	470.0	0.0	32.0	427.7
110.0	-105.5	31.3	762.6	0.0	32.0	720.3
120.0	-105.5	31.3	974.5	0.0	32.0	932.2
130.0	-105.5	31.3	1079.2	0.0	32.0	1027.0
140.0	-105.5	31.3	1063.0	0.0	32.0	1027.7
150.0	-105.5	31.3	926.1	0.0	32.0	833.8
160.0	-105.5	31.3	683.5	0.0	32.0	641.2
170.0	-105.5	31.3	362.6	0.0	32.0	320.3
180.0	-105.5	31.3	0.0	0.0	-32.0	-106.2
190.0	-105.5	31.3	-362.6	0.0	-32.0	-468.8
200.0	-105.5	31.3	-683.5	0.0	-32.0	-789.7
210.0	-105.5	31.3	-926.1	0.0	-32.0	-1032.3
220.0	-105.5	31.3	-1063.0	0.0	-32.0	-1169.2
230.0	-105.5	31.3	-1079.2	0.0	-32.0	-1185.4
240.0	-105.5	31.3	-974.5	0.0	-32.0	-1080.7
250.0	-105.5	31.3	-762.6	0.0	-32.0	-868.8
260.0	-105.5	31.3	-470.0	0.0	-32.0	-576.2
270.0	-105.5	31.3	-132.4	0.0	-32.0	-238.6
280.0	-105.5	31.3	209.2	0.0	32.0	166.9
290.0	-105.5	31.3	513.8	0.0	32.0	471.5
300.0	-105.5	31.3	745.2	0.0	32.0	702.9
310.0	-105.5	31.3	876.4	0.0	32.0	834.1
320.0	-105.5	31.3	892.8	0.0	32.0	850.5
330.0	-105.5	31.3	793.7	0.0	32.0	751.4
340.0	-105.5	31.3	593.0	0.0	32.0	550.7
350.0	-105.5	31.3	316.6	0.0	32.0	274.3
360.0	-105.5	31.3	0.0	0.0	-32.0	-106.2

6.11.4 Thruster use

Case 11 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	94.6	9.2	92.7	170.8	16.4	90.0	46.5	87.6
10.0	92.6	14.0	88.3	180.0	16.2	90.0	38.6	87.7
20.0	90.9	10.4	88.2	180.0	16.2	90.0	32.7	88.0
30.0	89.7	7.8	88.1	180.0	16.4	90.0	28.6	88.4
40.0	89.0	6.5	87.9	180.0	16.6	90.0	26.8	88.8
50.0	88.7	6.9	87.7	180.0	17.0	90.0	27.7	89.3
60.0	88.3	8.9	87.5	180.0	17.5	90.0	31.2	90.5
70.0	88.7	12.0	87.3	180.0	17.3	90.0	35.7	90.9
80.0	89.7	16.0	87.2	180.0	17.1	90.0	41.8	91.4
90.0	91.8	21.2	87.2	180.0	16.9	90.0	50.2	91.8
100.0	92.5	25.6	85.7	180.0	17.0	90.0	57.0	92.3
110.0	93.2	29.5	84.3	180.0	17.0	90.0	63.0	92.9
120.0	93.5	32.4	83.0	180.0	17.2	90.0	67.4	93.4
130.0	92.9	34.1	81.9	180.0	17.2	90.0	69.4	94.1
140.0	91.1	34.4	81.0	180.0	17.3	90.0	68.9	94.8
150.0	88.4	33.1	80.2	180.0	17.4	90.0	66.0	95.4
160.0	85.0	30.5	79.7	180.0	17.6	90.0	61.1	96.0
170.0	81.7	26.5	79.4	180.0	17.9	90.0	54.7	96.5
180.0	78.7	20.5	79.3	180.0	18.2	90.0	46.2	96.9
190.0	76.8	15.0	79.4	180.0	18.2	90.0	38.4	97.8
200.0	76.1	9.9	79.7	180.0	18.3	90.0	31.7	98.6
210.0	76.2	6.1	80.2	180.0	18.3	90.0	26.8	99.6
220.0	76.6	4.1	81.0	180.0	18.5	90.0	24.4	100.8
230.0	76.9	4.0	81.5	180.0	18.7	90.0	24.6	102.2
240.0	56.1	1.6	67.1	178.8	18.9	90.0	22.4	103.7
250.0	16.6	-35.3	17.2	182.4	18.9	90.0	17.5	105.3
260.0	3.5	-34.1	7.3	184.9	15.0	90.0	14.2	105.8
270.0	2.5	-30.1	5.3	167.9	10.2	90.0	13.0	103.7
280.0	4.1	-78.1	4.9	129.1	5.9	90.0	13.9	99.4
290.0	7.8	-77.3	6.4	119.8	3.8	90.0	17.0	95.0
300.0	11.6	-73.2	8.2	119.8	3.5	90.0	21.7	91.9
310.0	15.1	-67.0	9.8	119.8	5.1	90.0	27.6	87.9
320.0	16.9	-64.3	11.6	119.8	8.6	90.0	33.9	87.4
330.0	17.3	-60.7	13.1	119.8	13.4	90.0	40.0	87.2
340.0	30.5	-27.9	28.7	149.6	16.8	90.0	45.7	87.2
350.0	78.3	-12.7	76.0	167.0	16.5	90.0	50.8	87.4
360.0	94.6	9.2	92.7	170.8	16.4	90.0	46.5	87.6

6.11.5 Thruster loss

Case 11 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.84	0.82
10.0	0.86	0.79	0.81
20.0	0.86	0.79	0.81
30.0	0.87	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.88	0.78	0.85
60.0	0.89	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.90	0.78	0.85
90.0	0.91	0.78	0.84
100.0	0.91	0.76	0.85
110.0	0.92	0.75	0.85
120.0	0.93	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.72	0.86
150.0	0.94	0.72	0.87
160.0	0.94	0.71	0.88
170.0	0.95	0.71	0.89
180.0	0.95	0.71	0.91
190.0	0.95	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.96	0.72	0.92
230.0	0.96	0.73	0.93
240.0	0.95	0.75	0.94
250.0	0.94	0.77	0.94
260.0	0.92	0.80	0.94
270.0	0.94	0.84	0.94
280.0	0.95	0.90	0.95
290.0	0.94	0.90	0.95
300.0	0.94	0.90	0.96
310.0	0.94	0.90	0.92
320.0	0.94	0.90	0.89
330.0	0.93	0.90	0.86
340.0	0.88	0.89	0.84
350.0	0.86	0.86	0.82
360.0	0.86	0.84	0.82

Preliminary Design, @IDR5

6.12 Case 12 - Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 4

6.12.1 Environment and thrust utilisation

Case 12 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	110.0	110.0	0.0	35.0	2.5	6.0	8.5	2.00	> 100.0
10.0	110.0	110.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	110.0	110.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	110.0	110.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	110.0	110.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	110.0	110.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	110.0	110.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	110.0	110.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	110.0	110.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	110.0	110.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	110.0	110.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	110.0	110.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	110.0	110.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	110.0	110.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	110.0	110.0	140.0	35.0	2.5	6.0	8.5	2.00	> 100.0
150.0	110.0	110.0	150.0	35.0	2.5	6.0	8.5	2.00	97.8
160.0	110.0	110.0	160.0	35.0	2.5	6.0	8.5	2.00	96.6
170.0	110.0	110.0	170.0	35.0	2.5	6.0	8.5	2.00	99.6
180.0	110.0	110.0	180.0	35.0	2.5	6.0	8.5	2.00	> 100.0
190.0	110.0	110.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	110.0	110.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	110.0	110.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	110.0	110.0	220.0	35.0	2.5	6.0	8.5	2.00	> 100.0
230.0	110.0	110.0	230.0	35.0	2.5	6.0	8.5	2.00	96.3
240.0	110.0	110.0	240.0	35.0	2.5	6.0	8.5	2.00	79.2
250.0	110.0	110.0	250.0	35.0	2.5	6.0	8.5	2.00	60.3
260.0	110.0	110.0	260.0	35.0	2.5	6.0	8.5	2.00	41.3
270.0	110.0	110.0	270.0	35.0	2.5	6.0	8.5	2.00	24.7
280.0	110.0	110.0	280.0	35.0	2.5	6.0	8.5	2.00	9.3
290.0	110.0	110.0	290.0	35.0	2.5	6.0	8.5	2.00	7.4
300.0	110.0	110.0	300.0	35.0	2.5	6.0	8.5	2.00	10.4
310.0	110.0	110.0	310.0	35.0	2.5	6.0	8.5	2.00	13.4
320.0	110.0	110.0	320.0	35.0	2.5	6.0	8.5	2.00	20.1
330.0	110.0	110.0	330.0	35.0	2.5	6.0	8.5	2.00	35.6
340.0	110.0	110.0	340.0	35.0	2.5	6.0	8.5	2.00	55.7
350.0	110.0	110.0	350.0	35.0	2.5	6.0	8.5	2.00	78.4
360.0	110.0	110.0	360.0	35.0	2.5	6.0	8.5	2.00	> 100.0

6.12.2 Relative contributions of force components

Case 12 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	57.9	24.1	-0.3	0.0	18.4	100.0
10.0	53.0	22.1	8.1	0.0	16.8	100.0
20.0	48.7	20.3	15.6	0.0	15.4	100.0
30.0	44.6	18.6	22.6	0.0	14.2	100.0
40.0	41.0	17.1	28.9	0.0	13.0	100.0
50.0	37.8	15.8	34.4	0.0	12.0	100.0
60.0	35.3	14.7	38.8	0.0	11.2	100.0
70.0	33.4	13.9	42.1	0.0	10.6	100.0
80.0	32.3	13.5	44.0	0.0	10.2	100.0
90.0	31.9	13.3	44.7	0.0	10.1	100.0
100.0	32.2	13.5	44.1	0.0	10.2	100.0
110.0	33.3	13.9	42.1	0.0	10.6	100.0
120.0	35.2	14.7	39.0	0.0	11.2	100.0
130.0	37.6	15.7	34.7	0.0	12.0	100.0
140.0	40.7	17.0	29.3	0.0	13.0	100.0
150.0	44.2	18.5	23.2	0.0	14.1	100.0
160.0	48.0	20.1	16.6	0.0	15.3	100.0
170.0	52.1	21.8	9.5	0.0	16.7	100.0
180.0	56.6	23.7	1.6	0.0	18.1	100.0
190.0	61.9	25.9	-7.6	0.0	19.8	100.0
200.0	68.7	28.8	-15.5	0.0	22.0	100.0
210.0	78.1	32.0	-36.0	0.0	25.1	100.0
220.0	91.5	38.1	-59.4	0.0	29.5	100.0
230.0	110.6	46.6	-92.9	0.0	35.8	100.0
240.0	133.6	57.7	-138.7	0.0	44.4	100.0
250.0	168.2	71.2	-194.4	0.0	55.0	100.0
260.0	199.3	84.6	-249.5	0.0	65.6	100.0
270.0	222.3	94.4	-289.9	0.0	73.1	100.0
280.0	224.5	95.0	-292.8	0.0	73.3	100.0
290.0	196.1	82.5	-242.0	0.0	63.4	100.0
300.0	155.5	65.2	-170.5	0.0	49.9	100.0
310.0	121.6	50.9	-111.3	0.0	38.8	100.0
320.0	98.0	40.9	-70.1	0.0	31.2	100.0
330.0	82.1	34.3	-42.4	0.0	26.1	100.0
340.0	71.3	29.7	-23.7	0.0	22.6	100.0
350.0	63.7	26.6	-10.4	0.0	20.2	100.0
360.0	57.9	24.1	-0.3	0.0	18.4	100.0

6.12.3 Environment forces

Case 12 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	3.0	1.6	-3.6	0.0	1.5	2.6
10.0	3.0	1.6	-3.6	0.0	1.5	2.6
20.0	3.0	1.6	-3.5	0.0	1.5	2.7
30.0	3.0	1.6	-3.2	0.0	1.5	3.0
40.0	3.0	1.6	-2.8	0.0	1.5	3.4
50.0	3.0	1.6	-2.3	0.0	1.5	3.9
60.0	3.0	1.6	-1.6	0.0	1.5	4.5
70.0	3.0	1.6	-0.9	0.0	1.5	5.3
80.0	3.0	1.6	-0.1	0.0	1.5	6.1
90.0	3.0	1.6	0.7	0.0	1.5	6.9
100.0	3.0	1.6	1.5	0.0	1.5	7.7
110.0	3.0	1.6	2.3	0.0	1.5	8.4
120.0	3.0	1.6	3.0	0.0	1.5	9.1
130.0	3.0	1.6	3.5	0.0	1.5	9.7
140.0	3.0	1.6	4.0	0.0	1.5	10.1
150.0	3.0	1.6	4.3	0.0	1.5	10.4
160.0	3.0	1.6	4.4	0.0	1.5	10.6
170.0	3.0	1.6	4.4	0.0	1.5	10.6
180.0	3.0	1.6	4.3	0.0	1.5	10.5
190.0	3.0	1.6	4.4	0.0	1.5	10.6
200.0	3.0	1.6	4.4	0.0	1.5	10.6
210.0	3.0	1.6	4.3	0.0	1.5	10.4
220.0	3.0	1.6	4.0	0.0	1.5	10.1
230.0	3.0	1.6	3.5	0.0	1.5	9.7
240.0	3.0	1.6	3.0	0.0	1.5	9.1
250.0	3.0	1.6	2.3	0.0	1.5	8.4
260.0	3.0	1.6	1.5	0.0	1.5	7.7
270.0	3.0	1.6	0.7	0.0	1.5	6.9
280.0	3.0	1.6	-0.1	0.0	1.5	6.1
290.0	3.0	1.6	-0.9	0.0	1.5	5.3
300.0	3.0	1.6	-1.6	0.0	1.5	4.5
310.0	3.0	1.6	-2.3	0.0	1.5	3.9
320.0	3.0	1.6	-2.8	0.0	1.5	3.4
330.0	3.0	1.6	-3.2	0.0	1.5	3.0
340.0	3.0	1.6	-3.5	0.0	1.5	2.7
350.0	3.0	1.6	-3.6	0.0	1.5	2.6
360.0	3.0	1.6	-3.6	0.0	1.5	2.6

Case 12 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.5	-12.7	0.0	0.0	-9.6	-52.8
10.0	-30.5	-12.7	-4.8	0.0	-9.6	-57.7
20.0	-30.5	-12.7	-10.0	0.0	-9.6	-62.8
30.0	-30.5	-12.7	-15.6	0.0	-9.6	-68.5
40.0	-30.5	-12.7	-21.7	0.0	-9.6	-74.6
50.0	-30.5	-12.7	-28.0	0.0	-9.6	-80.8
60.0	-30.5	-12.7	-33.8	0.0	-9.6	-86.7
70.0	-30.5	-12.7	-38.7	0.0	-9.6	-91.5
80.0	-30.5	-12.7	-41.9	0.0	-9.6	-94.7
90.0	-30.5	-12.7	-43.0	0.0	-9.6	-95.8
100.0	-30.5	-12.7	-41.9	0.0	-9.6	-94.7
110.0	-30.5	-12.7	-38.7	0.0	-9.6	-91.5
120.0	-30.5	-12.7	-33.8	0.0	-9.6	-86.7
130.0	-30.5	-12.7	-28.0	0.0	-9.6	-80.8
140.0	-30.5	-12.7	-21.7	0.0	-9.6	-74.6
150.0	-30.5	-12.7	-15.6	0.0	-9.6	-68.5
160.0	-30.5	-12.7	-10.0	0.0	-9.6	-62.8
170.0	-30.5	-12.7	-4.8	0.0	-9.6	-57.7
180.0	-30.5	-12.7	0.0	0.0	-9.6	-52.8
190.0	-30.5	-12.7	4.8	0.0	-9.6	-48.0
200.0	-30.5	-12.7	10.0	0.0	-9.6	-42.8
210.0	-30.5	-12.7	15.6	0.0	-9.6	-37.2
220.0	-30.5	-12.7	21.7	0.0	-9.6	-31.1
230.0	-30.5	-12.7	28.0	0.0	-9.6	-24.8
240.0	-30.5	-12.7	33.8	0.0	-9.6	-19.0
250.0	-30.5	-12.7	38.7	0.0	-9.6	-14.2
260.0	-30.5	-12.7	41.9	0.0	-9.6	-11.0
270.0	-30.5	-12.7	43.0	0.0	-9.6	-9.8
280.0	-30.5	-12.7	41.9	0.0	-9.6	-11.0
290.0	-30.5	-12.7	38.7	0.0	-9.6	-14.2
300.0	-30.5	-12.7	33.8	0.0	-9.6	-19.0
310.0	-30.5	-12.7	28.0	0.0	-9.6	-24.8
320.0	-30.5	-12.7	21.7	0.0	-9.6	-31.1
330.0	-30.5	-12.7	15.6	0.0	-9.6	-37.2
340.0	-30.5	-12.7	10.0	0.0	-9.6	-42.8
350.0	-30.5	-12.7	4.8	0.0	-9.6	-48.0
360.0	-30.5	-12.7	0.0	0.0	-9.6	-52.8

Case 12 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-1.5	61.0	0.0	0.0	34.1	93.6
10.0	-1.5	61.0	-316.6	0.0	-34.1	-291.2
20.0	-1.5	61.0	-593.0	0.0	-34.1	-567.6
30.0	-1.5	61.0	-793.7	0.0	-34.1	-768.3
40.0	-1.5	61.0	-892.8	0.0	-34.1	-867.4
50.0	-1.5	61.0	-876.4	0.0	-34.1	-851.0
60.0	-1.5	61.0	-745.2	0.0	-34.1	-719.8
70.0	-1.5	61.0	-513.8	0.0	-34.1	-488.4
80.0	-1.5	61.0	-209.2	0.0	-34.1	-183.8
90.0	-1.5	61.0	132.4	0.0	34.1	226.0
100.0	-1.5	61.0	470.0	0.0	34.1	563.6
110.0	-1.5	61.0	762.6	0.0	34.1	856.3
120.0	-1.5	61.0	974.5	0.0	34.1	1068.2
130.0	-1.5	61.0	1079.2	0.0	34.1	1172.9
140.0	-1.5	61.0	1063.0	0.0	34.1	1155.6
150.0	-1.5	61.0	926.1	0.0	34.1	1019.7
160.0	-1.5	61.0	683.5	0.0	34.1	777.2
170.0	-1.5	61.0	362.6	0.0	34.1	456.2
180.0	-1.5	61.0	0.0	0.0	34.1	93.6
190.0	-1.5	61.0	-362.6	0.0	-34.1	-337.2
200.0	-1.5	61.0	-683.5	0.0	-34.1	-658.1
210.0	-1.5	61.0	-926.1	0.0	-34.1	-900.7
220.0	-1.5	61.0	-1063.0	0.0	-34.1	-1037.6
230.0	-1.5	61.0	-1079.2	0.0	-34.1	-1053.8
240.0	-1.5	61.0	-974.5	0.0	-34.1	-949.1
250.0	-1.5	61.0	-762.6	0.0	-34.1	-737.2
260.0	-1.5	61.0	-470.0	0.0	-34.1	-444.6
270.0	-1.5	61.0	-132.4	0.0	-34.1	-107.0
280.0	-1.5	61.0	209.2	0.0	34.1	302.9
290.0	-1.5	61.0	513.8	0.0	34.1	607.5
300.0	-1.5	61.0	745.2	0.0	34.1	838.9
310.0	-1.5	61.0	876.4	0.0	34.1	970.1
320.0	-1.5	61.0	892.8	0.0	34.1	986.4
330.0	-1.5	61.0	793.7	0.0	34.1	887.3
340.0	-1.5	61.0	593.0	0.0	34.1	686.6
350.0	-1.5	61.0	316.6	0.0	34.1	410.3
360.0	-1.5	61.0	0.0	0.0	34.1	93.6

6.12.4 Thruster use

Case 12 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	91.5	11.8	93.3	170.6	16.4	90.0	50.4	92.8
10.0	90.0	16.0	88.3	180.0	16.2	90.0	41.1	92.6
20.0	88.7	12.3	88.2	180.0	16.2	90.0	35.2	92.5
30.0	87.9	9.6	88.1	180.0	16.4	90.0	31.1	92.5
40.0	87.5	8.4	87.9	180.0	16.6	90.0	29.4	92.6
50.0	87.2	8.7	87.7	180.0	17.0	90.0	30.3	92.8
60.0	87.2	10.8	87.5	180.0	17.5	90.0	33.9	93.0
70.0	87.6	13.9	87.3	180.0	17.3	90.0	38.4	93.4
80.0	88.6	17.9	87.2	180.0	17.1	90.0	44.5	93.7
90.0	90.7	23.3	87.2	180.0	16.9	90.0	52.9	94.2
100.0	91.3	27.8	85.7	180.0	17.0	90.0	59.8	94.7
110.0	91.9	31.8	84.3	180.0	17.0	90.0	65.8	95.4
120.0	92.0	34.9	83.0	180.0	17.2	90.0	70.2	96.1
130.0	91.2	36.7	81.9	180.0	17.2	90.0	72.2	96.9
140.0	89.2	37.1	81.0	180.0	17.3	90.0	71.8	97.9
150.0	86.3	36.0	80.2	180.0	17.4	90.0	68.9	98.7
160.0	72.0	20.2	80.8	165.4	17.6	90.0	63.7	99.6
170.0	79.0	29.4	79.4	180.0	17.9	90.0	67.7	100.6
180.0	76.0	24.3	79.3	180.0	18.2	90.0	50.1	101.4
190.0	73.7	17.5	79.4	180.0	18.2	90.0	41.5	102.7
200.0	72.9	12.3	79.7	180.0	18.3	90.0	34.8	104.0
210.0	72.7	8.3	80.2	180.0	18.3	90.0	30.0	105.9
220.0	72.7	6.1	81.0	180.0	18.5	90.0	27.7	108.4
230.0	66.1	3.0	75.0	175.0	18.7	90.0	26.7	111.3
240.0	30.5	0.1	39.6	179.9	18.9	90.0	21.1	115.7
250.0	2.5	-319.0	6.4	188.4	17.3	90.0	16.5	120.8
260.0	0.5	-29.8	7.9	183.5	11.9	90.0	13.4	125.1
270.0	1.8	-125.8	6.0	167.1	7.0	90.0	12.0	125.0
280.0	4.0	-119.2	5.5	132.2	2.6	90.0	12.5	119.0
290.0	7.8	-103.8	6.9	119.8	0.6	90.0	15.1	110.5
300.0	11.1	-91.2	8.7	119.8	0.3	90.0	19.5	103.5
310.0	13.7	-84.3	10.6	119.8	2.0	90.0	25.2	98.9
320.0	15.2	-79.6	12.3	119.8	5.4	90.0	31.3	96.2
330.0	15.4	-75.3	13.8	119.8	10.3	90.0	37.3	94.6
340.0	14.4	-70.7	15.0	119.8	16.2	90.0	42.9	93.6
350.0	52.3	-17.5	54.8	163.3	16.5	90.0	48.1	93.1
360.0	91.2	-10.9	93.5	169.7	16.4	90.0	50.4	92.8

6.12.5 Thruster loss

Case 12 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.84	0.82
10.0	0.86	0.79	0.81
20.0	0.86	0.79	0.81
30.0	0.86	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.88	0.78	0.85
60.0	0.89	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.90	0.78	0.85
90.0	0.90	0.78	0.84
100.0	0.91	0.76	0.85
110.0	0.92	0.75	0.85
120.0	0.93	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.72	0.86
150.0	0.94	0.72	0.87
160.0	0.95	0.77	0.88
170.0	0.94	0.71	0.89
180.0	0.95	0.71	0.91
190.0	0.95	0.71	0.91
200.0	0.96	0.71	0.91
210.0	0.96	0.72	0.92
220.0	0.96	0.72	0.92
230.0	0.96	0.74	0.93
240.0	0.96	0.74	0.94
250.0	0.86	0.81	0.94
260.0	0.83	0.79	0.94
270.0	0.84	0.84	0.94
280.0	0.95	0.90	0.95
290.0	0.95	0.90	0.95
300.0	0.94	0.90	0.96
310.0	0.94	0.90	0.92
320.0	0.94	0.90	0.89
330.0	0.94	0.90	0.86
340.0	0.93	0.90	0.84
350.0	0.86	0.87	0.82
360.0	0.86	0.85	0.82

Preliminary Design, @IDR5

6.13 Case 13 - Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 4

6.13.1 Environment and thrust utilisation

Case 13 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	120.0	120.0	0.0	35.0	2.5	6.0	8.5	2.00	89.6
10.0	120.0	120.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	120.0	120.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	120.0	120.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	120.0	120.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	120.0	120.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	120.0	120.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	120.0	120.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	120.0	120.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	120.0	120.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	120.0	120.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	120.0	120.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	120.0	120.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	120.0	120.0	130.0	35.0	2.5	6.0	8.5	2.00	> 100.0
140.0	120.0	120.0	140.0	35.0	2.5	6.0	8.5	2.00	89.0
150.0	120.0	120.0	150.0	35.0	2.5	6.0	8.5	2.00	82.8
160.0	120.0	120.0	160.0	35.0	2.5	6.0	8.5	2.00	81.7
170.0	120.0	120.0	170.0	35.0	2.5	6.0	8.5	2.00	84.8
180.0	120.0	120.0	180.0	35.0	2.5	6.0	8.5	2.00	90.1
190.0	120.0	120.0	190.0	35.0	2.5	6.0	8.5	2.00	> 100.0
200.0	120.0	120.0	200.0	35.0	2.5	6.0	8.5	2.00	> 100.0
210.0	120.0	120.0	210.0	35.0	2.5	6.0	8.5	2.00	> 100.0
220.0	120.0	120.0	220.0	35.0	2.5	6.0	8.5	2.00	96.1
230.0	120.0	120.0	230.0	35.0	2.5	6.0	8.5	2.00	83.5
240.0	120.0	120.0	240.0	35.0	2.5	6.0	8.5	2.00	66.6
250.0	120.0	120.0	250.0	35.0	2.5	6.0	8.5	2.00	47.8
260.0	120.0	120.0	260.0	35.0	2.5	6.0	8.5	2.00	7.2
270.0	120.0	120.0	270.0	35.0	2.5	6.0	8.5	2.00	28.6
280.0	120.0	120.0	280.0	35.0	2.5	6.0	8.5	2.00	41.1
290.0	120.0	120.0	290.0	35.0	2.5	6.0	8.5	2.00	15.4
300.0	120.0	120.0	300.0	35.0	2.5	6.0	8.5	2.00	15.3
310.0	120.0	120.0	310.0	35.0	2.5	6.0	8.5	2.00	13.6
320.0	120.0	120.0	320.0	35.0	2.5	6.0	8.5	2.00	14.1
330.0	120.0	120.0	330.0	35.0	2.5	6.0	8.5	2.00	21.8
340.0	120.0	120.0	340.0	35.0	2.5	6.0	8.5	2.00	41.1
350.0	120.0	120.0	350.0	35.0	2.5	6.0	8.5	2.00	65.4
360.0	120.0	120.0	360.0	35.0	2.5	6.0	8.5	2.00	89.6

6.13.2 Relative contributions of force components

Case 13 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	63.6	20.7	-0.9	0.0	16.7	100.0
10.0	57.9	18.8	8.2	0.0	15.2	100.0
20.0	52.8	17.1	16.3	0.0	13.8	100.0
30.0	48.1	15.6	23.6	0.0	12.6	100.0
40.0	44.0	14.2	30.3	0.0	11.5	100.0
50.0	40.4	13.1	36.0	0.0	10.6	100.0
60.0	37.5	12.1	40.5	0.0	9.8	100.0
70.0	35.4	11.5	43.8	0.0	9.3	100.0
80.0	34.1	11.1	45.8	0.0	9.0	100.0
90.0	33.7	10.9	46.5	0.0	8.9	100.0
100.0	34.1	11.1	45.9	0.0	9.0	100.0
110.0	35.3	11.5	43.9	0.0	9.3	100.0
120.0	37.3	12.1	40.7	0.0	9.8	100.0
130.0	40.0	13.1	36.3	0.0	10.6	100.0
140.0	43.4	14.2	30.9	0.0	11.5	100.0
150.0	47.2	15.5	24.7	0.0	12.6	100.0
160.0	51.4	16.9	17.9	0.0	13.8	100.0
170.0	56.0	18.5	10.6	0.0	15.0	100.0
180.0	61.0	20.2	2.4	0.0	16.4	100.0
190.0	66.8	22.1	-7.0	0.0	18.1	100.0
200.0	74.2	24.7	-15.1	0.0	20.2	100.0
210.0	84.2	28.2	-35.5	0.0	23.1	100.0
220.0	97.9	33.1	-58.1	0.0	27.1	100.0
230.0	113.8	39.6	-87.9	0.0	32.6	100.0
240.0	131.9	47.0	-120.9	0.0	38.9	100.0
250.0	147.2	52.7	-143.9	0.0	44.0	100.0
260.0	-106.8	-28.3	188.3	0.0	46.8	100.0
270.0	-121.9	-33.7	206.6	0.0	49.0	100.0
280.0	-131.1	-36.0	213.6	0.0	53.5	100.0
290.0	194.8	68.1	-219.4	0.0	56.4	100.0
300.0	173.6	58.9	-180.9	0.0	48.3	100.0
310.0	139.6	46.5	-124.0	0.0	37.9	100.0
320.0	111.9	36.9	-78.8	0.0	30.0	100.0
330.0	92.7	30.4	-47.7	0.0	24.6	100.0
340.0	79.7	26.0	-26.7	0.0	21.1	100.0
350.0	70.5	22.9	-12.0	0.0	18.6	100.0
360.0	63.6	20.7	-0.9	0.0	16.7	100.0

6.13.3 Environment forces

Case 13 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	4.8	2.6	-3.6	0.0	2.4	6.3
10.0	4.8	2.6	-3.6	0.0	2.4	6.3
20.0	4.8	2.6	-3.5	0.0	2.4	6.4
30.0	4.8	2.6	-3.2	0.0	2.4	6.7
40.0	4.8	2.6	-2.8	0.0	2.4	7.1
50.0	4.8	2.6	-2.3	0.0	2.4	7.6
60.0	4.8	2.6	-1.6	0.0	2.4	8.2
70.0	4.8	2.6	-0.9	0.0	2.4	9.0
80.0	4.8	2.6	-0.1	0.0	2.4	9.8
90.0	4.8	2.6	0.7	0.0	2.4	10.6
100.0	4.8	2.6	1.5	0.0	2.4	11.4
110.0	4.8	2.6	2.3	0.0	2.4	12.1
120.0	4.8	2.6	3.0	0.0	2.4	12.8
130.0	4.8	2.6	3.5	0.0	2.4	13.4
140.0	4.8	2.6	4.0	0.0	2.4	13.8
150.0	4.8	2.6	4.3	0.0	2.4	14.1
160.0	4.8	2.6	4.4	0.0	2.4	14.3
170.0	4.8	2.6	4.4	0.0	2.4	14.3
180.0	4.8	2.6	4.3	0.0	2.4	14.2
190.0	4.8	2.6	4.4	0.0	2.4	14.3
200.0	4.8	2.6	4.4	0.0	2.4	14.3
210.0	4.8	2.6	4.3	0.0	2.4	14.1
220.0	4.8	2.6	4.0	0.0	2.4	13.8
230.0	4.8	2.6	3.5	0.0	2.4	13.4
240.0	4.8	2.6	3.0	0.0	2.4	12.8
250.0	4.8	2.6	2.3	0.0	2.4	12.1
260.0	4.8	2.6	1.5	0.0	2.4	11.4
270.0	4.8	2.6	0.7	0.0	2.4	10.6
280.0	4.8	2.6	-0.1	0.0	2.4	9.8
290.0	4.8	2.6	-0.9	0.0	2.4	9.0
300.0	4.8	2.6	-1.6	0.0	2.4	8.2
310.0	4.8	2.6	-2.3	0.0	2.4	7.6
320.0	4.8	2.6	-2.8	0.0	2.4	7.1
330.0	4.8	2.6	-3.2	0.0	2.4	6.7
340.0	4.8	2.6	-3.5	0.0	2.4	6.4
350.0	4.8	2.6	-3.6	0.0	2.4	6.3
360.0	4.8	2.6	-3.6	0.0	2.4	6.3

Case 13 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.7	-9.8	0.0	0.0	-7.9	-48.4
10.0	-30.7	-9.8	-4.8	0.0	-7.9	-53.2
20.0	-30.7	-9.8	-10.0	0.0	-7.9	-58.4
30.0	-30.7	-9.8	-15.6	0.0	-7.9	-64.0
40.0	-30.7	-9.8	-21.7	0.0	-7.9	-70.1
50.0	-30.7	-9.8	-28.0	0.0	-7.9	-76.4
60.0	-30.7	-9.8	-33.8	0.0	-7.9	-82.2
70.0	-30.7	-9.8	-38.7	0.0	-7.9	-87.1
80.0	-30.7	-9.8	-41.9	0.0	-7.9	-90.3
90.0	-30.7	-9.8	-43.0	0.0	-7.9	-91.4
100.0	-30.7	-9.8	-41.9	0.0	-7.9	-90.3
110.0	-30.7	-9.8	-38.7	0.0	-7.9	-87.1
120.0	-30.7	-9.8	-33.8	0.0	-7.9	-82.2
130.0	-30.7	-9.8	-28.0	0.0	-7.9	-76.4
140.0	-30.7	-9.8	-21.7	0.0	-7.9	-70.1
150.0	-30.7	-9.8	-15.6	0.0	-7.9	-64.0
160.0	-30.7	-9.8	-10.0	0.0	-7.9	-58.4
170.0	-30.7	-9.8	-4.8	0.0	-7.9	-53.2
180.0	-30.7	-9.8	0.0	0.0	-7.9	-48.4
190.0	-30.7	-9.8	4.8	0.0	-7.9	-43.6
200.0	-30.7	-9.8	10.0	0.0	-7.9	-38.4
210.0	-30.7	-9.8	15.6	0.0	-7.9	-32.8
220.0	-30.7	-9.8	21.7	0.0	-7.9	-26.7
230.0	-30.7	-9.8	28.0	0.0	-7.9	-20.4
240.0	-30.7	-9.8	33.8	0.0	-7.9	-14.6
250.0	-30.7	-9.8	38.7	0.0	-7.9	-9.7
260.0	-30.7	-9.8	41.9	0.0	7.9	9.3
270.0	-30.7	-9.8	43.0	0.0	7.9	10.4
280.0	-30.7	-9.8	41.9	0.0	7.9	9.3
290.0	-30.7	-9.8	38.7	0.0	-7.9	-9.7
300.0	-30.7	-9.8	33.8	0.0	-7.9	-14.6
310.0	-30.7	-9.8	28.0	0.0	-7.9	-20.4
320.0	-30.7	-9.8	21.7	0.0	-7.9	-26.7
330.0	-30.7	-9.8	15.6	0.0	-7.9	-32.8
340.0	-30.7	-9.8	10.0	0.0	-7.9	-38.4
350.0	-30.7	-9.8	4.8	0.0	-7.9	-43.6
360.0	-30.7	-9.8	0.0	0.0	-7.9	-48.4

Case 13 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	105.7	85.4	0.0	0.0	53.5	244.6
10.0	105.7	85.4	-316.6	0.0	-53.5	-179.0
20.0	105.7	85.4	-593.0	0.0	-53.5	-455.3
30.0	105.7	85.4	-793.7	0.0	-53.5	-656.1
40.0	105.7	85.4	-892.8	0.0	-53.5	-755.2
50.0	105.7	85.4	-876.4	0.0	-53.5	-738.8
60.0	105.7	85.4	-745.2	0.0	-53.5	-607.6
70.0	105.7	85.4	-513.8	0.0	-53.5	-376.2
80.0	105.7	85.4	-209.2	0.0	-53.5	-71.6
90.0	105.7	85.4	132.4	0.0	53.5	377.0
100.0	105.7	85.4	470.0	0.0	53.5	714.6
110.0	105.7	85.4	762.6	0.0	53.5	1007.3
120.0	105.7	85.4	974.5	0.0	53.5	1219.1
130.0	105.7	85.4	1079.2	0.0	53.5	1335.9
140.0	105.7	85.4	1063.0	0.0	53.5	1307.6
150.0	105.7	85.4	926.1	0.0	53.5	1170.1
160.0	105.7	85.4	683.5	0.0	53.5	928.1
170.0	105.7	85.4	362.6	0.0	53.5	607.2
180.0	105.7	85.4	0.0	0.0	53.5	244.6
190.0	105.7	85.4	-362.6	0.0	-53.5	-225.0
200.0	105.7	85.4	-683.5	0.0	-53.5	-545.9
210.0	105.7	85.4	-926.1	0.0	-53.5	-788.5
220.0	105.7	85.4	-1063.0	0.0	-53.5	-925.3
230.0	105.7	85.4	-1079.2	0.0	-53.5	-941.6
240.0	105.7	85.4	-974.5	0.0	-53.5	-836.9
250.0	105.7	85.4	-762.6	0.0	-53.5	-625.0
260.0	105.7	85.4	-470.0	0.0	-53.5	-332.4
270.0	105.7	85.4	-132.4	0.0	53.5	112.2
280.0	105.7	85.4	209.2	0.0	53.5	453.8
290.0	105.7	85.4	513.8	0.0	53.5	758.5
300.0	105.7	85.4	745.2	0.0	53.5	989.8
310.0	105.7	85.4	876.4	0.0	53.5	1121.0
320.0	105.7	85.4	892.8	0.0	53.5	1137.4
330.0	105.7	85.4	793.7	0.0	53.5	1038.3
340.0	105.7	85.4	593.0	0.0	53.5	837.6
350.0	105.7	85.4	316.6	0.0	53.5	561.2
360.0	105.7	85.4	0.0	0.0	53.5	244.6

6.13.4 Thruster use

Case 13 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	67.6	13.8	73.6	167.5	16.4	90.0	48.8	97.4
10.0	87.4	17.9	88.3	180.0	16.2	90.0	43.3	96.8
20.0	86.7	14.1	88.2	180.0	16.2	90.0	37.5	96.3
30.0	86.2	11.3	88.1	180.0	16.4	90.0	33.4	96.0
40.0	85.9	10.0	87.9	180.0	16.6	90.0	31.7	95.9
50.0	85.8	10.4	87.7	180.0	17.0	90.0	32.6	95.7
60.0	85.8	12.4	87.5	180.0	17.5	90.0	36.2	95.8
70.0	86.3	15.6	87.3	180.0	17.3	90.0	40.7	96.0
80.0	87.2	19.7	87.2	180.0	17.1	90.0	46.8	96.3
90.0	89.5	25.7	87.2	180.0	16.9	90.0	56.1	96.7
100.0	90.0	30.4	85.7	180.0	17.0	90.0	63.0	97.3
110.0	90.5	34.5	84.3	180.0	17.0	90.0	69.0	98.1
120.0	90.4	37.8	83.0	180.0	17.2	90.0	73.5	99.0
130.0	89.3	39.8	81.9	180.0	17.2	90.0	75.5	100.1
140.0	58.8	29.2	69.5	159.6	17.3	90.0	71.5	101.2
150.0	44.6	34.5	55.2	157.2	17.4	90.0	65.6	102.5
160.0	39.9	33.7	51.0	158.6	17.6	90.0	60.1	103.8
170.0	43.0	26.8	55.1	163.2	17.9	90.0	55.1	105.0
180.0	51.5	18.9	64.3	167.9	18.2	90.0	50.1	106.3
190.0	69.6	20.2	79.4	180.0	18.2	90.0	44.5	108.4
200.0	68.5	14.6	79.7	180.0	18.3	90.0	38.0	110.6
210.0	67.9	10.4	80.2	180.0	18.3	90.0	33.5	113.8
220.0	61.4	4.3	75.1	177.3	18.5	90.0	30.0	117.4
230.0	35.2	1.6	48.5	175.1	18.7	90.0	24.4	123.3
240.0	1.9	299.8	1.9	190.1	18.7	90.0	19.4	131.4
250.0	2.2	233.9	1.0	189.5	13.4	90.0	15.6	141.3
260.0	7.0	217.9	6.9	216.2	-1.3	90.0	14.7	219.3
270.0	3.1	190.4	3.0	211.0	-7.4	90.0	14.9	224.6
280.0	9.1	175.1	1.1	127.1	-10.9	90.0	13.5	223.6
290.0	9.4	126.3	6.8	119.8	-3.8	90.0	13.2	132.7
300.0	11.8	109.6	8.6	119.8	-4.1	90.0	16.7	119.5
310.0	13.9	99.8	10.5	119.8	-2.4	90.0	21.8	110.4
320.0	15.0	93.7	12.3	119.8	1.0	90.0	27.6	104.8
330.0	14.9	89.3	13.8	119.8	5.9	90.0	33.4	101.5
340.0	13.6	85.7	15.0	119.8	11.8	90.0	38.9	99.5
350.0	20.5	40.9	25.7	147.9	16.5	90.0	44.0	98.2
360.0	67.6	13.8	73.6	167.5	16.4	90.0	48.8	97.4

6.13.5 Thruster loss

Case 13 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.85	0.82
10.0	0.86	0.79	0.81
20.0	0.86	0.79	0.81
30.0	0.86	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.88	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.89	0.78	0.85
90.0	0.90	0.78	0.84
100.0	0.90	0.76	0.85
110.0	0.91	0.75	0.85
120.0	0.92	0.74	0.86
130.0	0.94	0.73	0.86
140.0	0.94	0.79	0.86
150.0	0.94	0.79	0.87
160.0	0.94	0.79	0.88
170.0	0.95	0.78	0.89
180.0	0.95	0.77	0.91
190.0	0.95	0.71	0.91
200.0	0.95	0.71	0.91
210.0	0.95	0.71	0.92
220.0	0.96	0.74	0.92
230.0	0.96	0.74	0.93
240.0	0.85	0.81	0.94
250.0	0.81	0.81	0.94
260.0	0.83	0.86	0.85
270.0	0.82	0.88	0.84
280.0	0.82	0.90	0.85
290.0	0.95	0.90	0.86
300.0	0.95	0.90	0.87
310.0	0.94	0.90	0.85
320.0	0.94	0.90	0.89
330.0	0.94	0.90	0.86
340.0	0.94	0.90	0.84
350.0	0.88	0.89	0.82
360.0	0.86	0.85	0.82

Preliminary Design, @IDR5

6.14 Case 14 - Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 4

6.14.1 Environment and thrust utilisation

Case 14 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	130.0	130.0	0.0	35.0	2.5	6.0	8.5	2.00	74.5
10.0	130.0	130.0	10.0	35.0	2.5	6.0	8.5	2.00	> 100.0
20.0	130.0	130.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	130.0	130.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	130.0	130.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	130.0	130.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	130.0	130.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	130.0	130.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	130.0	130.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	130.0	130.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	130.0	130.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	130.0	130.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	130.0	130.0	120.0	35.0	2.5	6.0	8.5	2.00	> 100.0
130.0	130.0	130.0	130.0	35.0	2.5	6.0	8.5	2.00	84.4
140.0	130.0	130.0	140.0	35.0	2.5	6.0	8.5	2.00	71.8
150.0	130.0	130.0	150.0	35.0	2.5	6.0	8.5	2.00	66.8
160.0	130.0	130.0	160.0	35.0	2.5	6.0	8.5	2.00	66.2
170.0	130.0	130.0	170.0	35.0	2.5	6.0	8.5	2.00	69.5
180.0	130.0	130.0	180.0	35.0	2.5	6.0	8.5	2.00	75.0
190.0	130.0	130.0	190.0	35.0	2.5	6.0	8.5	2.00	86.6
200.0	130.0	130.0	200.0	35.0	2.5	6.0	8.5	2.00	90.2
210.0	130.0	130.0	210.0	35.0	2.5	6.0	8.5	2.00	89.0
220.0	130.0	130.0	220.0	35.0	2.5	6.0	8.5	2.00	82.0
230.0	130.0	130.0	230.0	35.0	2.5	6.0	8.5	2.00	69.6
240.0	130.0	130.0	240.0	35.0	2.5	6.0	8.5	2.00	52.7
250.0	130.0	130.0	250.0	35.0	2.5	6.0	8.5	2.00	9.3
260.0	130.0	130.0	260.0	35.0	2.5	6.0	8.5	2.00	16.5
270.0	130.0	130.0	270.0	35.0	2.5	6.0	8.5	2.00	39.0
280.0	130.0	130.0	280.0	35.0	2.5	6.0	8.5	2.00	51.4
290.0	130.0	130.0	290.0	35.0	2.5	6.0	8.5	2.00	57.7
300.0	130.0	130.0	300.0	35.0	2.5	6.0	8.5	2.00	30.2
310.0	130.0	130.0	310.0	35.0	2.5	6.0	8.5	2.00	24.9
320.0	130.0	130.0	320.0	35.0	2.5	6.0	8.5	2.00	18.4
330.0	130.0	130.0	330.0	35.0	2.5	6.0	8.5	2.00	14.1
340.0	130.0	130.0	340.0	35.0	2.5	6.0	8.5	2.00	26.5
350.0	130.0	130.0	350.0	35.0	2.5	6.0	8.5	2.00	50.3
360.0	130.0	130.0	360.0	35.0	2.5	6.0	8.5	2.00	74.5

6.14.2 Relative contributions of force components

Case 14 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	67.6	18.3	-1.5	0.0	15.6	100.0
10.0	60.9	16.5	8.6	0.0	14.0	100.0
20.0	55.0	14.9	17.4	0.0	12.7	100.0
30.0	49.8	13.4	25.4	0.0	11.4	100.0
40.0	45.1	12.2	32.4	0.0	10.4	100.0
50.0	41.1	11.1	38.3	0.0	9.4	100.0
60.0	38.0	10.2	43.0	0.0	8.7	100.0
70.0	35.8	9.6	46.4	0.0	8.2	100.0
80.0	34.4	9.3	48.4	0.0	7.9	100.0
90.0	33.9	9.2	49.1	0.0	7.8	100.0
100.0	34.4	9.3	48.5	0.0	7.9	100.0
110.0	35.6	9.6	46.5	0.0	8.2	100.0
120.0	37.8	10.2	43.2	0.0	8.7	100.0
130.0	40.7	11.1	38.7	0.0	9.4	100.0
140.0	44.4	12.1	33.1	0.0	10.3	100.0
150.0	48.6	13.3	26.7	0.0	11.1	100.0
160.0	53.3	14.6	19.6	0.0	12.5	100.0
170.0	58.3	16.1	11.9	0.0	13.7	100.0
180.0	63.9	17.7	3.3	0.0	15.1	100.0
190.0	70.3	19.6	-6.6	0.0	16.7	100.0
200.0	78.4	22.0	-13.1	0.0	18.8	100.0
210.0	89.1	25.2	-35.3	0.0	21.6	100.0
220.0	102.7	29.1	-57.4	0.0	25.2	100.0
230.0	118.6	34.2	-80.2	0.0	29.4	100.0
240.0	129.6	36.8	-89.2	0.0	31.8	100.0
250.0	-58.9	-10.5	136.0	0.0	33.3	100.0
260.0	-81.2	-17.4	164.0	0.0	34.5	100.0
270.0	-91.0	-20.3	175.8	0.0	35.4	100.0
280.0	-96.9	-21.5	180.2	0.0	38.1	100.0
290.0	-93.7	-19.2	170.0	0.0	42.9	100.0
300.0	178.2	52.6	-176.1	0.0	45.3	100.0
310.0	157.6	44.7	-140.6	0.0	38.3	100.0
320.0	126.5	35.2	-91.8	0.0	30.1	100.0
330.0	103.0	28.3	-55.5	0.0	24.2	100.0
340.0	87.0	23.7	-31.0	0.0	20.3	100.0
350.0	75.8	20.6	-14.0	0.0	17.6	100.0
360.0	67.6	18.3	-1.5	0.0	15.6	100.0

6.14.3 Environment forces

Case 14 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	6.5	2.7	-3.6	0.0	2.4	8.1
10.0	6.5	2.7	-3.6	0.0	2.4	8.1
20.0	6.5	2.7	-3.5	0.0	2.4	8.2
30.0	6.5	2.7	-3.2	0.0	2.4	8.5
40.0	6.5	2.7	-2.8	0.0	2.4	8.9
50.0	6.5	2.7	-2.3	0.0	2.4	9.4
60.0	6.5	2.7	-1.6	0.0	2.4	10.1
70.0	6.5	2.7	-0.9	0.0	2.4	10.8
80.0	6.5	2.7	-0.1	0.0	2.4	11.6
90.0	6.5	2.7	0.7	0.0	2.4	12.4
100.0	6.5	2.7	1.5	0.0	2.4	13.2
110.0	6.5	2.7	2.3	0.0	2.4	14.0
120.0	6.5	2.7	3.0	0.0	2.4	14.6
130.0	6.5	2.7	3.5	0.0	2.4	15.2
140.0	6.5	2.7	4.0	0.0	2.4	15.7
150.0	6.5	2.7	4.3	0.0	2.4	16.0
160.0	6.5	2.7	4.4	0.0	2.4	16.1
170.0	6.5	2.7	4.4	0.0	2.4	16.1
180.0	6.5	2.7	4.3	0.0	2.4	16.0
190.0	6.5	2.7	4.4	0.0	2.4	16.1
200.0	6.5	2.7	4.4	0.0	2.4	16.1
210.0	6.5	2.7	4.3	0.0	2.4	16.0
220.0	6.5	2.7	4.0	0.0	2.4	15.7
230.0	6.5	2.7	3.5	0.0	2.4	15.2
240.0	6.5	2.7	3.0	0.0	2.4	14.6
250.0	6.5	2.7	2.3	0.0	2.4	14.0
260.0	6.5	2.7	1.5	0.0	2.4	13.2
270.0	6.5	2.7	0.7	0.0	2.4	12.4
280.0	6.5	2.7	-0.1	0.0	2.4	11.6
290.0	6.5	2.7	-0.9	0.0	2.4	10.8
300.0	6.5	2.7	-1.6	0.0	2.4	10.1
310.0	6.5	2.7	-2.3	0.0	2.4	9.4
320.0	6.5	2.7	-2.8	0.0	2.4	8.9
330.0	6.5	2.7	-3.2	0.0	2.4	8.5
340.0	6.5	2.7	-3.5	0.0	2.4	8.2
350.0	6.5	2.7	-3.6	0.0	2.4	8.1
360.0	6.5	2.7	-3.6	0.0	2.4	8.1

Case 14 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-28.8	-7.6	0.0	0.0	-6.5	-43.0
10.0	-28.8	-7.6	-4.8	0.0	-6.5	-47.8
20.0	-28.8	-7.6	-10.0	0.0	-6.5	-53.0
30.0	-28.8	-7.6	-15.6	0.0	-6.5	-58.6
40.0	-28.8	-7.6	-21.7	0.0	-6.5	-64.7
50.0	-28.8	-7.6	-28.0	0.0	-6.5	-71.0
60.0	-28.8	-7.6	-33.8	0.0	-6.5	-76.8
70.0	-28.8	-7.6	-38.7	0.0	-6.5	-81.6
80.0	-28.8	-7.6	-41.9	0.0	-6.5	-84.8
90.0	-28.8	-7.6	-43.0	0.0	-6.5	-86.0
100.0	-28.8	-7.6	-41.9	0.0	-6.5	-84.8
110.0	-28.8	-7.6	-38.7	0.0	-6.5	-81.6
120.0	-28.8	-7.6	-33.8	0.0	-6.5	-76.8
130.0	-28.8	-7.6	-28.0	0.0	-6.5	-71.0
140.0	-28.8	-7.6	-21.7	0.0	-6.5	-64.7
150.0	-28.8	-7.6	-15.6	0.0	-6.5	-58.6
160.0	-28.8	-7.6	-10.0	0.0	-6.5	-53.0
170.0	-28.8	-7.6	-4.8	0.0	-6.5	-47.8
180.0	-28.8	-7.6	0.0	0.0	-6.5	-43.0
190.0	-28.8	-7.6	4.8	0.0	-6.5	-38.1
200.0	-28.8	-7.6	10.0	0.0	-6.5	-33.0
210.0	-28.8	-7.6	15.6	0.0	-6.5	-27.3
220.0	-28.8	-7.6	21.7	0.0	-6.5	-21.2
230.0	-28.8	-7.6	28.0	0.0	-6.5	-15.0
240.0	-28.8	-7.6	33.8	0.0	-6.5	-9.1
250.0	-28.8	-7.6	38.7	0.0	6.5	8.7
260.0	-28.8	-7.6	41.9	0.0	6.5	11.9
270.0	-28.8	-7.6	43.0	0.0	6.5	13.0
280.0	-28.8	-7.6	41.9	0.0	6.5	11.9
290.0	-28.8	-7.6	38.7	0.0	6.5	8.7
300.0	-28.8	-7.6	33.8	0.0	-6.5	-9.1
310.0	-28.8	-7.6	28.0	0.0	-6.5	-15.0
320.0	-28.8	-7.6	21.7	0.0	-6.5	-21.2
330.0	-28.8	-7.6	15.6	0.0	-6.5	-27.3
340.0	-28.8	-7.6	10.0	0.0	-6.5	-33.0
350.0	-28.8	-7.6	4.8	0.0	-6.5	-38.1
360.0	-28.8	-7.6	0.0	0.0	-6.5	-43.0

Case 14 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	200.3	87.3	0.0	0.0	62.5	350.0
10.0	200.3	87.3	-316.6	0.0	-62.5	-91.6
20.0	200.3	87.3	-593.0	0.0	-62.5	-368.0
30.0	200.3	87.3	-793.7	0.0	-62.5	-568.7
40.0	200.3	87.3	-892.8	0.0	-62.5	-667.8
50.0	200.3	87.3	-876.4	0.0	-62.5	-651.4
60.0	200.3	87.3	-745.2	0.0	-62.5	-520.2
70.0	200.3	87.3	-513.8	0.0	-62.5	-288.8
80.0	200.3	87.3	-209.2	0.0	62.5	140.8
90.0	200.3	87.3	132.4	0.0	62.5	482.4
100.0	200.3	87.3	470.0	0.0	62.5	820.0
110.0	200.3	87.3	762.6	0.0	62.5	1112.6
120.0	200.3	87.3	974.5	0.0	62.5	1324.5
130.0	200.3	87.3	1079.2	0.0	62.5	1429.3
140.0	200.3	87.3	1063.0	0.0	62.5	1413.0
150.0	200.3	87.3	926.1	0.0	62.5	1276.1
160.0	200.3	87.3	683.5	0.0	62.5	1033.5
170.0	200.3	87.3	362.6	0.0	62.5	712.6
180.0	200.3	87.3	0.0	0.0	62.5	350.0
190.0	200.3	87.3	-362.6	0.0	-62.5	-137.6
200.0	200.3	87.3	-683.5	0.0	-62.5	-458.5
210.0	200.3	87.3	-926.1	0.0	-62.5	-701.1
220.0	200.3	87.3	-1063.0	0.0	-62.5	-838.0
230.0	200.3	87.3	-1079.2	0.0	-62.5	-854.2
240.0	200.3	87.3	-974.5	0.0	-62.5	-749.5
250.0	200.3	87.3	-762.6	0.0	-62.5	-537.6
260.0	200.3	87.3	-470.0	0.0	-62.5	-245.0
270.0	200.3	87.3	-132.4	0.0	62.5	217.6
280.0	200.3	87.3	209.2	0.0	62.5	559.2
290.0	200.3	87.3	513.8	0.0	62.5	863.8
300.0	200.3	87.3	745.2	0.0	62.5	1095.2
310.0	200.3	87.3	876.4	0.0	62.5	1226.4
320.0	200.3	87.3	892.8	0.0	62.5	1242.8
330.0	200.3	87.3	793.7	0.0	62.5	1143.7
340.0	200.3	87.3	593.0	0.0	62.5	943.0
350.0	200.3	87.3	316.6	0.0	62.5	666.6
360.0	200.3	87.3	0.0	0.0	62.5	350.0

6.14.4 Thruster use

Case 14 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	34.7	22.4	42.4	161.6	16.4	90.0	43.7	100.7
10.0	85.5	19.4	88.3	180.0	16.2	90.0	45.3	99.7
20.0	85.2	15.4	88.2	180.0	16.2	90.0	39.4	99.0
30.0	85.0	12.6	88.1	180.0	16.4	90.0	35.3	98.4
40.0	84.9	11.3	87.9	180.0	16.6	90.0	33.6	98.0
50.0	84.8	11.7	87.7	180.0	17.0	90.0	34.5	97.7
60.0	84.9	13.8	87.5	180.0	17.5	90.0	38.0	97.6
70.0	85.4	16.9	87.3	180.0	17.3	90.0	42.5	97.6
80.0	87.0	22.8	87.2	180.0	17.1	90.0	51.3	97.9
90.0	88.7	27.4	87.2	180.0	16.9	90.0	58.4	98.4
100.0	89.2	32.2	85.7	180.0	17.0	90.0	65.3	99.0
110.0	89.6	36.5	84.3	180.0	17.0	90.0	71.3	99.9
120.0	89.4	39.9	83.0	180.0	17.2	90.0	75.9	100.9
130.0	52.3	33.7	63.8	157.1	17.2	90.0	72.6	102.1
140.0	31.0	55.0	40.0	146.6	17.3	90.0	66.6	103.6
150.0	21.9	81.6	27.4	134.5	17.4	90.0	60.7	105.2
160.0	18.5	91.0	23.0	133.2	17.6	90.0	55.3	106.9
170.0	16.7	73.1	25.2	146.5	17.9	90.0	50.4	108.6
180.0	20.2	41.6	33.1	160.1	18.2	90.0	45.1	110.4
190.0	40.4	15.9	55.7	170.9	18.2	90.0	41.4	112.9
200.0	46.8	10.2	62.5	174.1	18.3	90.0	36.7	116.0
210.0	43.9	6.6	59.7	176.2	18.3	90.0	31.7	120.3
220.0	29.3	3.1	45.0	173.5	18.5	90.0	26.4	126.4
230.0	3.8	328.7	18.5	185.2	18.7	90.0	21.4	135.4
240.0	3.4	232.1	12.3	192.2	14.5	90.0	17.3	148.1
250.0	7.7	226.3	9.6	213.0	1.6	90.0	16.5	211.9
260.0	8.7	207.9	6.8	216.7	-3.9	90.0	17.8	222.0
270.0	10.0	187.7	2.9	210.6	-10.2	90.0	18.0	226.4
280.0	11.1	175.3	1.1	119.8	-13.7	90.0	16.6	225.7
290.0	13.1	163.7	3.6	60.2	-15.5	90.0	13.9	218.9
300.0	12.6	119.6	7.7	119.8	-8.5	90.0	13.6	137.8
310.0	14.3	109.0	9.6	119.8	-6.9	90.0	17.7	122.2
320.0	15.2	102.4	11.4	119.8	-3.4	90.0	23.0	112.7
330.0	14.9	98.1	12.9	119.8	1.4	90.0	28.6	107.2
340.0	13.5	95.3	14.0	119.8	7.4	90.0	34.0	104.0
350.0	12.5	84.8	15.1	127.7	13.8	90.0	39.0	102.0
360.0	34.7	22.4	42.4	161.6	16.4	90.0	43.7	100.7

6.14.5 Thruster loss

Case 14 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.87	0.82
10.0	0.85	0.79	0.81
20.0	0.86	0.79	0.81
30.0	0.86	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.87	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.89	0.78	0.85
90.0	0.90	0.78	0.84
100.0	0.90	0.76	0.85
110.0	0.91	0.75	0.85
120.0	0.92	0.74	0.86
130.0	0.94	0.80	0.86
140.0	0.93	0.80	0.86
150.0	0.90	0.81	0.87
160.0	0.90	0.82	0.88
170.0	0.94	0.81	0.89
180.0	0.94	0.79	0.91
190.0	0.95	0.76	0.91
200.0	0.96	0.74	0.91
210.0	0.96	0.74	0.92
220.0	0.96	0.73	0.92
230.0	0.90	0.75	0.93
240.0	0.81	0.81	0.94
250.0	0.82	0.86	0.94
260.0	0.83	0.86	0.85
270.0	0.81	0.88	0.84
280.0	0.82	0.90	0.85
290.0	0.89	0.90	0.86
300.0	0.95	0.90	0.87
310.0	0.95	0.90	0.85
320.0	0.94	0.90	0.83
330.0	0.94	0.90	0.86
340.0	0.94	0.90	0.84
350.0	0.93	0.90	0.82
360.0	0.86	0.87	0.82

Preliminary Design, @IDR5

6.15 Case 15 - Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 4

6.15.1 Environment and thrust utilisation

Case 15 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	140.0	140.0	0.0	35.0	2.5	6.0	8.5	2.00	55.4
10.0	140.0	140.0	10.0	35.0	2.5	6.0	8.5	2.00	80.0
20.0	140.0	140.0	20.0	35.0	2.5	6.0	8.5	2.00	> 100.0
30.0	140.0	140.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	140.0	140.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	140.0	140.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	140.0	140.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	140.0	140.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	140.0	140.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	140.0	140.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	140.0	140.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	140.0	140.0	110.0	35.0	2.5	6.0	8.5	2.00	> 100.0
120.0	140.0	140.0	120.0	35.0	2.5	6.0	8.5	2.00	81.8
130.0	140.0	140.0	130.0	35.0	2.5	6.0	8.5	2.00	65.8
140.0	140.0	140.0	140.0	35.0	2.5	6.0	8.5	2.00	53.7
150.0	140.0	140.0	150.0	35.0	2.5	6.0	8.5	2.00	47.5
160.0	140.0	140.0	160.0	35.0	2.5	6.0	8.5	2.00	47.3
170.0	140.0	140.0	170.0	35.0	2.5	6.0	8.5	2.00	50.6
180.0	140.0	140.0	180.0	35.0	2.5	6.0	8.5	2.00	56.3
190.0	140.0	140.0	190.0	35.0	2.5	6.0	8.5	2.00	68.3
200.0	140.0	140.0	200.0	35.0	2.5	6.0	8.5	2.00	72.0
210.0	140.0	140.0	210.0	35.0	2.5	6.0	8.5	2.00	71.0
220.0	140.0	140.0	220.0	35.0	2.5	6.0	8.5	2.00	64.1
230.0	140.0	140.0	230.0	35.0	2.5	6.0	8.5	2.00	51.8
240.0	140.0	140.0	240.0	35.0	2.5	6.0	8.5	2.00	15.7
250.0	140.0	140.0	250.0	35.0	2.5	6.0	8.5	2.00	10.4
260.0	140.0	140.0	260.0	35.0	2.5	6.0	8.5	2.00	29.4
270.0	140.0	140.0	270.0	35.0	2.5	6.0	8.5	2.00	52.2
280.0	140.0	140.0	280.0	35.0	2.5	6.0	8.5	2.00	64.6
290.0	140.0	140.0	290.0	35.0	2.5	6.0	8.5	2.00	70.9
300.0	140.0	140.0	300.0	35.0	2.5	6.0	8.5	2.00	70.4
310.0	140.0	140.0	310.0	35.0	2.5	6.0	8.5	2.00	43.6
320.0	140.0	140.0	320.0	35.0	2.5	6.0	8.5	2.00	32.6
330.0	140.0	140.0	330.0	35.0	2.5	6.0	8.5	2.00	21.2
340.0	140.0	140.0	340.0	35.0	2.5	6.0	8.5	2.00	12.1
350.0	140.0	140.0	350.0	35.0	2.5	6.0	8.5	2.00	30.3
360.0	140.0	140.0	360.0	35.0	2.5	6.0	8.5	2.00	55.4

6.15.2 Relative contributions of force components

Case 15 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	70.5	17.0	-2.6	0.0	15.1	100.0
10.0	62.3	15.0	9.5	0.0	13.3	100.0
20.0	55.3	13.2	19.7	0.0	11.7	100.0
30.0	49.2	11.7	28.7	0.0	10.4	100.0
40.0	43.9	10.4	36.4	0.0	9.3	100.0
50.0	39.5	9.4	42.7	0.0	8.3	100.0
60.0	36.2	8.6	47.6	0.0	7.6	100.0
70.0	33.8	8.0	51.1	0.0	7.1	100.0
80.0	32.4	7.7	53.1	0.0	6.8	100.0
90.0	31.9	7.6	53.8	0.0	6.7	100.0
100.0	32.4	7.7	53.1	0.0	6.8	100.0
110.0	33.7	8.1	51.1	0.0	7.1	100.0
120.0	36.0	8.6	47.7	0.0	7.6	100.0
130.0	39.1	9.4	43.1	0.0	8.4	100.0
140.0	43.1	10.4	37.2	0.0	9.2	100.0
150.0	47.7	11.6	30.4	0.0	10.3	100.0
160.0	52.8	13.0	22.7	0.0	11.5	100.0
170.0	58.4	14.5	14.4	0.0	12.8	100.0
180.0	64.7	16.1	5.0	0.0	14.2	100.0
190.0	71.6	18.1	-5.6	0.0	15.9	100.0
200.0	80.0	20.5	-18.4	0.0	18.0	100.0
210.0	89.7	23.4	-33.7	0.0	20.5	100.0
220.0	97.8	26.1	-46.7	0.0	23.0	100.0
230.0	97.1	26.5	-40.5	0.0	22.9	100.0
240.0	-27.6	-1.3	104.2	0.0	24.7	100.0
250.0	-50.3	-7.8	133.4	0.0	24.7	100.0
260.0	-59.2	-10.6	146.0	0.0	23.8	100.0
270.0	-63.7	-11.9	151.9	0.0	23.7	100.0
280.0	-67.7	-12.6	155.1	0.0	25.3	100.0
290.0	-70.5	-12.4	154.1	0.0	28.8	100.0
300.0	-60.6	-8.2	134.8	0.0	34.1	100.0
310.0	152.3	42.2	-131.1	0.0	36.7	100.0
320.0	143.6	37.1	-113.2	0.0	32.5	100.0
330.0	116.6	29.1	-71.4	0.0	25.7	100.0
340.0	95.6	23.5	-39.8	0.0	20.7	100.0
350.0	81.0	19.7	-18.1	0.0	17.4	100.0
360.0	70.5	17.0	-2.6	0.0	15.1	100.0

6.15.3 Environment forces

Case 15 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	7.8	2.9	-3.6	0.0	2.4	9.5
10.0	7.8	2.9	-3.6	0.0	2.4	9.5
20.0	7.8	2.9	-3.5	0.0	2.4	9.6
30.0	7.8	2.9	-3.2	0.0	2.4	9.9
40.0	7.8	2.9	-2.8	0.0	2.4	10.3
50.0	7.8	2.9	-2.3	0.0	2.4	10.8
60.0	7.8	2.9	-1.6	0.0	2.4	11.5
70.0	7.8	2.9	-0.9	0.0	2.4	12.2
80.0	7.8	2.9	-0.1	0.0	2.4	13.0
90.0	7.8	2.9	0.7	0.0	2.4	13.8
100.0	7.8	2.9	1.5	0.0	2.4	14.6
110.0	7.8	2.9	2.3	0.0	2.4	15.4
120.0	7.8	2.9	3.0	0.0	2.4	16.0
130.0	7.8	2.9	3.5	0.0	2.4	16.6
140.0	7.8	2.9	4.0	0.0	2.4	17.1
150.0	7.8	2.9	4.3	0.0	2.4	17.4
160.0	7.8	2.9	4.4	0.0	2.4	17.5
170.0	7.8	2.9	4.4	0.0	2.4	17.5
180.0	7.8	2.9	4.3	0.0	2.4	17.4
190.0	7.8	2.9	4.4	0.0	2.4	17.5
200.0	7.8	2.9	4.4	0.0	2.4	17.5
210.0	7.8	2.9	4.3	0.0	2.4	17.4
220.0	7.8	2.9	4.0	0.0	2.4	17.1
230.0	7.8	2.9	3.5	0.0	2.4	16.6
240.0	7.8	2.9	3.0	0.0	2.4	16.0
250.0	7.8	2.9	2.3	0.0	2.4	15.4
260.0	7.8	2.9	1.5	0.0	2.4	14.6
270.0	7.8	2.9	0.7	0.0	2.4	13.8
280.0	7.8	2.9	-0.1	0.0	2.4	13.0
290.0	7.8	2.9	-0.9	0.0	2.4	12.2
300.0	7.8	2.9	-1.6	0.0	2.4	11.5
310.0	7.8	2.9	-2.3	0.0	2.4	10.8
320.0	7.8	2.9	-2.8	0.0	2.4	10.3
330.0	7.8	2.9	-3.2	0.0	2.4	9.9
340.0	7.8	2.9	-3.5	0.0	2.4	9.6
350.0	7.8	2.9	-3.6	0.0	2.4	9.5
360.0	7.8	2.9	-3.6	0.0	2.4	9.5

Case 15 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-24.2	-5.6	0.0	0.0	-5.0	-34.7
10.0	-24.2	-5.6	-4.8	0.0	-5.0	-39.6
20.0	-24.2	-5.6	-10.0	0.0	-5.0	-44.7
30.0	-24.2	-5.6	-15.6	0.0	-5.0	-50.4
40.0	-24.2	-5.6	-21.7	0.0	-5.0	-56.5
50.0	-24.2	-5.6	-28.0	0.0	-5.0	-62.7
60.0	-24.2	-5.6	-33.8	0.0	-5.0	-68.6
70.0	-24.2	-5.6	-38.7	0.0	-5.0	-73.4
80.0	-24.2	-5.6	-41.9	0.0	-5.0	-76.6
90.0	-24.2	-5.6	-43.0	0.0	-5.0	-77.7
100.0	-24.2	-5.6	-41.9	0.0	-5.0	-76.6
110.0	-24.2	-5.6	-38.7	0.0	-5.0	-73.4
120.0	-24.2	-5.6	-33.8	0.0	-5.0	-68.6
130.0	-24.2	-5.6	-28.0	0.0	-5.0	-62.7
140.0	-24.2	-5.6	-21.7	0.0	-5.0	-56.5
150.0	-24.2	-5.6	-15.6	0.0	-5.0	-50.4
160.0	-24.2	-5.6	-10.0	0.0	-5.0	-44.7
170.0	-24.2	-5.6	-4.8	0.0	-5.0	-39.6
180.0	-24.2	-5.6	0.0	0.0	-5.0	-34.7
190.0	-24.2	-5.6	4.8	0.0	-5.0	-29.9
200.0	-24.2	-5.6	10.0	0.0	-5.0	-24.8
210.0	-24.2	-5.6	15.6	0.0	-5.0	-19.1
220.0	-24.2	-5.6	21.7	0.0	-5.0	-13.0
230.0	-24.2	-5.6	28.0	0.0	-5.0	-6.7
240.0	-24.2	-5.6	33.8	0.0	5.0	9.0
250.0	-24.2	-5.6	38.7	0.0	5.0	13.9
260.0	-24.2	-5.6	41.9	0.0	5.0	17.1
270.0	-24.2	-5.6	43.0	0.0	5.0	18.2
280.0	-24.2	-5.6	41.9	0.0	5.0	17.1
290.0	-24.2	-5.6	38.7	0.0	5.0	13.9
300.0	-24.2	-5.6	33.8	0.0	5.0	9.0
310.0	-24.2	-5.6	28.0	0.0	-5.0	-6.7
320.0	-24.2	-5.6	21.7	0.0	-5.0	-13.0
330.0	-24.2	-5.6	15.6	0.0	-5.0	-19.1
340.0	-24.2	-5.6	10.0	0.0	-5.0	-24.8
350.0	-24.2	-5.6	4.8	0.0	-5.0	-29.9
360.0	-24.2	-5.6	0.0	0.0	-5.0	-34.7

Case 15 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	252.6	85.4	0.0	0.0	67.7	405.8
10.0	252.6	85.4	-316.6	0.0	67.7	89.2
20.0	252.6	85.4	-593.0	0.0	-67.7	-322.6
30.0	252.6	85.4	-793.7	0.0	-67.7	-523.3
40.0	252.6	85.4	-892.8	0.0	-67.7	-622.4
50.0	252.6	85.4	-876.4	0.0	-67.7	-606.1
60.0	252.6	85.4	-745.2	0.0	-67.7	-474.9
70.0	252.6	85.4	-513.8	0.0	-67.7	-243.5
80.0	252.6	85.4	-209.2	0.0	67.7	196.5
90.0	252.6	85.4	132.4	0.0	67.7	538.2
100.0	252.6	85.4	470.0	0.0	67.7	875.7
110.0	252.6	85.4	762.6	0.0	67.7	1168.4
120.0	252.6	85.4	974.5	0.0	67.7	1380.3
130.0	252.6	85.4	1079.2	0.0	67.7	1485.0
140.0	252.6	85.4	1063.0	0.0	67.7	1463.7
150.0	252.6	85.4	926.1	0.0	67.7	1331.8
160.0	252.6	85.4	683.5	0.0	67.7	1089.3
170.0	252.6	85.4	362.6	0.0	67.7	768.4
180.0	252.6	85.4	0.0	0.0	67.7	405.8
190.0	252.6	85.4	-362.6	0.0	-67.7	-92.3
200.0	252.6	85.4	-683.5	0.0	-67.7	-413.2
210.0	252.6	85.4	-926.1	0.0	-67.7	-655.7
220.0	252.6	85.4	-1063.0	0.0	-67.7	-792.6
230.0	252.6	85.4	-1079.2	0.0	-67.7	-808.9
240.0	252.6	85.4	-974.5	0.0	-67.7	-704.2
250.0	252.6	85.4	-762.6	0.0	-67.7	-492.3
260.0	252.6	85.4	-470.0	0.0	-67.7	-199.6
270.0	252.6	85.4	-132.4	0.0	67.7	273.4
280.0	252.6	85.4	209.2	0.0	67.7	615.0
290.0	252.6	85.4	513.8	0.0	67.7	919.6
300.0	252.6	85.4	745.2	0.0	67.7	1151.0
310.0	252.6	85.4	876.4	0.0	67.7	1282.2
320.0	252.6	85.4	892.8	0.0	67.7	1298.5
330.0	252.6	85.4	793.7	0.0	67.7	1199.4
340.0	252.6	85.4	593.0	0.0	67.7	998.7
350.0	252.6	85.4	316.6	0.0	67.7	722.4
360.0	252.6	85.4	0.0	0.0	67.7	405.8

6.15.4 Thruster use

Case 15 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	10.1	83.5	14.4	137.6	15.0	90.0	36.0	105.3
10.0	43.5	15.6	52.7	167.2	16.2	90.0	40.7	103.5
20.0	82.9	16.4	88.2	180.0	16.2	90.0	40.5	102.3
30.0	83.2	13.4	88.1	180.0	16.4	90.0	36.4	101.3
40.0	83.4	12.0	87.9	180.0	16.6	90.0	34.6	100.5
50.0	83.5	12.4	87.7	180.0	17.0	90.0	35.5	99.9
60.0	83.6	14.5	87.5	180.0	17.5	90.0	39.0	99.6
70.0	84.1	17.8	87.3	180.0	17.3	90.0	43.6	99.6
80.0	85.7	23.9	87.2	180.0	17.1	90.0	52.6	99.8
90.0	87.2	28.6	87.2	180.0	16.9	90.0	59.6	100.3
100.0	87.6	33.5	85.7	180.0	17.0	90.0	66.6	101.0
110.0	84.1	34.7	84.2	175.8	17.0	90.0	72.7	101.8
120.0	46.5	36.2	58.7	155.9	17.2	90.0	70.4	103.2
130.0	23.8	83.2	29.3	131.6	17.2	90.0	64.9	104.8
140.0	22.1	102.0	23.8	121.6	14.6	90.0	59.0	106.8
150.0	20.1	105.3	21.8	123.5	12.8	90.0	53.3	109.0
160.0	17.5	107.9	19.7	128.0	12.5	90.0	48.0	111.4
170.0	14.4	109.8	17.8	135.3	13.5	90.0	45.3	113.9
180.0	11.0	111.8	16.2	145.0	15.2	90.0	38.2	116.6
190.0	6.4	98.4	17.4	162.2	18.2	90.0	34.7	120.4
200.0	7.2	30.0	24.0	173.1	18.3	90.0	30.3	125.3
210.0	3.8	6.5	21.2	179.1	18.3	90.0	25.8	132.3
220.0	3.4	220.8	14.6	183.4	17.3	90.0	21.4	142.7
230.0	4.8	228.1	13.3	184.9	13.9	90.0	17.9	157.9
240.0	8.7	224.5	11.7	212.9	3.4	90.0	18.4	209.4
250.0	9.8	216.4	9.6	219.0	-2.0	90.0	20.7	222.1
260.0	10.9	207.8	6.9	225.5	-7.4	90.0	22.5	229.4
270.0	12.3	189.9	2.8	232.4	-13.9	90.0	22.8	232.8
280.0	15.0	180.0	2.5	0.0	-17.1	90.0	21.4	232.7
290.0	27.9	176.7	15.7	6.6	-17.3	90.0	18.5	228.7
300.0	26.7	171.1	15.5	16.2	-17.5	90.0	14.6	218.3
310.0	18.5	142.6	7.8	60.2	-11.2	90.0	12.8	148.1
320.0	14.9	112.3	9.3	119.8	-8.9	90.0	16.6	128.4
330.0	14.5	108.1	10.8	119.8	-4.1	90.0	21.5	117.4
340.0	13.0	106.3	12.0	119.8	1.9	90.0	26.6	111.2
350.0	11.2	99.8	13.0	125.8	8.4	90.0	31.4	107.6
360.0	10.1	83.5	14.4	137.6	15.0	90.0	36.0	105.3

6.15.5 Thruster loss

Case 15 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.92	0.90	0.82
10.0	0.86	0.85	0.81
20.0	0.86	0.79	0.81
30.0	0.86	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.87	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.89	0.78	0.85
90.0	0.89	0.78	0.84
100.0	0.90	0.76	0.85
110.0	0.91	0.77	0.85
120.0	0.93	0.81	0.86
130.0	0.87	0.81	0.86
140.0	0.87	0.81	0.86
150.0	0.87	0.82	0.87
160.0	0.88	0.82	0.88
170.0	0.89	0.82	0.89
180.0	0.90	0.82	0.91
190.0	0.93	0.79	0.91
200.0	0.95	0.75	0.91
210.0	0.96	0.72	0.92
220.0	0.81	0.78	0.92
230.0	0.81	0.81	0.93
240.0	0.81	0.85	0.94
250.0	0.82	0.86	0.85
260.0	0.83	0.86	0.85
270.0	0.82	0.87	0.84
280.0	0.78	0.94	0.85
290.0	0.81	0.91	0.86
300.0	0.85	0.89	0.87
310.0	0.94	0.89	0.85
320.0	0.94	0.90	0.83
330.0	0.94	0.90	0.82
340.0	0.94	0.90	0.84
350.0	0.94	0.90	0.82
360.0	0.92	0.90	0.82

Preliminary Design, @IDR5

6.16 Case 16 - Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 4

6.16.1 Environment and thrust utilisation

Case 16 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	150.0	150.0	0.0	35.0	2.5	6.0	8.5	2.00	35.7
10.0	150.0	150.0	10.0	35.0	2.5	6.0	8.5	2.00	60.2
20.0	150.0	150.0	20.0	35.0	2.5	6.0	8.5	2.00	89.1
30.0	150.0	150.0	30.0	35.0	2.5	6.0	8.5	2.00	> 100.0
40.0	150.0	150.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	150.0	150.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	150.0	150.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	150.0	150.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	150.0	150.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	150.0	150.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	150.0	150.0	100.0	35.0	2.5	6.0	8.5	2.00	> 100.0
110.0	150.0	150.0	110.0	35.0	2.5	6.0	8.5	2.00	81.8
120.0	150.0	150.0	120.0	35.0	2.5	6.0	8.5	2.00	62.0
130.0	150.0	150.0	130.0	35.0	2.5	6.0	8.5	2.00	46.0
140.0	150.0	150.0	140.0	35.0	2.5	6.0	8.5	2.00	34.2
150.0	150.0	150.0	150.0	35.0	2.5	6.0	8.5	2.00	28.0
160.0	150.0	150.0	160.0	35.0	2.5	6.0	8.5	2.00	27.0
170.0	150.0	150.0	170.0	35.0	2.5	6.0	8.5	2.00	30.9
180.0	150.0	150.0	180.0	35.0	2.5	6.0	8.5	2.00	36.9
190.0	150.0	150.0	190.0	35.0	2.5	6.0	8.5	2.00	48.9
200.0	150.0	150.0	200.0	35.0	2.5	6.0	8.5	2.00	52.6
210.0	150.0	150.0	210.0	35.0	2.5	6.0	8.5	2.00	51.5
220.0	150.0	150.0	220.0	35.0	2.5	6.0	8.5	2.00	30.5
230.0	150.0	150.0	230.0	35.0	2.5	6.0	8.5	2.00	19.6
240.0	150.0	150.0	240.0	35.0	2.5	6.0	8.5	2.00	12.1
250.0	150.0	150.0	250.0	35.0	2.5	6.0	8.5	2.00	23.6
260.0	150.0	150.0	260.0	35.0	2.5	6.0	8.5	2.00	43.3
270.0	150.0	150.0	270.0	35.0	2.5	6.0	8.5	2.00	65.9
280.0	150.0	150.0	280.0	35.0	2.5	6.0	8.5	2.00	78.1
290.0	150.0	150.0	290.0	35.0	2.5	6.0	8.5	2.00	84.4
300.0	150.0	150.0	300.0	35.0	2.5	6.0	8.5	2.00	83.8
310.0	150.0	150.0	310.0	35.0	2.5	6.0	8.5	2.00	78.9
320.0	150.0	150.0	320.0	35.0	2.5	6.0	8.5	2.00	67.2
330.0	150.0	150.0	330.0	35.0	2.5	6.0	8.5	2.00	35.8
340.0	150.0	150.0	340.0	35.0	2.5	6.0	8.5	2.00	19.2
350.0	150.0	150.0	350.0	35.0	2.5	6.0	8.5	2.00	11.9
360.0	150.0	150.0	360.0	35.0	2.5	6.0	8.5	2.00	35.7

6.16.2 Relative contributions of force components

Case 16 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	73.0	16.9	-5.1	0.0	15.3	100.0
10.0	62.1	14.1	10.9	0.0	12.9	100.0
20.0	53.4	12.0	23.7	0.0	11.0	100.0
30.0	46.1	10.2	34.3	0.0	9.4	100.0
40.0	40.1	8.9	42.9	0.0	8.1	100.0
50.0	35.3	7.8	49.8	0.0	7.2	100.0
60.0	31.8	7.0	54.8	0.0	6.4	100.0
70.0	29.4	6.4	58.3	0.0	5.9	100.0
80.0	28.0	6.1	60.3	0.0	5.7	100.0
90.0	27.5	6.0	60.9	0.0	5.6	100.0
100.0	28.0	6.2	60.2	0.0	5.7	100.0
110.0	29.3	6.5	58.2	0.0	6.0	100.0
120.0	31.7	7.1	54.7	0.0	6.5	100.0
130.0	35.0	7.9	49.9	0.0	7.2	100.0
140.0	39.2	9.0	43.7	0.0	8.2	100.0
150.0	44.2	10.3	36.2	0.0	9.3	100.0
160.0	49.8	11.8	27.8	0.0	10.5	100.0
170.0	55.9	13.5	18.5	0.0	12.1	100.0
180.0	62.6	15.4	8.3	0.0	13.7	100.0
190.0	69.1	17.5	-2.1	0.0	15.4	100.0
200.0	75.0	19.9	-12.1	0.0	17.3	100.0
210.0	76.0	21.0	-15.9	0.0	18.4	100.0
220.0	74.0	22.1	-46.6	0.0	17.1	100.0
230.0	69.7	4.1	85.5	0.0	19.1	100.0
240.0	-21.8	-1.2	110.2	0.0	17.8	100.0
250.0	-34.0	-3.8	121.8	0.0	16.0	100.0
260.0	-36.7	-4.9	126.9	0.0	14.7	100.0
270.0	-38.5	-5.5	129.6	0.0	14.4	100.0
280.0	-40.8	-5.9	131.5	0.0	15.1	100.0
290.0	-43.6	-6.0	132.4	0.0	17.1	100.0
300.0	-45.1	-5.1	129.2	0.0	20.9	100.0
310.0	-35.3	-0.5	109.2	0.0	26.7	100.0
320.0	17.1	14.6	38.9	0.0	29.4	100.0
330.0	127.6	33.5	-90.3	0.0	29.2	100.0
340.0	106.9	26.2	-56.4	0.0	23.3	100.0
350.0	87.3	20.6	-26.6	0.0	18.6	100.0
360.0	73.0	16.9	-5.1	0.0	15.3	100.0

6.16.3 Environment forces

Case 16 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.3	3.1	-3.6	0.0	2.4	10.2
10.0	8.3	3.1	-3.6	0.0	2.4	10.2
20.0	8.3	3.1	-3.5	0.0	2.4	10.3
30.0	8.3	3.1	-3.2	0.0	2.4	10.6
40.0	8.3	3.1	-2.8	0.0	2.4	11.0
50.0	8.3	3.1	-2.3	0.0	2.4	11.5
60.0	8.3	3.1	-1.6	0.0	2.4	12.2
70.0	8.3	3.1	-0.9	0.0	2.4	12.9
80.0	8.3	3.1	-0.1	0.0	2.4	13.7
90.0	8.3	3.1	0.7	0.0	2.4	14.5
100.0	8.3	3.1	1.5	0.0	2.4	15.3
110.0	8.3	3.1	2.3	0.0	2.4	16.1
120.0	8.3	3.1	3.0	0.0	2.4	16.7
130.0	8.3	3.1	3.5	0.0	2.4	17.3
140.0	8.3	3.1	4.0	0.0	2.4	17.8
150.0	8.3	3.1	4.3	0.0	2.4	18.1
160.0	8.3	3.1	4.4	0.0	2.4	18.2
170.0	8.3	3.1	4.4	0.0	2.4	18.2
180.0	8.3	3.1	4.3	0.0	2.4	18.1
190.0	8.3	3.1	4.4	0.0	2.4	18.2
200.0	8.3	3.1	4.4	0.0	2.4	18.2
210.0	8.3	3.1	4.3	0.0	2.4	18.1
220.0	8.3	3.1	4.0	0.0	2.4	17.8
230.0	8.3	3.1	3.5	0.0	2.4	17.3
240.0	8.3	3.1	3.0	0.0	2.4	16.7
250.0	8.3	3.1	2.3	0.0	2.4	16.1
260.0	8.3	3.1	1.5	0.0	2.4	15.3
270.0	8.3	3.1	0.7	0.0	2.4	14.5
280.0	8.3	3.1	-0.1	0.0	2.4	13.7
290.0	8.3	3.1	-0.9	0.0	2.4	12.9
300.0	8.3	3.1	-1.6	0.0	2.4	12.2
310.0	8.3	3.1	-2.3	0.0	2.4	11.5
320.0	8.3	3.1	-2.8	0.0	2.4	11.0
330.0	8.3	3.1	-3.2	0.0	2.4	10.6
340.0	8.3	3.1	-3.5	0.0	2.4	10.3
350.0	8.3	3.1	-3.6	0.0	2.4	10.2
360.0	8.3	3.1	-3.6	0.0	2.4	10.2

Case 16 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-17.7	-3.6	0.0	0.0	-3.4	-24.7
10.0	-17.7	-3.6	-4.8	0.0	-3.4	-29.6
20.0	-17.7	-3.6	-10.0	0.0	-3.4	-34.7
30.0	-17.7	-3.6	-15.6	0.0	-3.4	-40.4
40.0	-17.7	-3.6	-21.7	0.0	-3.4	-46.5
50.0	-17.7	-3.6	-28.0	0.0	-3.4	-52.7
60.0	-17.7	-3.6	-33.8	0.0	-3.4	-58.6
70.0	-17.7	-3.6	-38.7	0.0	-3.4	-63.4
80.0	-17.7	-3.6	-41.9	0.0	-3.4	-66.6
90.0	-17.7	-3.6	-43.0	0.0	-3.4	-67.7
100.0	-17.7	-3.6	-41.9	0.0	-3.4	-66.6
110.0	-17.7	-3.6	-38.7	0.0	-3.4	-63.4
120.0	-17.7	-3.6	-33.8	0.0	-3.4	-58.6
130.0	-17.7	-3.6	-28.0	0.0	-3.4	-52.7
140.0	-17.7	-3.6	-21.7	0.0	-3.4	-46.5
150.0	-17.7	-3.6	-15.6	0.0	-3.4	-40.4
160.0	-17.7	-3.6	-10.0	0.0	-3.4	-34.7
170.0	-17.7	-3.6	-4.8	0.0	-3.4	-29.6
180.0	-17.7	-3.6	0.0	0.0	-3.4	-24.7
190.0	-17.7	-3.6	4.8	0.0	-3.4	-19.9
200.0	-17.7	-3.6	10.0	0.0	-3.4	-14.8
210.0	-17.7	-3.6	15.6	0.0	-3.4	-9.1
220.0	-17.7	-3.6	21.7	0.0	3.4	3.8
230.0	-17.7	-3.6	28.0	0.0	3.4	10.1
240.0	-17.7	-3.6	33.8	0.0	3.4	15.9
250.0	-17.7	-3.6	38.7	0.0	3.4	20.8
260.0	-17.7	-3.6	41.9	0.0	3.4	24.0
270.0	-17.7	-3.6	43.0	0.0	3.4	25.1
280.0	-17.7	-3.6	41.9	0.0	3.4	24.0
290.0	-17.7	-3.6	38.7	0.0	3.4	20.8
300.0	-17.7	-3.6	33.8	0.0	3.4	15.9
310.0	-17.7	-3.6	28.0	0.0	3.4	10.1
320.0	-17.7	-3.6	21.7	0.0	3.4	3.8
330.0	-17.7	-3.6	15.6	0.0	-3.4	-9.1
340.0	-17.7	-3.6	10.0	0.0	-3.4	-14.8
350.0	-17.7	-3.6	4.8	0.0	-3.4	-19.9
360.0	-17.7	-3.6	0.0	0.0	-3.4	-24.7

Case 16 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	246.7	79.9	0.0	0.0	65.4	392.0
10.0	246.7	79.9	-316.6	0.0	65.4	75.4
20.0	246.7	79.9	-593.0	0.0	-65.4	-331.8
30.0	246.7	79.9	-793.7	0.0	-65.4	-532.5
40.0	246.7	79.9	-892.8	0.0	-65.4	-631.6
50.0	246.7	79.9	-876.4	0.0	-65.4	-615.3
60.0	246.7	79.9	-745.2	0.0	-65.4	-484.1
70.0	246.7	79.9	-513.8	0.0	-65.4	-252.7
80.0	246.7	79.9	-209.2	0.0	65.4	182.8
90.0	246.7	79.9	132.4	0.0	65.4	524.4
100.0	246.7	79.9	470.0	0.0	65.4	862.0
110.0	246.7	79.9	762.6	0.0	65.4	1154.7
120.0	246.7	79.9	974.5	0.0	65.4	1366.6
130.0	246.7	79.9	1079.2	0.0	65.4	1471.3
140.0	246.7	79.9	1063.0	0.0	65.4	1455.0
150.0	246.7	79.9	926.1	0.0	65.4	1318.1
160.0	246.7	79.9	683.5	0.0	65.4	1075.6
170.0	246.7	79.9	362.6	0.0	65.4	754.6
180.0	246.7	79.9	0.0	0.0	65.4	392.0
190.0	246.7	79.9	-362.6	0.0	-65.4	-101.4
200.0	246.7	79.9	-683.5	0.0	-65.4	-422.4
210.0	246.7	79.9	-926.1	0.0	-65.4	-664.9
220.0	246.7	79.9	-1063.0	0.0	-65.4	-801.8
230.0	246.7	79.9	-1079.2	0.0	-65.4	-818.1
240.0	246.7	79.9	-974.5	0.0	-65.4	-713.4
250.0	246.7	79.9	-762.6	0.0	-65.4	-501.5
260.0	246.7	79.9	-470.0	0.0	-65.4	-208.8
270.0	246.7	79.9	-132.4	0.0	65.4	259.7
280.0	246.7	79.9	209.2	0.0	65.4	601.3
290.0	246.7	79.9	513.8	0.0	65.4	905.9
300.0	246.7	79.9	745.2	0.0	65.4	1137.3
310.0	246.7	79.9	876.4	0.0	65.4	1268.5
320.0	246.7	79.9	892.8	0.0	65.4	1284.8
330.0	246.7	79.9	793.7	0.0	65.4	1185.7
340.0	246.7	79.9	593.0	0.0	65.4	985.0
350.0	246.7	79.9	316.6	0.0	65.4	708.7
360.0	246.7	79.9	0.0	0.0	65.4	392.1

6.16.4 Thruster use

Case 16 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	8.0	101.1	11.5	139.1	9.4	90.0	26.8	112.4
10.0	7.0	77.7	13.5	150.1	16.0	90.0	31.3	109.0
20.0	59.7	9.1	69.8	172.5	16.2	90.0	36.2	106.6
30.0	80.9	13.5	88.1	180.0	16.4	90.0	36.4	104.9
40.0	81.6	12.0	87.9	180.0	16.6	90.0	34.6	103.5
50.0	81.9	12.4	87.7	180.0	17.0	90.0	35.4	102.6
60.0	82.1	14.5	87.5	180.0	17.5	90.0	39.0	101.9
70.0	82.5	17.9	87.3	180.0	17.3	90.0	43.5	101.7
80.0	83.8	24.1	87.2	180.0	17.1	90.0	52.4	101.8
90.0	85.1	29.0	87.2	180.0	16.9	90.0	59.5	102.3
100.0	85.3	34.1	85.7	180.0	17.0	90.0	66.5	103.1
110.0	44.5	33.5	57.5	157.7	17.0	90.0	65.4	104.2
120.0	21.6	99.2	24.2	123.4	17.1	90.0	60.9	106.0
130.0	21.4	104.9	22.9	121.1	12.4	90.0	55.5	108.2
140.0	20.5	109.9	21.2	120.7	9.0	90.0	49.8	110.9
150.0	18.7	114.2	19.2	122.8	7.2	90.0	44.2	114.1
160.0	16.3	118.3	17.1	127.9	6.9	90.0	39.2	117.7
170.0	13.3	122.7	15.2	136.4	7.9	90.0	34.7	121.6
180.0	10.2	129.0	13.8	148.0	9.5	90.0	30.5	126.2
190.0	6.4	144.5	13.4	165.6	12.9	90.0	27.0	132.5
200.0	4.9	174.5	13.4	178.1	13.8	90.0	23.4	141.0
210.0	4.9	207.2	13.9	189.0	13.5	90.0	20.2	153.2
220.0	8.0	225.1	13.5	205.6	7.6	90.0	18.2	192.2
230.0	9.5	227.2	13.5	215.9	4.2	90.0	20.0	210.2
240.0	10.9	224.0	11.9	221.5	-0.5	90.0	23.1	223.6
250.0	12.1	217.1	8.0	229.8	-5.9	90.0	26.3	232.3
260.0	13.1	207.4	7.5	239.9	-11.3	90.0	28.4	237.4
270.0	9.5	191.7	6.2	317.3	-16.9	90.0	29.0	240.0
280.0	4.1	184.2	30.5	353.1	-17.1	90.0	27.6	240.3
290.0	56.3	181.7	43.4	357.5	-17.3	90.0	24.5	238.2
300.0	54.8	179.2	42.6	1.1	-17.5	90.0	20.1	232.6
310.0	45.2	175.8	33.7	6.1	-17.0	90.0	15.3	221.2
320.0	23.3	163.8	13.0	28.9	-16.6	90.0	11.6	199.2
330.0	13.6	119.1	7.9	119.8	-9.7	90.0	14.0	139.3
340.0	12.1	118.6	9.1	119.8	-3.8	90.0	18.0	125.0
350.0	9.9	117.6	10.1	123.9	2.8	90.0	22.4	117.1
360.0	8.0	101.1	11.5	139.1	9.4	90.0	26.8	112.4

6.16.5 Thruster loss

Case 16 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.94	0.90	0.82
10.0	0.90	0.89	0.81
20.0	0.86	0.83	0.81
30.0	0.86	0.78	0.82
40.0	0.87	0.78	0.83
50.0	0.87	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.89	0.78	0.85
90.0	0.89	0.78	0.84
100.0	0.90	0.76	0.85
110.0	0.91	0.81	0.85
120.0	0.85	0.81	0.86
130.0	0.86	0.81	0.86
140.0	0.86	0.81	0.86
150.0	0.86	0.82	0.87
160.0	0.87	0.82	0.88
170.0	0.87	0.82	0.89
180.0	0.88	0.81	0.91
190.0	0.87	0.78	0.91
200.0	0.75	0.72	0.91
210.0	0.80	0.78	0.92
220.0	0.81	0.83	0.92
230.0	0.81	0.84	0.93
240.0	0.81	0.85	0.86
250.0	0.82	0.85	0.85
260.0	0.83	0.85	0.85
270.0	0.82	0.88	0.84
280.0	0.80	0.92	0.85
290.0	0.79	0.92	0.86
300.0	0.79	0.91	0.87
310.0	0.82	0.88	0.85
320.0	0.89	0.87	0.83
330.0	0.94	0.90	0.82
340.0	0.94	0.90	0.81
350.0	0.94	0.90	0.82
360.0	0.94	0.90	0.82

Preliminary Design, @IDR5

6.17 Case 17 - Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 4

6.17.1 Environment and thrust utilisation

Case 17 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	160.0	160.0	0.0	35.0	2.5	6.0	8.5	2.00	20.4
10.0	160.0	160.0	10.0	35.0	2.5	6.0	8.5	2.00	49.3
20.0	160.0	160.0	20.0	35.0	2.5	6.0	8.5	2.00	72.4
30.0	160.0	160.0	30.0	35.0	2.5	6.0	8.5	2.00	92.9
40.0	160.0	160.0	40.0	35.0	2.5	6.0	8.5	2.00	> 100.0
50.0	160.0	160.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	160.0	160.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	160.0	160.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	160.0	160.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	160.0	160.0	90.0	35.0	2.5	6.0	8.5	2.00	> 100.0
100.0	160.0	160.0	100.0	35.0	2.5	6.0	8.5	2.00	86.0
110.0	160.0	160.0	110.0	35.0	2.5	6.0	8.5	2.00	66.7
120.0	160.0	160.0	120.0	35.0	2.5	6.0	8.5	2.00	46.7
130.0	160.0	160.0	130.0	35.0	2.5	6.0	8.5	2.00	31.2
140.0	160.0	160.0	140.0	35.0	2.5	6.0	8.5	2.00	22.5
150.0	160.0	160.0	150.0	35.0	2.5	6.0	8.5	2.00	17.7
160.0	160.0	160.0	160.0	35.0	2.5	6.0	8.5	2.00	15.4
170.0	160.0	160.0	170.0	35.0	2.5	6.0	8.5	2.00	15.7
180.0	160.0	160.0	180.0	35.0	2.5	6.0	8.5	2.00	22.0
190.0	160.0	160.0	190.0	35.0	2.5	6.0	8.5	2.00	32.6
200.0	160.0	160.0	200.0	35.0	2.5	6.0	8.5	2.00	36.2
210.0	160.0	160.0	210.0	35.0	2.5	6.0	8.5	2.00	26.0
220.0	160.0	160.0	220.0	35.0	2.5	6.0	8.5	2.00	20.5
230.0	160.0	160.0	230.0	35.0	2.5	6.0	8.5	2.00	13.3
240.0	160.0	160.0	240.0	35.0	2.5	6.0	8.5	2.00	16.2
250.0	160.0	160.0	250.0	35.0	2.5	6.0	8.5	2.00	35.6
260.0	160.0	160.0	260.0	35.0	2.5	6.0	8.5	2.00	54.6
270.0	160.0	160.0	270.0	35.0	2.5	6.0	8.5	2.00	75.7
280.0	160.0	160.0	280.0	35.0	2.5	6.0	8.5	2.00	87.8
290.0	160.0	160.0	290.0	35.0	2.5	6.0	8.5	2.00	94.1
300.0	160.0	160.0	300.0	35.0	2.5	6.0	8.5	2.00	93.5
310.0	160.0	160.0	310.0	35.0	2.5	6.0	8.5	2.00	88.9
320.0	160.0	160.0	320.0	35.0	2.5	6.0	8.5	2.00	77.6
330.0	160.0	160.0	330.0	35.0	2.5	6.0	8.5	2.00	61.2
340.0	160.0	160.0	340.0	35.0	2.5	6.0	8.5	2.00	30.5
350.0	160.0	160.0	350.0	35.0	2.5	6.0	8.5	2.00	8.6
360.0	160.0	160.0	360.0	35.0	2.5	6.0	8.5	2.00	20.0

6.17.2 Relative contributions of force components

Case 17 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	74.5	19.3	-10.8	0.0	17.0	100.0
10.0	60.1	14.9	11.7	0.0	13.3	100.0
20.0	48.9	11.7	28.8	0.0	10.6	100.0
30.0	40.2	9.4	41.8	0.0	8.6	100.0
40.0	33.6	7.7	51.7	0.0	7.1	100.0
50.0	28.6	6.5	58.9	0.0	6.0	100.0
60.0	25.2	5.6	63.9	0.0	5.3	100.0
70.0	22.9	5.1	67.2	0.0	4.8	100.0
80.0	21.6	4.8	69.1	0.0	4.5	100.0
90.0	21.2	4.8	69.6	0.0	4.4	100.0
100.0	21.7	4.9	68.8	0.0	4.6	100.0
110.0	23.0	5.3	66.8	0.0	4.9	100.0
120.0	25.3	5.9	63.4	0.0	5.4	100.0
130.0	28.6	6.8	58.3	0.0	6.2	100.0
140.0	33.0	8.1	51.7	0.0	7.3	100.0
150.0	38.2	9.7	43.5	0.0	8.5	100.0
160.0	44.2	11.6	34.1	0.0	10.2	100.0
170.0	50.4	13.7	24.0	0.0	11.9	100.0
180.0	56.4	16.1	13.8	0.0	13.7	100.0
190.0	59.8	18.2	6.8	0.0	15.2	100.0
200.0	57.7	19.2	1.5	0.0	15.6	100.0
210.0	28.4	13.5	42.2	0.0	15.6	100.0
220.0	6.9	8.1	69.6	0.0	15.5	100.0
230.0	1.3	3.4	90.5	0.0	13.4	100.0
240.0	-11.1	0.7	102.1	0.0	11.3	100.0
250.0	-16.8	-0.7	107.9	0.0	9.7	100.0
260.0	-18.0	-1.4	110.7	0.0	8.8	100.0
270.0	-18.9	-1.7	112.2	0.0	8.5	100.0
280.0	-20.0	-1.9	113.1	0.0	8.8	100.0
290.0	-21.3	-1.9	113.4	0.0	9.8	100.0
300.0	-22.5	-1.4	112.1	0.0	11.8	100.0
310.0	-21.6	0.3	105.9	0.0	15.4	100.0
320.0	-10.9	5.5	84.3	0.0	21.2	100.0
330.0	28.4	18.2	26.7	0.0	26.7	100.0
340.0	105.4	32.6	-64.9	0.0	27.0	100.0
350.0	92.7	25.6	-40.4	0.0	22.1	100.0
360.0	74.5	19.3	-10.8	0.0	17.0	100.0

6.17.3 Environment forces

Case 17 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.2	3.2	-3.6	0.0	2.5	10.3
10.0	8.2	3.2	-3.6	0.0	2.5	10.3
20.0	8.2	3.2	-3.5	0.0	2.5	10.5
30.0	8.2	3.2	-3.2	0.0	2.5	10.7
40.0	8.2	3.2	-2.8	0.0	2.5	11.1
50.0	8.2	3.2	-2.3	0.0	2.5	11.7
60.0	8.2	3.2	-1.6	0.0	2.5	12.3
70.0	8.2	3.2	-0.9	0.0	2.5	13.1
80.0	8.2	3.2	-0.1	0.0	2.5	13.8
90.0	8.2	3.2	0.7	0.0	2.5	14.7
100.0	8.2	3.2	1.5	0.0	2.5	15.5
110.0	8.2	3.2	2.3	0.0	2.5	16.2
120.0	8.2	3.2	3.0	0.0	2.5	16.9
130.0	8.2	3.2	3.5	0.0	2.5	17.5
140.0	8.2	3.2	4.0	0.0	2.5	17.9
150.0	8.2	3.2	4.3	0.0	2.5	18.2
160.0	8.2	3.2	4.4	0.0	2.5	18.4
170.0	8.2	3.2	4.4	0.0	2.5	18.4
180.0	8.2	3.2	4.3	0.0	2.5	18.3
190.0	8.2	3.2	4.4	0.0	2.5	18.4
200.0	8.2	3.2	4.4	0.0	2.5	18.4
210.0	8.2	3.2	4.3	0.0	2.5	18.2
220.0	8.2	3.2	4.0	0.0	2.5	17.9
230.0	8.2	3.2	3.5	0.0	2.5	17.5
240.0	8.2	3.2	3.0	0.0	2.5	16.9
250.0	8.2	3.2	2.3	0.0	2.5	16.2
260.0	8.2	3.2	1.5	0.0	2.5	15.5
270.0	8.2	3.2	0.7	0.0	2.5	14.7
280.0	8.2	3.2	-0.1	0.0	2.5	13.8
290.0	8.2	3.2	-0.9	0.0	2.5	13.1
300.0	8.2	3.2	-1.6	0.0	2.5	12.3
310.0	8.2	3.2	-2.3	0.0	2.5	11.7
320.0	8.2	3.2	-2.8	0.0	2.5	11.1
330.0	8.2	3.2	-3.2	0.0	2.5	10.7
340.0	8.2	3.2	-3.5	0.0	2.5	10.5
350.0	8.2	3.2	-3.6	0.0	2.5	10.3
360.0	8.2	3.2	-3.6	0.0	2.5	10.3

Case 17 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-11.1	-2.1	0.0	0.0	-2.1	-15.4
10.0	-11.1	-2.1	-4.8	0.0	-2.1	-20.2
20.0	-11.1	-2.1	-10.0	0.0	-2.1	-25.4
30.0	-11.1	-2.1	-15.6	0.0	-2.1	-31.0
40.0	-11.1	-2.1	-21.7	0.0	-2.1	-37.1
50.0	-11.1	-2.1	-28.0	0.0	-2.1	-43.4
60.0	-11.1	-2.1	-33.8	0.0	-2.1	-49.2
70.0	-11.1	-2.1	-38.7	0.0	-2.1	-54.1
80.0	-11.1	-2.1	-41.9	0.0	-2.1	-57.2
90.0	-11.1	-2.1	-43.0	0.0	-2.1	-58.4
100.0	-11.1	-2.1	-41.9	0.0	-2.1	-57.2
110.0	-11.1	-2.1	-38.7	0.0	-2.1	-54.1
120.0	-11.1	-2.1	-33.8	0.0	-2.1	-49.2
130.0	-11.1	-2.1	-28.0	0.0	-2.1	-43.4
140.0	-11.1	-2.1	-21.7	0.0	-2.1	-37.1
150.0	-11.1	-2.1	-15.6	0.0	-2.1	-31.0
160.0	-11.1	-2.1	-10.0	0.0	-2.1	-25.4
170.0	-11.1	-2.1	-4.8	0.0	-2.1	-20.2
180.0	-11.1	-2.1	0.0	0.0	-2.1	-15.4
190.0	-11.1	-2.1	4.8	0.0	-2.1	-10.5
200.0	-11.1	-2.1	10.0	0.0	-2.1	-5.4
210.0	-11.1	-2.1	15.6	0.0	2.1	4.5
220.0	-11.1	-2.1	21.7	0.0	2.1	10.6
230.0	-11.1	-2.1	28.0	0.0	2.1	16.9
240.0	-11.1	-2.1	33.8	0.0	2.1	22.7
250.0	-11.1	-2.1	38.7	0.0	2.1	27.6
260.0	-11.1	-2.1	41.9	0.0	2.1	30.8
270.0	-11.1	-2.1	43.0	0.0	2.1	31.9
280.0	-11.1	-2.1	41.9	0.0	2.1	30.8
290.0	-11.1	-2.1	38.7	0.0	2.1	27.6
300.0	-11.1	-2.1	33.8	0.0	2.1	22.7
310.0	-11.1	-2.1	28.0	0.0	2.1	16.9
320.0	-11.1	-2.1	21.7	0.0	2.1	10.6
330.0	-11.1	-2.1	15.6	0.0	2.1	4.5
340.0	-11.1	-2.1	10.0	0.0	-2.1	-5.4
350.0	-11.1	-2.1	4.8	0.0	-2.1	-10.5
360.0	-11.1	-2.1	0.0	0.0	-2.1	-15.4

Case 17 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	193.5	60.9	0.0	0.0	49.5	303.9
10.0	193.5	60.9	-316.6	0.0	-49.5	-111.7
20.0	193.5	60.9	-593.0	0.0	-49.5	-388.1
30.0	193.5	60.9	-793.7	0.0	-49.5	-588.8
40.0	193.5	60.9	-892.8	0.0	-49.5	-687.9
50.0	193.5	60.9	-876.4	0.0	-49.5	-671.6
60.0	193.5	60.9	-745.2	0.0	-49.5	-540.4
70.0	193.5	60.9	-513.8	0.0	-49.5	-309.0
80.0	193.5	60.9	-209.2	0.0	49.5	94.7
90.0	193.5	60.9	132.4	0.0	49.5	436.3
100.0	193.5	60.9	470.0	0.0	49.5	773.9
110.0	193.5	60.9	762.6	0.0	49.5	1066.5
120.0	193.5	60.9	974.5	0.0	49.5	1278.4
130.0	193.5	60.9	1079.2	0.0	49.5	1398.1
140.0	193.5	60.9	1063.0	0.0	49.5	1365.8
150.0	193.5	60.9	926.1	0.0	49.5	1230.0
160.0	193.5	60.9	683.5	0.0	49.5	987.4
170.0	193.5	60.9	362.6	0.0	49.5	666.5
180.0	193.5	60.9	0.0	0.0	49.5	303.9
190.0	193.5	60.9	-362.6	0.0	-49.5	-157.7
200.0	193.5	60.9	-683.5	0.0	-49.5	-478.7
210.0	193.5	60.9	-926.1	0.0	-49.5	-721.2
220.0	193.5	60.9	-1063.0	0.0	-49.5	-858.1
230.0	193.5	60.9	-1079.2	0.0	-49.5	-874.4
240.0	193.5	60.9	-974.5	0.0	-49.5	-769.7
250.0	193.5	60.9	-762.6	0.0	-49.5	-557.8
260.0	193.5	60.9	-470.0	0.0	-49.5	-265.1
270.0	193.5	60.9	-132.4	0.0	49.5	171.5
280.0	193.5	60.9	209.2	0.0	49.5	513.1
290.0	193.5	60.9	513.8	0.0	49.5	817.7
300.0	193.5	60.9	745.2	0.0	49.5	1049.1
310.0	193.5	60.9	876.4	0.0	49.5	1180.3
320.0	193.5	60.9	892.8	0.0	49.5	1196.7
330.0	193.5	60.9	793.7	0.0	49.5	1097.6
340.0	193.5	60.9	593.0	0.0	49.5	896.8
350.0	193.5	60.9	316.6	0.0	49.5	620.5
360.0	193.5	60.9	0.0	0.0	49.5	303.9

6.17.4 Thruster use

Case 17 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	6.2	122.7	8.6	144.4	5.1	90.0	18.5	123.9
10.0	3.7	87.4	11.1	161.4	13.0	90.0	22.7	117.1
20.0	24.6	10.9	34.9	172.6	16.2	90.0	27.4	112.4
30.0	65.7	6.6	76.4	174.7	16.4	90.0	32.8	109.1
40.0	79.6	11.3	87.9	180.0	16.6	90.0	33.7	107.0
50.0	80.2	11.6	87.7	180.0	17.0	90.0	34.4	105.3
60.0	80.4	13.8	87.5	180.0	17.5	90.0	37.9	104.3
70.0	80.8	17.2	87.3	180.0	17.3	90.0	42.4	103.8
80.0	81.7	23.2	87.2	180.0	17.1	90.0	50.7	103.8
90.0	82.7	28.2	87.2	180.0	16.9	90.0	57.9	104.3
100.0	51.1	24.6	64.8	162.9	17.0	90.0	59.3	105.1
110.0	19.8	74.5	28.0	140.1	17.0	90.0	56.4	106.7
120.0	19.3	105.0	21.4	123.8	12.8	90.0	52.0	108.9
130.0	19.4	111.4	20.1	121.2	8.1	90.0	46.7	111.9
140.0	18.7	117.1	18.4	120.7	4.7	90.0	41.2	115.8
150.0	17.1	122.6	16.4	123.2	2.9	90.0	36.0	120.4
160.0	14.9	128.4	14.4	129.4	2.6	90.0	31.3	125.9
170.0	12.2	135.5	12.6	140.0	3.5	90.0	27.3	132.3
180.0	9.5	146.4	11.5	154.6	5.2	90.0	23.2	139.9
190.0	6.9	169.6	11.6	174.2	8.1	90.0	21.2	150.2
200.0	6.3	197.0	12.5	188.4	9.1	90.0	19.1	163.6
210.0	8.3	219.8	13.0	204.7	6.2	90.0	18.8	193.9
220.0	9.9	227.8	13.6	211.2	4.4	90.0	20.8	210.7
230.0	11.5	229.1	13.5	229.6	1.0	90.0	24.3	224.0
240.0	12.9	225.9	12.5	231.0	-3.7	90.0	28.3	233.4
250.0	14.1	219.3	10.8	240.3	-9.1	90.0	32.0	239.5
260.0	15.1	217.0	8.7	252.1	-14.5	90.0	34.4	243.3
270.0	10.5	190.1	26.5	342.7	-16.9	90.0	35.1	245.3
280.0	5.7	185.7	51.5	351.9	-17.1	90.0	33.7	245.8
290.0	77.3	183.6	64.3	355.1	-17.3	90.0	30.5	244.7
300.0	75.7	181.8	63.4	357.5	-17.5	90.0	25.9	241.5
310.0	65.9	179.9	54.2	0.1	-17.0	90.0	20.5	235.3
320.0	43.3	176.2	32.2	5.5	-16.6	90.0	15.4	223.6
330.0	15.0	155.7	5.9	60.2	-15.8	90.0	11.7	202.8
340.0	11.0	132.4	6.1	119.8	-8.1	90.0	11.8	152.7
350.0	8.9	136.1	7.1	123.9	-1.5	90.0	14.8	134.4
360.0	6.2	122.7	8.6	144.4	5.1	90.0	18.5	123.9

6.17.5 Thruster loss

Case 17 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.94	0.89	0.82
10.0	0.91	0.87	0.81
20.0	0.86	0.83	0.81
30.0	0.87	0.82	0.82
40.0	0.87	0.78	0.83
50.0	0.87	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.89	0.78	0.85
90.0	0.89	0.78	0.84
100.0	0.91	0.82	0.85
110.0	0.86	0.82	0.85
120.0	0.85	0.81	0.86
130.0	0.85	0.81	0.86
140.0	0.86	0.81	0.86
150.0	0.86	0.82	0.87
160.0	0.86	0.82	0.88
170.0	0.86	0.82	0.89
180.0	0.85	0.80	0.91
190.0	0.79	0.74	0.91
200.0	0.78	0.77	0.91
210.0	0.81	0.83	0.92
220.0	0.81	0.84	0.92
230.0	0.81	0.85	0.93
240.0	0.81	0.85	0.86
250.0	0.82	0.85	0.85
260.0	0.83	0.85	0.85
270.0	0.82	0.91	0.84
280.0	0.81	0.92	0.85
290.0	0.80	0.91	0.86
300.0	0.79	0.90	0.87
310.0	0.78	0.89	0.85
320.0	0.81	0.87	0.83
330.0	0.92	0.89	0.82
340.0	0.94	0.90	0.81
350.0	0.94	0.90	0.81
360.0	0.94	0.89	0.82

Preliminary Design, @IDR5

6.18 Case 18 - Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 4

6.18.1 Environment and thrust utilisation

Case 18 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	170.0	170.0	0.0	35.0	2.5	6.0	8.5	2.00	9.4
10.0	170.0	170.0	10.0	35.0	2.5	6.0	8.5	2.00	36.4
20.0	170.0	170.0	20.0	35.0	2.5	6.0	8.5	2.00	59.5
30.0	170.0	170.0	30.0	35.0	2.5	6.0	8.5	2.00	80.0
40.0	170.0	170.0	40.0	35.0	2.5	6.0	8.5	2.00	96.3
50.0	170.0	170.0	50.0	35.0	2.5	6.0	8.5	2.00	> 100.0
60.0	170.0	170.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	170.0	170.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	170.0	170.0	80.0	35.0	2.5	6.0	8.5	2.00	> 100.0
90.0	170.0	170.0	90.0	35.0	2.5	6.0	8.5	2.00	91.7
100.0	170.0	170.0	100.0	35.0	2.5	6.0	8.5	2.00	75.1
110.0	170.0	170.0	110.0	35.0	2.5	6.0	8.5	2.00	55.2
120.0	170.0	170.0	120.0	35.0	2.5	6.0	8.5	2.00	36.4
130.0	170.0	170.0	130.0	35.0	2.5	6.0	8.5	2.00	21.3
140.0	170.0	170.0	140.0	35.0	2.5	6.0	8.5	2.00	17.2
150.0	170.0	170.0	150.0	35.0	2.5	6.0	8.5	2.00	15.6
160.0	170.0	170.0	160.0	35.0	2.5	6.0	8.5	2.00	13.5
170.0	170.0	170.0	170.0	35.0	2.5	6.0	8.5	2.00	11.6
180.0	170.0	170.0	180.0	35.0	2.5	6.0	8.5	2.00	11.3
190.0	170.0	170.0	190.0	35.0	2.5	6.0	8.5	2.00	20.0
200.0	170.0	170.0	200.0	35.0	2.5	6.0	8.5	2.00	19.0
210.0	170.0	170.0	210.0	35.0	2.5	6.0	8.5	2.00	18.5
220.0	170.0	170.0	220.0	35.0	2.5	6.0	8.5	2.00	13.7
230.0	170.0	170.0	230.0	35.0	2.5	6.0	8.5	2.00	14.5
240.0	170.0	170.0	240.0	35.0	2.5	6.0	8.5	2.00	24.0
250.0	170.0	170.0	250.0	35.0	2.5	6.0	8.5	2.00	43.5
260.0	170.0	170.0	260.0	35.0	2.5	6.0	8.5	2.00	62.8
270.0	170.0	170.0	270.0	35.0	2.5	6.0	8.5	2.00	81.8
280.0	170.0	170.0	280.0	35.0	2.5	6.0	8.5	2.00	94.0
290.0	170.0	170.0	290.0	35.0	2.5	6.0	8.5	2.00	> 100.0
300.0	170.0	170.0	300.0	35.0	2.5	6.0	8.5	2.00	99.5
310.0	170.0	170.0	310.0	35.0	2.5	6.0	8.5	2.00	95.0
320.0	170.0	170.0	320.0	35.0	2.5	6.0	8.5	2.00	84.0
330.0	170.0	170.0	330.0	35.0	2.5	6.0	8.5	2.00	67.3
340.0	170.0	170.0	340.0	35.0	2.5	6.0	8.5	2.00	47.0
350.0	170.0	170.0	350.0	35.0	2.5	6.0	8.5	2.00	19.1
360.0	170.0	170.0	360.0	35.0	2.5	6.0	8.5	2.00	9.6

6.18.2 Relative contributions of force components

Case 18 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	76.7	25.9	-23.5	0.0	20.9	100.0
10.0	58.3	18.1	8.5	0.0	15.1	100.0
20.0	43.1	12.5	33.6	0.0	10.7	100.0
30.0	32.4	8.9	50.9	0.0	7.8	100.0
40.0	25.1	6.6	62.3	0.0	5.9	100.0
50.0	20.3	5.2	69.9	0.0	4.7	100.0
60.0	17.1	4.3	74.7	0.0	3.9	100.0
70.0	15.2	3.8	77.6	0.0	3.4	100.0
80.0	14.2	3.5	79.1	0.0	3.2	100.0
90.0	13.9	3.5	79.4	0.0	3.2	100.0
100.0	14.4	3.7	78.6	0.0	3.3	100.0
110.0	15.7	4.1	76.6	0.0	3.6	100.0
120.0	17.8	4.8	73.2	0.0	4.2	100.0
130.0	21.1	5.9	67.9	0.0	5.1	100.0
140.0	25.6	7.4	60.6	0.0	6.4	100.0
150.0	31.3	9.6	51.1	0.0	8.1	100.0
160.0	37.7	12.1	40.1	0.0	10.0	100.0
170.0	43.9	14.9	29.1	0.0	12.1	100.0
180.0	48.2	17.5	20.5	0.0	13.8	100.0
190.0	46.9	18.4	20.5	0.0	14.2	100.0
200.0	34.2	15.6	30.1	0.0	14.2	100.0
210.0	20.8	11.4	55.0	0.0	12.8	100.0
220.0	9.6	7.1	72.8	0.0	10.3	100.0
230.0	2.5	4.4	85.1	0.0	8.1	100.0
240.0	-1.4	2.6	92.4	0.0	6.4	100.0
250.0	-3.3	1.6	96.4	0.0	5.3	100.0
260.0	-4.3	1.0	98.6	0.0	4.8	100.0
270.0	-4.9	0.8	99.7	0.0	4.5	100.0
280.0	-5.3	0.7	100.0	0.0	4.6	100.0
290.0	-5.5	0.9	99.6	0.0	5.1	100.0
300.0	-5.3	1.4	97.9	0.0	6.1	100.0
310.0	-4.0	2.6	93.5	0.0	7.9	100.0
320.0	0.6	5.3	83.0	0.0	11.2	100.0
330.0	13.9	11.4	58.0	0.0	16.7	100.0
340.0	44.7	22.7	9.0	0.0	23.5	100.0
350.0	85.8	32.5	-43.6	0.0	25.3	100.0
360.0	76.7	25.9	-23.5	0.0	20.9	100.0

6.18.3 Environment forces

Case 18 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.1	3.3	-3.6	0.0	2.5	10.3
10.0	8.1	3.3	-3.6	0.0	2.5	10.3
20.0	8.1	3.3	-3.5	0.0	2.5	10.4
30.0	8.1	3.3	-3.2	0.0	2.5	10.7
40.0	8.1	3.3	-2.8	0.0	2.5	11.1
50.0	8.1	3.3	-2.3	0.0	2.5	11.6
60.0	8.1	3.3	-1.6	0.0	2.5	12.2
70.0	8.1	3.3	-0.9	0.0	2.5	13.0
80.0	8.1	3.3	-0.1	0.0	2.5	13.8
90.0	8.1	3.3	0.7	0.0	2.5	14.6
100.0	8.1	3.3	1.5	0.0	2.5	15.4
110.0	8.1	3.3	2.3	0.0	2.5	16.1
120.0	8.1	3.3	3.0	0.0	2.5	16.8
130.0	8.1	3.3	3.5	0.0	2.5	17.4
140.0	8.1	3.3	4.0	0.0	2.5	17.8
150.0	8.1	3.3	4.3	0.0	2.5	18.1
160.0	8.1	3.3	4.4	0.0	2.5	18.3
170.0	8.1	3.3	4.4	0.0	2.5	18.3
180.0	8.1	3.3	4.3	0.0	2.5	18.2
190.0	8.1	3.3	4.4	0.0	2.5	18.3
200.0	8.1	3.3	4.4	0.0	2.5	18.3
210.0	8.1	3.3	4.3	0.0	2.5	18.1
220.0	8.1	3.3	4.0	0.0	2.5	17.8
230.0	8.1	3.3	3.5	0.0	2.5	17.4
240.0	8.1	3.3	3.0	0.0	2.5	16.8
250.0	8.1	3.3	2.3	0.0	2.5	16.1
260.0	8.1	3.3	1.5	0.0	2.5	15.4
270.0	8.1	3.3	0.7	0.0	2.5	14.6
280.0	8.1	3.3	-0.1	0.0	2.5	13.8
290.0	8.1	3.3	-0.9	0.0	2.5	13.0
300.0	8.1	3.3	-1.6	0.0	2.5	12.2
310.0	8.1	3.3	-2.3	0.0	2.5	11.6
320.0	8.1	3.3	-2.8	0.0	2.5	11.1
330.0	8.1	3.3	-3.2	0.0	2.5	10.7
340.0	8.1	3.3	-3.5	0.0	2.5	10.4
350.0	8.1	3.3	-3.6	0.0	2.5	10.3
360.0	8.1	3.3	-3.6	0.0	2.5	10.3

Case 18 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.2	-0.9	0.0	0.0	-1.0	-7.2
10.0	-5.2	-0.9	-4.8	0.0	-1.0	-12.0
20.0	-5.2	-0.9	-10.0	0.0	-1.0	-17.2
30.0	-5.2	-0.9	-15.6	0.0	-1.0	-22.8
40.0	-5.2	-0.9	-21.7	0.0	-1.0	-28.9
50.0	-5.2	-0.9	-28.0	0.0	-1.0	-35.2
60.0	-5.2	-0.9	-33.8	0.0	-1.0	-41.0
70.0	-5.2	-0.9	-38.7	0.0	-1.0	-45.9
80.0	-5.2	-0.9	-41.9	0.0	-1.0	-49.1
90.0	-5.2	-0.9	-43.0	0.0	-1.0	-50.2
100.0	-5.2	-0.9	-41.9	0.0	-1.0	-49.1
110.0	-5.2	-0.9	-38.7	0.0	-1.0	-45.9
120.0	-5.2	-0.9	-33.8	0.0	-1.0	-41.0
130.0	-5.2	-0.9	-28.0	0.0	-1.0	-35.2
140.0	-5.2	-0.9	-21.7	0.0	-1.0	-28.9
150.0	-5.2	-0.9	-15.6	0.0	-1.0	-22.8
160.0	-5.2	-0.9	-10.0	0.0	-1.0	-17.2
170.0	-5.2	-0.9	-4.8	0.0	-1.0	-12.0
180.0	-5.2	-0.9	0.0	0.0	-1.0	-7.2
190.0	-5.2	-0.9	4.8	0.0	-1.0	-2.4
200.0	-5.2	-0.9	10.0	0.0	1.0	4.8
210.0	-5.2	-0.9	15.6	0.0	1.0	10.4
220.0	-5.2	-0.9	21.7	0.0	1.0	16.5
230.0	-5.2	-0.9	28.0	0.0	1.0	22.8
240.0	-5.2	-0.9	33.8	0.0	1.0	28.7
250.0	-5.2	-0.9	38.7	0.0	1.0	33.5
260.0	-5.2	-0.9	41.9	0.0	1.0	36.7
270.0	-5.2	-0.9	43.0	0.0	1.0	37.8
280.0	-5.2	-0.9	41.9	0.0	1.0	36.7
290.0	-5.2	-0.9	38.7	0.0	1.0	33.5
300.0	-5.2	-0.9	33.8	0.0	1.0	28.7
310.0	-5.2	-0.9	28.0	0.0	1.0	22.8
320.0	-5.2	-0.9	21.7	0.0	1.0	16.5
330.0	-5.2	-0.9	15.6	0.0	1.0	10.4
340.0	-5.2	-0.9	10.0	0.0	1.0	4.8
350.0	-5.2	-0.9	4.8	0.0	-1.0	-2.4
360.0	-5.2	-0.9	0.0	0.0	-1.0	-7.2

Case 18 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	109.9	34.3	0.0	0.0	27.7	171.8
10.0	109.9	34.3	-316.6	0.0	-27.7	-200.2
20.0	109.9	34.3	-593.0	0.0	-27.7	-476.5
30.0	109.9	34.3	-793.7	0.0	-27.7	-677.2
40.0	109.9	34.3	-892.8	0.0	-27.7	-776.3
50.0	109.9	34.3	-876.4	0.0	-27.7	-760.0
60.0	109.9	34.3	-745.2	0.0	-27.7	-628.8
70.0	109.9	34.3	-513.8	0.0	-27.7	-397.4
80.0	109.9	34.3	-209.2	0.0	-27.7	-92.8
90.0	109.9	34.3	132.4	0.0	27.7	304.2
100.0	109.9	34.3	470.0	0.0	27.7	641.8
110.0	109.9	34.3	762.6	0.0	27.7	934.5
120.0	109.9	34.3	974.5	0.0	27.7	1146.4
130.0	109.9	34.3	1079.2	0.0	27.7	1251.1
140.0	109.9	34.3	1063.0	0.0	27.7	1231.8
150.0	109.9	34.3	926.1	0.0	27.7	1077.9
160.0	109.9	34.3	683.5	0.0	27.7	855.4
170.0	109.9	34.3	362.6	0.0	27.7	534.4
180.0	109.9	34.3	0.0	0.0	27.7	171.8
190.0	109.9	34.3	-362.6	0.0	-27.7	-246.2
200.0	109.9	34.3	-683.5	0.0	-27.7	-567.1
210.0	109.9	34.3	-926.1	0.0	-27.7	-809.6
220.0	109.9	34.3	-1063.0	0.0	-27.7	-946.5
230.0	109.9	34.3	-1079.2	0.0	-27.7	-962.8
240.0	109.9	34.3	-974.5	0.0	-27.7	-858.1
250.0	109.9	34.3	-762.6	0.0	-27.7	-646.2
260.0	109.9	34.3	-470.0	0.0	-27.7	-353.5
270.0	109.9	34.3	-132.4	0.0	27.7	39.5
280.0	109.9	34.3	209.2	0.0	27.7	381.1
290.0	109.9	34.3	513.8	0.0	27.7	685.7
300.0	109.9	34.3	745.2	0.0	27.7	917.1
310.0	109.9	34.3	876.4	0.0	27.7	1048.3
320.0	109.9	34.3	892.8	0.0	27.7	1064.6
330.0	109.9	34.3	793.7	0.0	27.7	965.5
340.0	109.9	34.3	593.0	0.0	27.7	764.8
350.0	109.9	34.3	316.6	0.0	27.7	488.5
360.0	109.9	34.3	0.0	0.0	27.7	171.8

6.18.4 Thruster use

Case 18 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	5.3	149.8	6.2	156.4	2.0	90.0	12.5	145.0
10.0	2.0	135.4	8.9	172.0	9.4	90.0	15.8	130.5
20.0	1.3	35.1	11.5	176.5	15.7	90.0	20.1	121.2
30.0	38.8	5.0	49.4	176.4	16.4	90.0	25.2	115.0
40.0	71.9	5.1	82.9	175.9	16.6	90.0	31.0	110.9
50.0	78.5	10.4	87.7	180.0	17.0	90.0	32.8	108.5
60.0	78.9	12.6	87.5	180.0	17.5	90.0	36.3	106.8
70.0	79.2	16.1	87.3	180.0	17.3	90.0	40.8	106.0
80.0	79.5	20.7	87.2	180.0	17.1	90.0	47.0	105.9
90.0	62.3	16.3	76.0	168.0	16.9	90.0	52.3	106.2
100.0	29.1	35.2	42.0	158.5	17.0	90.0	51.4	107.4
110.0	16.1	102.4	19.7	130.1	15.0	90.0	48.6	109.4
120.0	17.1	110.4	18.7	125.3	9.7	90.0	44.3	112.3
130.0	17.4	117.5	17.4	122.4	5.0	90.0	39.2	116.3
140.0	16.9	124.1	15.7	122.0	1.6	90.0	34.0	121.6
150.0	15.6	130.8	13.8	125.1	-0.3	90.0	29.1	128.5
160.0	13.6	138.3	11.9	133.1	-0.5	90.0	25.1	136.8
170.0	11.3	148.3	10.4	146.8	0.4	90.0	21.9	146.7
180.0	9.1	163.4	9.8	165.2	2.1	90.0	19.7	158.4
190.0	7.7	187.7	10.7	185.5	4.4	90.0	18.4	172.6
200.0	8.5	211.6	12.0	202.3	4.2	90.0	18.9	194.7
210.0	9.9	225.2	13.3	213.2	3.9	90.0	20.9	209.9
220.0	11.7	231.1	14.2	222.1	2.0	90.0	24.3	222.9
230.0	13.3	231.7	14.5	231.2	-1.4	90.0	28.7	232.7
240.0	14.7	228.6	12.6	238.6	-6.1	90.0	33.2	239.6
250.0	15.8	223.0	12.1	248.0	-11.4	90.0	37.2	244.3
260.0	16.7	217.8	10.2	259.7	-16.8	90.0	39.8	247.3
270.0	13.9	190.5	40.0	344.0	-16.9	90.0	40.5	248.9
280.0	78.4	186.8	65.0	350.8	-17.1	90.0	39.2	249.4
290.0	87.3	180.0	76.1	348.2	-17.3	90.0	35.3	248.6
300.0	87.5	180.0	76.0	351.8	-17.5	90.0	30.9	246.7
310.0	79.0	182.0	67.5	357.4	-17.0	90.0	25.6	243.0
320.0	56.3	180.0	45.3	0.1	-16.6	90.0	19.9	236.2
330.0	23.1	172.7	12.6	13.7	-16.4	90.0	14.9	224.4
340.0	12.7	160.4	3.2	60.2	-11.9	90.0	11.4	204.8
350.0	8.3	154.9	4.4	128.8	-4.6	90.0	10.5	167.0
360.0	5.3	149.8	6.2	156.4	2.0	90.0	12.5	145.0

6.18.5 Thruster loss

Case 18 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.93	0.88	0.82
10.0	0.94	0.83	0.81
20.0	0.85	0.81	0.81
30.0	0.87	0.81	0.82
40.0	0.88	0.81	0.83
50.0	0.88	0.78	0.85
60.0	0.88	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.89	0.78	0.85
90.0	0.91	0.82	0.84
100.0	0.90	0.82	0.85
110.0	0.85	0.81	0.85
120.0	0.85	0.81	0.86
130.0	0.85	0.81	0.86
140.0	0.85	0.81	0.86
150.0	0.85	0.82	0.92
160.0	0.85	0.82	0.91
170.0	0.84	0.81	0.89
180.0	0.81	0.78	0.91
190.0	0.75	0.75	0.91
200.0	0.80	0.82	0.91
210.0	0.81	0.84	0.92
220.0	0.81	0.85	0.92
230.0	0.81	0.85	0.86
240.0	0.81	0.85	0.86
250.0	0.82	0.85	0.85
260.0	0.83	0.85	0.85
270.0	0.82	0.92	0.84
280.0	0.82	0.91	0.85
290.0	0.78	0.90	0.86
300.0	0.78	0.89	0.87
310.0	0.79	0.89	0.85
320.0	0.78	0.88	0.83
330.0	0.85	0.85	0.82
340.0	0.91	0.88	0.81
350.0	0.92	0.90	0.81
360.0	0.93	0.88	0.82

Preliminary Design, @IDR5

6.19 Case 19 - Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 4

6.19.1 Environment and thrust utilisation

Case 19 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	180.0	180.0	0.0	35.0	2.5	6.0	8.5	2.00	5.7
10.0	180.0	180.0	10.0	35.0	2.5	6.0	8.5	2.00	26.8
20.0	180.0	180.0	20.0	35.0	2.5	6.0	8.5	2.00	49.9
30.0	180.0	180.0	30.0	35.0	2.5	6.0	8.5	2.00	70.3
40.0	180.0	180.0	40.0	35.0	2.5	6.0	8.5	2.00	86.8
50.0	180.0	180.0	50.0	35.0	2.5	6.0	8.5	2.00	97.8
60.0	180.0	180.0	60.0	35.0	2.5	6.0	8.5	2.00	> 100.0
70.0	180.0	180.0	70.0	35.0	2.5	6.0	8.5	2.00	> 100.0
80.0	180.0	180.0	80.0	35.0	2.5	6.0	8.5	2.00	6.9
90.0	180.0	180.0	90.0	35.0	2.5	6.0	8.5	2.00	84.8
100.0	180.0	180.0	100.0	35.0	2.5	6.0	8.5	2.00	68.1
110.0	180.0	180.0	110.0	35.0	2.5	6.0	8.5	2.00	49.1
120.0	180.0	180.0	120.0	35.0	2.5	6.0	8.5	2.00	29.8
130.0	180.0	180.0	130.0	35.0	2.5	6.0	8.5	2.00	16.4
140.0	180.0	180.0	140.0	35.0	2.5	6.0	8.5	2.00	15.2
150.0	180.0	180.0	150.0	35.0	2.5	6.0	8.5	2.00	13.8
160.0	180.0	180.0	160.0	35.0	2.5	6.0	8.5	2.00	13.4
170.0	180.0	180.0	170.0	35.0	2.5	6.0	8.5	2.00	11.1
180.0	180.0	180.0	180.0	35.0	2.5	6.0	8.5	2.00	11.2
190.0	180.0	180.0	190.0	35.0	2.5	6.0	8.5	2.00	11.1
200.0	180.0	180.0	200.0	35.0	2.5	6.0	8.5	2.00	13.4
210.0	180.0	180.0	210.0	35.0	2.5	6.0	8.5	2.00	13.8
220.0	180.0	180.0	220.0	35.0	2.5	6.0	8.5	2.00	15.2
230.0	180.0	180.0	230.0	35.0	2.5	6.0	8.5	2.00	16.4
240.0	180.0	180.0	240.0	35.0	2.5	6.0	8.5	2.00	29.4
250.0	180.0	180.0	250.0	35.0	2.5	6.0	8.5	2.00	49.0
260.0	180.0	180.0	260.0	35.0	2.5	6.0	8.5	2.00	68.1
270.0	180.0	180.0	270.0	35.0	2.5	6.0	8.5	2.00	84.8
280.0	180.0	180.0	280.0	35.0	2.5	6.0	8.5	2.00	96.9
290.0	180.0	180.0	290.0	35.0	2.5	6.0	8.5	2.00	> 100.0
300.0	180.0	180.0	300.0	35.0	2.5	6.0	8.5	2.00	> 100.0
310.0	180.0	180.0	310.0	35.0	2.5	6.0	8.5	2.00	97.8
320.0	180.0	180.0	320.0	35.0	2.5	6.0	8.5	2.00	86.8
330.0	180.0	180.0	330.0	35.0	2.5	6.0	8.5	2.00	70.3
340.0	180.0	180.0	340.0	35.0	2.5	6.0	8.5	2.00	49.9
350.0	180.0	180.0	350.0	35.0	2.5	6.0	8.5	2.00	26.8
360.0	180.0	180.0	360.0	35.0	2.5	6.0	8.5	2.00	5.7

6.19.2 Relative contributions of force components

Case 19 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	78.1	32.5	-35.3	0.0	24.6	100.0
10.0	63.8	26.6	-10.5	0.0	20.1	100.0
20.0	39.9	16.6	31.0	0.0	12.6	100.0
30.0	23.7	9.9	59.0	0.0	7.5	100.0
40.0	14.8	6.1	74.4	0.0	4.7	100.0
50.0	10.0	4.2	82.6	0.0	3.2	100.0
60.0	7.5	3.1	87.0	0.0	2.4	100.0
70.0	6.2	2.6	89.3	0.0	2.0	100.0
80.0	5.6	2.3	90.3	0.0	1.8	100.0
90.0	5.6	2.3	90.3	0.0	1.8	100.0
100.0	6.1	2.6	89.4	0.0	1.9	100.0
110.0	7.3	3.0	87.4	0.0	2.3	100.0
120.0	9.4	3.9	83.8	0.0	3.0	100.0
130.0	12.7	5.3	77.9	0.0	4.0	100.0
140.0	17.9	7.5	68.9	0.0	5.7	100.0
150.0	25.2	10.5	56.3	0.0	8.0	100.0
160.0	33.6	14.0	41.8	0.0	10.6	100.0
170.0	40.8	17.0	29.3	0.0	12.9	100.0
180.0	44.0	18.3	23.8	0.0	13.9	100.0
190.0	40.8	17.0	29.3	0.0	12.9	100.0
200.0	33.6	14.0	41.8	0.0	10.6	100.0
210.0	25.2	10.5	56.3	0.0	8.0	100.0
220.0	17.9	7.5	68.9	0.0	5.7	100.0
230.0	12.7	5.3	77.9	0.0	4.0	100.0
240.0	9.4	3.9	83.8	0.0	3.0	100.0
250.0	7.3	3.0	87.4	0.0	2.3	100.0
260.0	6.1	2.6	89.4	0.0	1.9	100.0
270.0	5.6	2.3	90.3	0.0	1.8	100.0
280.0	5.6	2.3	90.3	0.0	1.8	100.0
290.0	6.2	2.6	89.3	0.0	2.0	100.0
300.0	7.5	3.1	87.0	0.0	2.4	100.0
310.0	10.0	4.2	82.6	0.0	3.2	100.0
320.0	14.8	6.1	74.4	0.0	4.7	100.0
330.0	23.7	9.9	59.0	0.0	7.5	100.0
340.0	39.9	16.6	31.0	0.0	12.6	100.0
350.0	63.8	26.6	-10.5	0.0	20.1	100.0
360.0	78.1	32.5	-35.3	0.0	24.6	100.0

6.19.3 Environment forces

Case 19 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.0	3.3	-3.6	0.0	2.5	10.2
10.0	8.0	3.3	-3.6	0.0	2.5	10.2
20.0	8.0	3.3	-3.5	0.0	2.5	10.3
30.0	8.0	3.3	-3.2	0.0	2.5	10.6
40.0	8.0	3.3	-2.8	0.0	2.5	11.0
50.0	8.0	3.3	-2.3	0.0	2.5	11.5
60.0	8.0	3.3	-1.6	0.0	2.5	12.2
70.0	8.0	3.3	-0.9	0.0	2.5	12.9
80.0	8.0	3.3	-0.1	0.0	2.5	13.7
90.0	8.0	3.3	0.7	0.0	2.5	14.5
100.0	8.0	3.3	1.5	0.0	2.5	15.3
110.0	8.0	3.3	2.3	0.0	2.5	16.1
120.0	8.0	3.3	3.0	0.0	2.5	16.8
130.0	8.0	3.3	3.5	0.0	2.5	17.3
140.0	8.0	3.3	4.0	0.0	2.5	17.8
150.0	8.0	3.3	4.3	0.0	2.5	18.1
160.0	8.0	3.3	4.4	0.0	2.5	18.2
170.0	8.0	3.3	4.4	0.0	2.5	18.2
180.0	8.0	3.3	4.3	0.0	2.5	18.1
190.0	8.0	3.3	4.4	0.0	2.5	18.2
200.0	8.0	3.3	4.4	0.0	2.5	18.2
210.0	8.0	3.3	4.3	0.0	2.5	18.1
220.0	8.0	3.3	4.0	0.0	2.5	17.8
230.0	8.0	3.3	3.5	0.0	2.5	17.3
240.0	8.0	3.3	3.0	0.0	2.5	16.8
250.0	8.0	3.3	2.3	0.0	2.5	16.1
260.0	8.0	3.3	1.5	0.0	2.5	15.3
270.0	8.0	3.3	0.7	0.0	2.5	14.5
280.0	8.0	3.3	-0.1	0.0	2.5	13.7
290.0	8.0	3.3	-0.9	0.0	2.5	12.9
300.0	8.0	3.3	-1.6	0.0	2.5	12.2
310.0	8.0	3.3	-2.3	0.0	2.5	11.5
320.0	8.0	3.3	-2.8	0.0	2.5	11.0
330.0	8.0	3.3	-3.2	0.0	2.5	10.6
340.0	8.0	3.3	-3.5	0.0	2.5	10.3
350.0	8.0	3.3	-3.6	0.0	2.5	10.2
360.0	8.0	3.3	-3.6	0.0	2.5	10.2

Case 19 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-4.8	0.0	0.0	-4.8
20.0	0.0	0.0	-10.0	0.0	0.0	-10.0
30.0	0.0	0.0	-15.6	0.0	0.0	-15.6
40.0	0.0	0.0	-21.7	0.0	0.0	-21.7
50.0	0.0	0.0	-28.0	0.0	0.0	-28.0
60.0	0.0	0.0	-33.8	0.0	0.0	-33.8
70.0	0.0	0.0	-38.7	0.0	0.0	-38.7
80.0	0.0	0.0	-41.9	0.0	0.0	-41.9
90.0	0.0	0.0	-43.0	0.0	0.0	-43.0
100.0	0.0	0.0	-41.9	0.0	0.0	-41.9
110.0	0.0	0.0	-38.7	0.0	0.0	-38.7
120.0	0.0	0.0	-33.8	0.0	0.0	-33.8
130.0	0.0	0.0	-28.0	0.0	0.0	-28.0
140.0	0.0	0.0	-21.7	0.0	0.0	-21.7
150.0	0.0	0.0	-15.6	0.0	0.0	-15.6
160.0	0.0	0.0	-10.0	0.0	0.0	-10.0
170.0	0.0	0.0	-4.8	0.0	0.0	-4.8
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	4.8	0.0	0.0	4.8
200.0	0.0	0.0	10.0	0.0	0.0	10.0
210.0	0.0	0.0	15.6	0.0	0.0	15.6
220.0	0.0	0.0	21.7	0.0	0.0	21.7
230.0	0.0	0.0	28.0	0.0	0.0	28.0
240.0	0.0	0.0	33.8	0.0	0.0	33.8
250.0	0.0	0.0	38.7	0.0	0.0	38.7
260.0	0.0	0.0	41.9	0.0	0.0	41.9
270.0	0.0	0.0	43.0	0.0	0.0	43.0
280.0	0.0	0.0	41.9	0.0	0.0	41.9
290.0	0.0	0.0	38.7	0.0	0.0	38.7
300.0	0.0	0.0	33.8	0.0	0.0	33.8
310.0	0.0	0.0	28.0	0.0	0.0	28.0
320.0	0.0	0.0	21.7	0.0	0.0	21.7
330.0	0.0	0.0	15.6	0.0	0.0	15.6
340.0	0.0	0.0	10.0	0.0	0.0	10.0
350.0	0.0	0.0	4.8	0.0	0.0	4.8
360.0	0.0	0.0	0.0	0.0	0.0	0.0

Case 19 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-316.6	0.0	0.0	-316.6
20.0	0.0	0.0	-593.0	0.0	0.0	-593.0
30.0	0.0	0.0	-793.7	0.0	0.0	-793.7
40.0	0.0	0.0	-892.8	0.0	0.0	-892.8
50.0	0.0	0.0	-876.4	0.0	0.0	-876.4
60.0	0.0	0.0	-745.2	0.0	0.0	-745.2
70.0	0.0	0.0	-513.8	0.0	0.0	-513.8
80.0	0.0	0.0	-209.2	0.0	0.0	-209.2
90.0	0.0	0.0	132.4	0.0	0.0	132.4
100.0	0.0	0.0	470.0	0.0	0.0	470.0
110.0	0.0	0.0	762.6	0.0	0.0	762.6
120.0	0.0	0.0	974.5	0.0	0.0	974.5
130.0	0.0	0.0	1079.2	0.0	0.0	1079.2
140.0	0.0	0.0	1063.0	0.0	0.0	1063.0
150.0	0.0	0.0	926.1	0.0	0.0	926.1
160.0	0.0	0.0	683.5	0.0	0.0	683.5
170.0	0.0	0.0	362.6	0.0	0.0	362.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	-362.6	0.0	0.0	-362.6
200.0	0.0	0.0	-683.5	0.0	0.0	-683.5
210.0	0.0	0.0	-926.1	0.0	0.0	-926.1
220.0	0.0	0.0	-1063.0	0.0	0.0	-1063.0
230.0	0.0	0.0	-1079.2	0.0	0.0	-1079.2
240.0	0.0	0.0	-974.5	0.0	0.0	-974.5
250.0	0.0	0.0	-762.6	0.0	0.0	-762.6
260.0	0.0	0.0	-470.0	0.0	0.0	-470.0
270.0	0.0	0.0	-132.4	0.0	0.0	-132.4
280.0	0.0	0.0	209.2	0.0	0.0	209.2
290.0	0.0	0.0	513.8	0.0	0.0	513.8
300.0	0.0	0.0	745.2	0.0	0.0	745.2
310.0	0.0	0.0	876.4	0.0	0.0	876.4
320.0	0.0	0.0	892.8	0.0	0.0	892.8
330.0	0.0	0.0	793.7	0.0	0.0	793.7
340.0	0.0	0.0	593.0	0.0	0.0	593.0
350.0	0.0	0.0	316.6	0.0	0.0	316.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.19.4 Thruster use

Case 19 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	5.1	180.0	5.1	180.0	0.0	90.0	10.2	180.0
10.0	2.5	201.9	7.9	186.4	6.7	90.0	11.3	154.6
20.0	1.5	299.8	11.2	188.4	12.9	90.0	14.4	136.0
30.0	18.7	358.8	29.3	180.7	16.4	90.0	18.9	124.1
40.0	51.8	3.0	62.8	177.8	16.6	90.0	24.4	116.8
50.0	74.1	4.5	85.5	176.5	17.0	90.0	30.3	112.4
60.0	77.2	10.9	87.5	180.0	17.5	90.0	34.2	110.0
70.0	77.4	14.4	87.3	180.0	17.3	90.0	38.6	108.7
80.0	71.8	10.5	85.1	172.0	17.1	90.0	44.1	108.1
90.0	47.0	17.0	60.7	168.3	16.9	90.0	45.4	108.7
100.0	15.6	55.3	27.1	153.4	17.0	90.0	44.6	110.1
110.0	13.7	107.1	17.4	133.8	13.0	90.0	41.9	112.6
120.0	14.9	116.0	16.4	128.5	7.6	90.0	37.8	116.3
130.0	15.4	123.9	15.0	125.5	3.0	90.0	32.9	121.8
140.0	15.1	131.5	13.3	125.5	-0.5	90.0	28.1	129.3
150.0	14.1	139.5	11.5	130.0	-2.3	90.0	23.9	139.1
160.0	12.4	149.0	9.8	140.7	-2.6	90.0	20.8	151.3
170.0	10.6	161.9	8.8	158.7	-1.6	90.0	18.9	165.2
180.0	9.1	180.0	9.1	180.0	0.0	90.0	18.2	180.0
190.0	8.8	201.3	10.6	198.1	1.6	90.0	18.9	194.8
200.0	9.8	219.3	12.4	211.0	2.6	90.0	20.8	208.7
210.0	11.5	230.0	14.1	220.5	2.3	90.0	23.9	220.9
220.0	13.3	234.5	15.1	223.5	0.5	90.0	28.1	230.7
230.0	15.0	234.5	15.4	235.1	-3.0	90.0	32.9	238.2
240.0	16.4	231.5	14.9	244.0	-7.6	90.0	37.8	243.7
250.0	17.4	226.2	16.7	252.9	-13.0	90.0	41.9	247.4
260.0	27.1	207.6	15.6	304.7	-17.0	90.0	44.6	249.9
270.0	50.7	191.7	47.0	343.0	-16.9	90.0	45.4	251.3
280.0	35.1	188.0	71.8	349.5	-17.1	90.0	44.1	251.9
290.0	87.3	180.0	77.4	345.6	-17.3	90.0	38.6	251.3
300.0	87.5	180.0	77.2	349.1	-17.5	90.0	34.2	250.0
310.0	85.5	183.5	74.1	355.5	-17.0	90.0	30.3	247.6
320.0	62.8	182.2	51.8	357.0	-16.6	90.0	24.4	243.2
330.0	29.3	179.3	18.7	1.2	-16.4	90.0	18.9	235.9
340.0	11.2	171.6	1.5	60.2	-12.9	90.0	14.4	224.0
350.0	7.9	173.6	2.5	158.1	-6.7	90.0	11.3	205.4
360.0	5.1	180.0	5.1	180.0	0.0	90.0	10.2	180.0

6.19.5 Thruster loss

Case 19 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.79	0.79	1.00
10.0	0.88	0.84	0.81
20.0	0.88	0.86	0.81
30.0	0.87	0.79	0.82
40.0	0.88	0.80	0.83
50.0	0.89	0.80	0.85
60.0	0.88	0.78	0.87
70.0	0.89	0.78	0.86
80.0	0.91	0.82	0.85
90.0	0.91	0.82	0.84
100.0	0.87	0.83	0.85
110.0	0.85	0.82	0.85
120.0	0.85	0.81	0.86
130.0	0.85	0.81	0.86
140.0	0.85	0.81	0.92
150.0	0.85	0.81	0.92
160.0	0.84	0.81	0.91
170.0	0.81	0.79	0.91
180.0	0.71	0.71	1.00
190.0	0.79	0.81	0.91
200.0	0.81	0.84	0.91
210.0	0.81	0.85	0.92
220.0	0.81	0.85	0.92
230.0	0.81	0.85	0.86
240.0	0.81	0.85	0.86
250.0	0.82	0.85	0.85
260.0	0.83	0.87	0.85
270.0	0.82	0.91	0.84
280.0	0.82	0.91	0.85
290.0	0.78	0.89	0.86
300.0	0.78	0.88	0.87
310.0	0.80	0.89	0.85
320.0	0.80	0.88	0.83
330.0	0.79	0.87	0.82
340.0	0.86	0.88	0.81
350.0	0.84	0.88	0.81
360.0	0.79	0.79	1.00

Preliminary Design, @IDR5

6.20 Case 20 - Thrust Utilization: 35 knots wind @ 0 deg, 2 knots current, Sea State 5

6.20.1 Environment and thrust utilisation

Case 20 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	0.0	0.0	0.0	35.0	4.0	6.7	9.4	2.00	9.7
10.0	0.0	0.0	10.0	35.0	4.0	6.7	9.4	2.00	28.1
20.0	0.0	0.0	20.0	35.0	4.0	6.7	9.4	2.00	50.3
30.0	0.0	0.0	30.0	35.0	4.0	6.7	9.4	2.00	69.7
40.0	0.0	0.0	40.0	35.0	4.0	6.7	9.4	2.00	84.9
50.0	0.0	0.0	50.0	35.0	4.0	6.7	9.4	2.00	94.6
60.0	0.0	0.0	60.0	35.0	4.0	6.7	9.4	2.00	98.1
70.0	0.0	0.0	70.0	35.0	4.0	6.7	9.4	2.00	97.5
80.0	0.0	0.0	80.0	35.0	4.0	6.7	9.4	2.00	90.8
90.0	0.0	0.0	90.0	35.0	4.0	6.7	9.4	2.00	79.7
100.0	0.0	0.0	100.0	35.0	4.0	6.7	9.4	2.00	62.8
110.0	0.0	0.0	110.0	35.0	4.0	6.7	9.4	2.00	44.7
120.0	0.0	0.0	120.0	35.0	4.0	6.7	9.4	2.00	27.2
130.0	0.0	0.0	130.0	35.0	4.0	6.7	9.4	2.00	16.9
140.0	0.0	0.0	140.0	35.0	4.0	6.7	9.4	2.00	13.1
150.0	0.0	0.0	150.0	35.0	4.0	6.7	9.4	2.00	11.3
160.0	0.0	0.0	160.0	35.0	4.0	6.7	9.4	2.00	11.1
170.0	0.0	0.0	170.0	35.0	4.0	6.7	9.4	2.00	7.8
180.0	0.0	0.0	180.0	35.0	4.0	6.7	9.4	2.00	5.1
190.0	0.0	0.0	190.0	35.0	4.0	6.7	9.4	2.00	7.8
200.0	0.0	0.0	200.0	35.0	4.0	6.7	9.4	2.00	11.1
210.0	0.0	0.0	210.0	35.0	4.0	6.7	9.4	2.00	11.3
220.0	0.0	0.0	220.0	35.0	4.0	6.7	9.4	2.00	13.1
230.0	0.0	0.0	230.0	35.0	4.0	6.7	9.4	2.00	16.9
240.0	0.0	0.0	240.0	35.0	4.0	6.7	9.4	2.00	27.2
250.0	0.0	0.0	250.0	35.0	4.0	6.7	9.4	2.00	44.7
260.0	0.0	0.0	260.0	35.0	4.0	6.7	9.4	2.00	62.8
270.0	0.0	0.0	270.0	35.0	4.0	6.7	9.4	2.00	79.7
280.0	0.0	0.0	280.0	35.0	4.0	6.7	9.4	2.00	90.8
290.0	0.0	0.0	290.0	35.0	4.0	6.7	9.4	2.00	97.5
300.0	0.0	0.0	300.0	35.0	4.0	6.7	9.4	2.00	98.1
310.0	0.0	0.0	310.0	35.0	4.0	6.7	9.4	2.00	94.6
320.0	0.0	0.0	320.0	35.0	4.0	6.7	9.4	2.00	84.9
330.0	0.0	0.0	330.0	35.0	4.0	6.7	9.4	2.00	69.7
340.0	0.0	0.0	340.0	35.0	4.0	6.7	9.4	2.00	50.3
350.0	0.0	0.0	350.0	35.0	4.0	6.7	9.4	2.00	28.1
360.0	0.0	0.0	360.0	35.0	4.0	6.7	9.4	2.00	9.7

6.20.2 Relative contributions of force components

Case 20 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	35.4	25.0	18.9	0.0	20.6	100.0
10.0	33.3	23.5	23.8	0.0	19.4	100.0
20.0	27.9	19.7	36.2	0.0	16.2	100.0
30.0	21.2	15.0	51.4	0.0	12.3	100.0
40.0	15.3	10.8	65.1	0.0	8.9	100.0
50.0	10.9	7.7	75.1	0.0	6.3	100.0
60.0	8.0	5.6	81.7	0.0	4.6	100.0
70.0	6.2	4.4	85.7	0.0	3.6	100.0
80.0	5.2	3.7	88.0	0.0	3.0	100.0
90.0	4.8	3.4	89.0	0.0	2.8	100.0
100.0	4.8	3.4	89.0	0.0	2.8	100.0
110.0	5.3	3.7	87.9	0.0	3.1	100.0
120.0	6.5	4.6	85.2	0.0	3.8	100.0
130.0	8.7	6.1	80.2	0.0	5.0	100.0
140.0	12.8	9.0	70.8	0.0	7.4	100.0
150.0	20.4	14.4	53.4	0.0	11.8	100.0
160.0	33.6	23.7	23.2	0.0	19.5	100.0
170.0	51.4	36.3	-17.6	0.0	29.9	100.0
180.0	60.7	42.9	-38.9	0.0	35.3	100.0
190.0	51.4	36.3	-17.6	0.0	29.9	100.0
200.0	33.6	23.7	23.2	0.0	19.5	100.0
210.0	20.4	14.4	53.4	0.0	11.8	100.0
220.0	12.8	9.0	70.8	0.0	7.4	100.0
230.0	8.7	6.1	80.2	0.0	5.0	100.0
240.0	6.5	4.6	85.2	0.0	3.8	100.0
250.0	5.3	3.7	87.9	0.0	3.1	100.0
260.0	4.8	3.4	89.0	0.0	2.8	100.0
270.0	4.8	3.4	89.0	0.0	2.8	100.0
280.0	5.2	3.7	88.0	0.0	3.0	100.0
290.0	6.2	4.4	85.7	0.0	3.6	100.0
300.0	8.0	5.6	81.7	0.0	4.6	100.0
310.0	10.9	7.7	75.1	0.0	6.3	100.0
320.0	15.3	10.8	65.1	0.0	8.9	100.0
330.0	21.2	15.0	51.4	0.0	12.3	100.0
340.0	27.9	19.7	36.2	0.0	16.2	100.0
350.0	33.3	23.5	23.8	0.0	19.4	100.0
360.0	35.4	25.0	18.9	0.0	20.6	100.0

6.20.3 Environment forces

Case 20 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	-4.8	-3.6	0.0	-3.9	-19.0
10.0	-6.7	-4.8	-3.6	0.0	-3.9	-19.0
20.0	-6.7	-4.8	-3.5	0.0	-3.9	-18.9
30.0	-6.7	-4.8	-3.2	0.0	-3.9	-18.6
40.0	-6.7	-4.8	-2.8	0.0	-3.9	-18.2
50.0	-6.7	-4.8	-2.3	0.0	-3.9	-17.7
60.0	-6.7	-4.8	-1.6	0.0	-3.9	-17.0
70.0	-6.7	-4.8	-0.9	0.0	-3.9	-16.3
80.0	-6.7	-4.8	-0.1	0.0	-3.9	-15.5
90.0	-6.7	-4.8	0.7	0.0	-3.9	-14.7
100.0	-6.7	-4.8	1.5	0.0	-3.9	-13.9
110.0	-6.7	-4.8	2.3	0.0	-3.9	-13.1
120.0	-6.7	-4.8	3.0	0.0	-3.9	-12.5
130.0	-6.7	-4.8	3.5	0.0	-3.9	-11.9
140.0	-6.7	-4.8	4.0	0.0	-3.9	-11.4
150.0	-6.7	-4.8	4.3	0.0	-3.9	-11.1
160.0	-6.7	-4.8	4.4	0.0	-3.9	-11.0
170.0	-6.7	-4.8	4.4	0.0	-3.9	-11.0
180.0	-6.7	-4.8	4.3	0.0	-3.9	-11.1
190.0	-6.7	-4.8	4.4	0.0	-3.9	-11.0
200.0	-6.7	-4.8	4.4	0.0	-3.9	-11.0
210.0	-6.7	-4.8	4.3	0.0	-3.9	-11.1
220.0	-6.7	-4.8	4.0	0.0	-3.9	-11.4
230.0	-6.7	-4.8	3.5	0.0	-3.9	-11.9
240.0	-6.7	-4.8	3.0	0.0	-3.9	-12.5
250.0	-6.7	-4.8	2.3	0.0	-3.9	-13.1
260.0	-6.7	-4.8	1.5	0.0	-3.9	-13.9
270.0	-6.7	-4.8	0.7	0.0	-3.9	-14.7
280.0	-6.7	-4.8	-0.1	0.0	-3.9	-15.5
290.0	-6.7	-4.8	-0.9	0.0	-3.9	-16.3
300.0	-6.7	-4.8	-1.6	0.0	-3.9	-17.0
310.0	-6.7	-4.8	-2.3	0.0	-3.9	-17.7
320.0	-6.7	-4.8	-2.8	0.0	-3.9	-18.2
330.0	-6.7	-4.8	-3.2	0.0	-3.9	-18.6
340.0	-6.7	-4.8	-3.5	0.0	-3.9	-18.9
350.0	-6.7	-4.8	-3.6	0.0	-3.9	-19.0
360.0	-6.7	-4.8	-3.6	0.0	-3.9	-19.0

Case 20 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-4.8	0.0	0.0	-4.8
20.0	0.0	0.0	-10.0	0.0	0.0	-10.0
30.0	0.0	0.0	-15.6	0.0	0.0	-15.6
40.0	0.0	0.0	-21.7	0.0	0.0	-21.7
50.0	0.0	0.0	-28.0	0.0	0.0	-28.0
60.0	0.0	0.0	-33.8	0.0	0.0	-33.8
70.0	0.0	0.0	-38.7	0.0	0.0	-38.7
80.0	0.0	0.0	-41.9	0.0	0.0	-41.9
90.0	0.0	0.0	-43.0	0.0	0.0	-43.0
100.0	0.0	0.0	-41.9	0.0	0.0	-41.9
110.0	0.0	0.0	-38.7	0.0	0.0	-38.7
120.0	0.0	0.0	-33.8	0.0	0.0	-33.8
130.0	0.0	0.0	-28.0	0.0	0.0	-28.0
140.0	0.0	0.0	-21.7	0.0	0.0	-21.7
150.0	0.0	0.0	-15.6	0.0	0.0	-15.6
160.0	0.0	0.0	-10.0	0.0	0.0	-10.0
170.0	0.0	0.0	-4.8	0.0	0.0	-4.8
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	4.8	0.0	0.0	4.8
200.0	0.0	0.0	10.0	0.0	0.0	10.0
210.0	0.0	0.0	15.6	0.0	0.0	15.6
220.0	0.0	0.0	21.7	0.0	0.0	21.7
230.0	0.0	0.0	28.0	0.0	0.0	28.0
240.0	0.0	0.0	33.8	0.0	0.0	33.8
250.0	0.0	0.0	38.7	0.0	0.0	38.7
260.0	0.0	0.0	41.9	0.0	0.0	41.9
270.0	0.0	0.0	43.0	0.0	0.0	43.0
280.0	0.0	0.0	41.9	0.0	0.0	41.9
290.0	0.0	0.0	38.7	0.0	0.0	38.7
300.0	0.0	0.0	33.8	0.0	0.0	33.8
310.0	0.0	0.0	28.0	0.0	0.0	28.0
320.0	0.0	0.0	21.7	0.0	0.0	21.7
330.0	0.0	0.0	15.6	0.0	0.0	15.6
340.0	0.0	0.0	10.0	0.0	0.0	10.0
350.0	0.0	0.0	4.8	0.0	0.0	4.8
360.0	0.0	0.0	0.0	0.0	0.0	0.0

Case 20 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-316.6	0.0	0.0	-316.6
20.0	0.0	0.0	-593.0	0.0	0.0	-593.0
30.0	0.0	0.0	-793.7	0.0	0.0	-793.7
40.0	0.0	0.0	-892.8	0.0	0.0	-892.8
50.0	0.0	0.0	-876.4	0.0	0.0	-876.4
60.0	0.0	0.0	-745.2	0.0	0.0	-745.2
70.0	0.0	0.0	-513.8	0.0	0.0	-513.8
80.0	0.0	0.0	-209.2	0.0	0.0	-209.2
90.0	0.0	0.0	132.4	0.0	0.0	132.4
100.0	0.0	0.0	470.0	0.0	0.0	470.0
110.0	0.0	0.0	762.6	0.0	0.0	762.6
120.0	0.0	0.0	974.5	0.0	0.0	974.5
130.0	0.0	0.0	1079.2	0.0	0.0	1079.2
140.0	0.0	0.0	1063.0	0.0	0.0	1063.0
150.0	0.0	0.0	926.1	0.0	0.0	926.1
160.0	0.0	0.0	683.5	0.0	0.0	683.5
170.0	0.0	0.0	362.6	0.0	0.0	362.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	-362.6	0.0	0.0	-362.6
200.0	0.0	0.0	-683.5	0.0	0.0	-683.5
210.0	0.0	0.0	-926.1	0.0	0.0	-926.1
220.0	0.0	0.0	-1063.0	0.0	0.0	-1063.0
230.0	0.0	0.0	-1079.2	0.0	0.0	-1079.2
240.0	0.0	0.0	-974.5	0.0	0.0	-974.5
250.0	0.0	0.0	-762.6	0.0	0.0	-762.6
260.0	0.0	0.0	-470.0	0.0	0.0	-470.0
270.0	0.0	0.0	-132.4	0.0	0.0	-132.4
280.0	0.0	0.0	209.2	0.0	0.0	209.2
290.0	0.0	0.0	513.8	0.0	0.0	513.8
300.0	0.0	0.0	745.2	0.0	0.0	745.2
310.0	0.0	0.0	876.4	0.0	0.0	876.4
320.0	0.0	0.0	892.8	0.0	0.0	892.8
330.0	0.0	0.0	793.7	0.0	0.0	793.7
340.0	0.0	0.0	593.0	0.0	0.0	593.0
350.0	0.0	0.0	316.6	0.0	0.0	316.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.20.4 Thruster use

Case 20 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	9.5	0.0	9.5	0.0	0.0	90.0	19.0	360.0
10.0	12.4	355.8	6.7	352.2	6.6	90.0	19.6	14.3
20.0	15.1	354.4	4.1	338.7	13.0	90.0	21.4	27.9
30.0	34.7	359.5	16.1	180.9	16.2	90.0	24.3	40.0
40.0	67.8	2.4	49.6	177.1	16.4	90.0	28.4	50.1
50.0	90.1	3.7	72.5	175.8	16.8	90.0	33.1	57.7
60.0	99.3	4.1	82.6	173.4	17.3	90.0	37.9	63.3
70.0	100.4	6.3	84.2	172.7	17.1	90.0	42.0	67.2
80.0	87.7	8.6	72.2	170.5	16.9	90.0	44.7	69.7
90.0	62.5	12.8	47.9	165.0	16.7	90.0	45.4	71.1
100.0	28.2	27.9	16.3	132.8	16.7	90.0	44.1	71.6
110.0	16.7	64.1	11.7	60.2	13.5	90.0	40.8	71.2
120.0	15.8	67.8	13.0	60.2	7.9	90.0	36.1	69.8
130.0	14.3	68.5	13.4	60.2	3.1	90.0	30.4	67.0
140.0	12.3	66.9	12.8	58.8	-0.5	90.0	24.6	62.2
150.0	10.0	65.9	11.3	51.4	-2.3	90.0	19.2	54.5
160.0	7.6	57.5	9.2	41.9	-2.6	90.0	14.8	42.3
170.0	5.7	35.3	7.1	26.9	-1.7	90.0	12.0	23.8
180.0	5.5	0.0	5.5	0.0	0.0	90.0	11.0	360.0
190.0	7.1	333.1	5.7	324.7	1.7	90.0	12.0	336.2
200.0	9.2	318.1	7.6	302.5	2.6	90.0	14.8	317.7
210.0	11.3	308.6	10.0	294.1	2.3	90.0	19.2	305.5
220.0	12.8	301.2	12.3	293.1	0.5	90.0	24.6	297.8
230.0	13.4	299.8	14.5	291.5	-3.1	90.0	30.4	293.0
240.0	13.0	299.8	15.3	292.2	-7.9	90.0	36.1	290.2
250.0	11.7	299.3	16.7	295.9	-13.5	90.0	40.8	288.8
260.0	16.3	227.2	28.2	332.1	-16.7	90.0	44.1	288.4
270.0	17.9	195.0	62.5	347.2	-16.7	90.0	45.4	288.9
280.0	12.1	189.5	87.7	351.4	-16.9	90.0	44.7	290.3
290.0	84.1	187.0	100.4	353.5	-17.1	90.0	42.0	292.8
300.0	82.6	186.6	99.3	355.9	-17.3	90.0	37.9	296.7
310.0	72.5	184.2	90.1	356.3	-16.8	90.0	33.1	302.3
320.0	49.6	182.9	67.8	357.6	-16.4	90.0	28.4	309.9
330.0	16.1	179.1	34.7	0.5	-16.2	90.0	24.3	320.0
340.0	4.1	21.3	15.1	5.6	-13.0	90.0	21.4	332.1
350.0	6.7	7.8	12.4	4.2	-6.6	90.0	19.6	345.7
360.0	9.5	0.0	9.5	0.0	0.0	90.0	19.0	360.0

6.20.5 Thruster loss

Case 20 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.86	1.00
10.0	0.85	0.85	0.80
20.0	0.85	0.86	0.80
30.0	0.86	0.78	0.81
40.0	0.87	0.79	0.82
50.0	0.88	0.80	0.84
60.0	0.89	0.81	0.86
70.0	0.90	0.81	0.85
80.0	0.90	0.82	0.84
90.0	0.91	0.82	0.83
100.0	0.90	0.81	0.84
110.0	0.86	0.83	0.84
120.0	0.87	0.84	0.85
130.0	0.88	0.85	0.85
140.0	0.90	0.87	0.91
150.0	0.91	0.88	0.90
160.0	0.92	0.88	0.90
170.0	0.93	0.90	0.90
180.0	0.95	0.95	1.00
190.0	0.90	0.93	0.90
200.0	0.88	0.92	0.90
210.0	0.88	0.91	0.90
220.0	0.87	0.90	0.91
230.0	0.85	0.88	0.85
240.0	0.84	0.87	0.85
250.0	0.83	0.86	0.84
260.0	0.81	0.90	0.84
270.0	0.82	0.91	0.83
280.0	0.82	0.90	0.84
290.0	0.81	0.89	0.85
300.0	0.81	0.89	0.86
310.0	0.80	0.88	0.84
320.0	0.79	0.87	0.82
330.0	0.78	0.86	0.81
340.0	0.86	0.85	0.80
350.0	0.85	0.85	0.80
360.0	0.86	0.86	1.00

Preliminary Design, @IDR5

6.21 Case 21 - Thrust Utilization: 35 knots wind @ 10 deg, 2 knots current, Sea State 5

6.21.1 Environment and thrust utilisation

Case 21 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	10.0	10.0	0.0	35.0	4.0	6.7	9.4	2.00	37.5
10.0	10.0	10.0	10.0	35.0	4.0	6.7	9.4	2.00	61.2
20.0	10.0	10.0	20.0	35.0	4.0	6.7	9.4	2.00	83.3
30.0	10.0	10.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	10.0	10.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	10.0	10.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	10.0	10.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	10.0	10.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	10.0	10.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	10.0	10.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	10.0	10.0	100.0	35.0	4.0	6.7	9.4	2.00	90.2
110.0	10.0	10.0	110.0	35.0	4.0	6.7	9.4	2.00	71.7
120.0	10.0	10.0	120.0	35.0	4.0	6.7	9.4	2.00	53.4
130.0	10.0	10.0	130.0	35.0	4.0	6.7	9.4	2.00	38.0
140.0	10.0	10.0	140.0	35.0	4.0	6.7	9.4	2.00	26.8
150.0	10.0	10.0	150.0	35.0	4.0	6.7	9.4	2.00	20.6
160.0	10.0	10.0	160.0	35.0	4.0	6.7	9.4	2.00	19.3
170.0	10.0	10.0	170.0	35.0	4.0	6.7	9.4	2.00	22.3
180.0	10.0	10.0	180.0	35.0	4.0	6.7	9.4	2.00	31.9
190.0	10.0	10.0	190.0	35.0	4.0	6.7	9.4	2.00	37.4
200.0	10.0	10.0	200.0	35.0	4.0	6.7	9.4	2.00	33.6
210.0	10.0	10.0	210.0	35.0	4.0	6.7	9.4	2.00	32.8
220.0	10.0	10.0	220.0	35.0	4.0	6.7	9.4	2.00	27.1
230.0	10.0	10.0	230.0	35.0	4.0	6.7	9.4	2.00	17.7
240.0	10.0	10.0	240.0	35.0	4.0	6.7	9.4	2.00	15.7
250.0	10.0	10.0	250.0	35.0	4.0	6.7	9.4	2.00	30.1
260.0	10.0	10.0	260.0	35.0	4.0	6.7	9.4	2.00	39.5
270.0	10.0	10.0	270.0	35.0	4.0	6.7	9.4	2.00	55.2
280.0	10.0	10.0	280.0	35.0	4.0	6.7	9.4	2.00	67.4
290.0	10.0	10.0	290.0	35.0	4.0	6.7	9.4	2.00	78.7
300.0	10.0	10.0	300.0	35.0	4.0	6.7	9.4	2.00	79.4
310.0	10.0	10.0	310.0	35.0	4.0	6.7	9.4	2.00	75.5
320.0	10.0	10.0	320.0	35.0	4.0	6.7	9.4	2.00	65.4
330.0	10.0	10.0	330.0	35.0	4.0	6.7	9.4	2.00	49.9
340.0	10.0	10.0	340.0	35.0	4.0	6.7	9.4	2.00	30.3
350.0	10.0	10.0	350.0	35.0	4.0	6.7	9.4	2.00	10.2
360.0	10.0	10.0	360.0	35.0	4.0	6.7	9.4	2.00	37.5

6.21.2 Relative contributions of force components

Case 21 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	39.1	25.7	14.7	0.0	20.4	100.0
10.0	35.4	22.8	23.9	0.0	17.9	100.0
20.0	30.8	19.3	34.8	0.0	15.1	100.0
30.0	26.0	16.0	45.5	0.0	12.5	100.0
40.0	21.7	13.1	55.0	0.0	10.2	100.0
50.0	18.2	10.9	62.5	0.0	8.4	100.0
60.0	15.7	9.2	68.1	0.0	7.1	100.0
70.0	13.9	8.1	71.8	0.0	6.2	100.0
80.0	12.9	7.5	73.9	0.0	5.7	100.0
90.0	12.5	7.2	74.8	0.0	5.5	100.0
100.0	12.7	7.3	74.4	0.0	5.6	100.0
110.0	13.6	7.8	72.6	0.0	5.9	100.0
120.0	15.2	8.8	69.4	0.0	6.7	100.0
130.0	17.7	10.3	64.1	0.0	7.8	100.0
140.0	21.5	12.6	56.3	0.0	9.6	100.0
150.0	26.9	16.0	44.8	0.0	12.3	100.0
160.0	34.5	20.8	28.6	0.0	15.1	100.0
170.0	44.6	27.5	6.5	0.0	21.4	100.0
180.0	56.8	36.1	-21.3	0.0	28.4	100.0
190.0	68.2	45.1	-49.2	0.0	35.9	100.0
200.0	39.3	30.6	-1.9	0.0	37.0	100.0
210.0	12.1	12.7	46.2	0.0	29.0	100.0
220.0	-0.9	3.1	77.2	0.0	20.3	100.0
230.0	-3.8	-0.4	91.0	0.0	14.7	100.0
240.0	-5.4	-1.7	96.8	0.0	11.4	100.0
250.0	-6.5	-2.1	99.0	0.0	9.5	100.0
260.0	-6.2	-2.1	99.7	0.0	8.6	100.0
270.0	-5.8	-1.9	99.3	0.0	8.4	100.0
280.0	-5.3	-1.5	98.1	0.0	8.8	100.0
290.0	-4.4	-0.8	95.4	0.0	9.8	100.0
300.0	-2.7	0.6	90.5	0.0	11.6	100.0
310.0	0.8	3.2	81.7	0.0	14.3	100.0
320.0	7.3	7.8	67.1	0.0	17.8	100.0
330.0	17.4	14.4	47.2	0.0	21.0	100.0
340.0	28.8	21.4	27.9	0.0	21.9	100.0
350.0	40.0	27.1	11.1	0.0	21.8	100.0
360.0	39.1	25.7	14.7	0.0	20.4	100.0

6.21.3 Environment forces

Case 21 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.8	-4.8	-3.6	0.0	-3.9	-19.2
10.0	-6.8	-4.8	-3.6	0.0	-3.9	-19.2
20.0	-6.8	-4.8	-3.5	0.0	-3.9	-19.1
30.0	-6.8	-4.8	-3.2	0.0	-3.9	-18.8
40.0	-6.8	-4.8	-2.8	0.0	-3.9	-18.4
50.0	-6.8	-4.8	-2.3	0.0	-3.9	-17.9
60.0	-6.8	-4.8	-1.6	0.0	-3.9	-17.2
70.0	-6.8	-4.8	-0.9	0.0	-3.9	-16.5
80.0	-6.8	-4.8	-0.1	0.0	-3.9	-15.7
90.0	-6.8	-4.8	0.7	0.0	-3.9	-14.9
100.0	-6.8	-4.8	1.5	0.0	-3.9	-14.1
110.0	-6.8	-4.8	2.3	0.0	-3.9	-13.3
120.0	-6.8	-4.8	3.0	0.0	-3.9	-12.6
130.0	-6.8	-4.8	3.5	0.0	-3.9	-12.1
140.0	-6.8	-4.8	4.0	0.0	-3.9	-11.6
150.0	-6.8	-4.8	4.3	0.0	-3.9	-11.3
160.0	-6.8	-4.8	4.4	0.0	-3.9	-11.2
170.0	-6.8	-4.8	4.4	0.0	-3.9	-11.2
180.0	-6.8	-4.8	4.3	0.0	-3.9	-11.3
190.0	-6.8	-4.8	4.4	0.0	-3.9	-11.2
200.0	-6.8	-4.8	4.4	0.0	-3.9	-11.2
210.0	-6.8	-4.8	4.3	0.0	-3.9	-11.3
220.0	-6.8	-4.8	4.0	0.0	-3.9	-11.6
230.0	-6.8	-4.8	3.5	0.0	-3.9	-12.1
240.0	-6.8	-4.8	3.0	0.0	-3.9	-12.6
250.0	-6.8	-4.8	2.3	0.0	-3.9	-13.3
260.0	-6.8	-4.8	1.5	0.0	-3.9	-14.1
270.0	-6.8	-4.8	0.7	0.0	-3.9	-14.9
280.0	-6.8	-4.8	-0.1	0.0	-3.9	-15.7
290.0	-6.8	-4.8	-0.9	0.0	-3.9	-16.5
300.0	-6.8	-4.8	-1.6	0.0	-3.9	-17.2
310.0	-6.8	-4.8	-2.3	0.0	-3.9	-17.9
320.0	-6.8	-4.8	-2.8	0.0	-3.9	-18.4
330.0	-6.8	-4.8	-3.2	0.0	-3.9	-18.8
340.0	-6.8	-4.8	-3.5	0.0	-3.9	-19.1
350.0	-6.8	-4.8	-3.6	0.0	-3.9	-19.2
360.0	-6.8	-4.8	-3.6	0.0	-3.9	-19.2

Case 21 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.3	-2.8	0.0	0.0	-2.0	-10.1
10.0	-5.3	-2.8	-4.8	0.0	-2.0	-14.9
20.0	-5.3	-2.8	-10.0	0.0	-2.0	-20.0
30.0	-5.3	-2.8	-15.6	0.0	-2.0	-25.7
40.0	-5.3	-2.8	-21.7	0.0	-2.0	-31.8
50.0	-5.3	-2.8	-28.0	0.0	-2.0	-38.0
60.0	-5.3	-2.8	-33.8	0.0	-2.0	-43.9
70.0	-5.3	-2.8	-38.7	0.0	-2.0	-48.7
80.0	-5.3	-2.8	-41.9	0.0	-2.0	-51.9
90.0	-5.3	-2.8	-43.0	0.0	-2.0	-53.1
100.0	-5.3	-2.8	-41.9	0.0	-2.0	-51.9
110.0	-5.3	-2.8	-38.7	0.0	-2.0	-48.7
120.0	-5.3	-2.8	-33.8	0.0	-2.0	-43.9
130.0	-5.3	-2.8	-28.0	0.0	-2.0	-38.0
140.0	-5.3	-2.8	-21.7	0.0	-2.0	-31.8
150.0	-5.3	-2.8	-15.6	0.0	-2.0	-25.7
160.0	-5.3	-2.8	-10.0	0.0	-2.0	-20.0
170.0	-5.3	-2.8	-4.8	0.0	-2.0	-14.9
180.0	-5.3	-2.8	0.0	0.0	-2.0	-10.1
190.0	-5.3	-2.8	4.8	0.0	-2.0	-5.2
200.0	-5.3	-2.8	10.0	0.0	2.0	4.0
210.0	-5.3	-2.8	15.6	0.0	2.0	9.6
220.0	-5.3	-2.8	21.7	0.0	2.0	15.7
230.0	-5.3	-2.8	28.0	0.0	2.0	22.0
240.0	-5.3	-2.8	33.8	0.0	2.0	27.8
250.0	-5.3	-2.8	38.7	0.0	2.0	32.7
260.0	-5.3	-2.8	41.9	0.0	2.0	35.9
270.0	-5.3	-2.8	43.0	0.0	2.0	37.0
280.0	-5.3	-2.8	41.9	0.0	2.0	35.9
290.0	-5.3	-2.8	38.7	0.0	2.0	32.7
300.0	-5.3	-2.8	33.8	0.0	2.0	27.8
310.0	-5.3	-2.8	28.0	0.0	2.0	22.0
320.0	-5.3	-2.8	21.7	0.0	2.0	15.7
330.0	-5.3	-2.8	15.6	0.0	2.0	9.6
340.0	-5.3	-2.8	10.0	0.0	2.0	4.0
350.0	-5.3	-2.8	4.8	0.0	-2.0	-5.2
360.0	-5.3	-2.8	0.0	0.0	-2.0	-10.1

Case 21 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-184.0	-55.8	0.0	0.0	-55.6	-295.3
10.0	-184.0	-55.8	-316.6	0.0	-55.6	-612.0
20.0	-184.0	-55.8	-593.0	0.0	-55.6	-888.3
30.0	-184.0	-55.8	-793.7	0.0	-55.6	-1089.0
40.0	-184.0	-55.8	-892.8	0.0	-55.6	-1188.1
50.0	-184.0	-55.8	-876.4	0.0	-55.6	-1171.8
60.0	-184.0	-55.8	-745.2	0.0	-55.6	-1040.6
70.0	-184.0	-55.8	-513.8	0.0	-55.6	-809.2
80.0	-184.0	-55.8	-209.2	0.0	-55.6	-504.6
90.0	-184.0	-55.8	132.4	0.0	-55.6	-163.0
100.0	-184.0	-55.8	470.0	0.0	55.6	285.7
110.0	-184.0	-55.8	762.6	0.0	55.6	578.4
120.0	-184.0	-55.8	974.5	0.0	55.6	790.3
130.0	-184.0	-55.8	1079.2	0.0	55.6	895.0
140.0	-184.0	-55.8	1063.0	0.0	55.6	873.7
150.0	-184.0	-55.8	926.1	0.0	55.6	711.9
160.0	-184.0	-55.8	683.5	0.0	55.6	499.3
170.0	-184.0	-55.8	362.6	0.0	55.6	178.4
180.0	-184.0	-55.8	0.0	0.0	-55.6	-295.3
190.0	-184.0	-55.8	-362.6	0.0	-55.6	-657.9
200.0	-184.0	-55.8	-683.5	0.0	-55.6	-978.9
210.0	-184.0	-55.8	-926.1	0.0	-55.6	-1221.4
220.0	-184.0	-55.8	-1063.0	0.0	-55.6	-1358.3
230.0	-184.0	-55.8	-1079.2	0.0	-55.6	-1374.6
240.0	-184.0	-55.8	-974.5	0.0	-55.6	-1269.9
250.0	-184.0	-55.8	-762.6	0.0	-55.6	-1058.0
260.0	-184.0	-55.8	-470.0	0.0	-55.6	-765.3
270.0	-184.0	-55.8	-132.4	0.0	-55.6	-427.7
280.0	-184.0	-55.8	209.2	0.0	-55.6	-86.1
290.0	-184.0	-55.8	513.8	0.0	55.6	329.6
300.0	-184.0	-55.8	745.2	0.0	55.6	561.0
310.0	-184.0	-55.8	876.4	0.0	55.6	692.2
320.0	-184.0	-55.8	892.8	0.0	55.6	708.5
330.0	-184.0	-55.8	793.7	0.0	55.6	609.4
340.0	-184.0	-55.8	593.0	0.0	55.6	408.7
350.0	-184.0	-55.8	316.6	0.0	55.6	132.4
360.0	-184.0	-55.8	0.0	0.0	-55.6	-295.3

6.21.4 Thruster use

Case 21 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	13.6	1.4	5.6	3.4	9.4	90.0	21.7	27.7
10.0	16.7	358.1	2.6	347.7	16.0	90.0	24.3	37.8
20.0	63.3	1.9	44.3	177.5	16.0	90.0	27.7	46.4
30.0	97.1	0.1	79.6	174.4	16.2	90.0	30.0	53.3
40.0	98.0	0.1	84.7	175.6	16.4	90.0	26.8	59.5
50.0	99.1	0.1	87.7	175.0	16.8	90.0	27.2	64.4
60.0	100.5	0.1	89.8	173.0	17.3	90.0	30.7	68.4
70.0	102.0	0.2	92.0	169.9	17.1	90.0	35.3	71.2
80.0	101.8	6.7	89.8	173.2	16.9	90.0	41.1	73.2
90.0	102.8	8.9	89.6	171.1	16.7	90.0	48.2	74.3
100.0	86.6	12.6	72.3	166.9	16.7	90.0	53.8	74.8
110.0	46.6	21.4	33.5	153.7	16.8	90.0	50.5	74.7
120.0	18.3	68.8	12.1	60.2	16.3	90.0	45.7	73.9
130.0	16.8	69.5	12.5	60.2	11.5	90.0	39.9	72.4
140.0	14.8	67.1	11.9	60.2	7.9	90.0	33.9	69.9
150.0	12.5	60.3	10.3	60.2	5.9	90.0	28.1	66.2
160.0	10.5	46.7	8.0	60.2	5.5	90.0	22.9	60.9
170.0	9.2	28.5	5.2	53.1	6.4	90.0	18.6	53.1
180.0	9.6	2.1	1.7	11.4	9.4	90.0	15.2	41.7
190.0	10.7	344.3	3.1	287.0	11.1	90.0	12.3	25.1
200.0	12.0	325.6	7.0	280.5	9.7	90.0	11.9	340.4
210.0	13.8	316.6	9.6	277.8	9.4	90.0	14.9	319.6
220.0	15.1	309.4	11.8	280.0	7.6	90.0	19.6	306.5
230.0	15.5	303.2	13.7	285.2	4.2	90.0	25.1	298.8
240.0	15.1	299.8	15.1	289.9	-0.6	90.0	30.6	294.4
250.0	13.8	296.3	15.9	293.9	-6.1	90.0	35.3	292.2
260.0	11.8	291.8	16.2	300.5	-11.7	90.0	38.5	291.4
270.0	9.4	299.8	16.0	309.6	-16.5	90.0	39.9	291.9
280.0	7.0	206.2	35.8	344.2	-16.9	90.0	39.2	293.6
290.0	41.9	190.3	58.3	352.0	-17.1	90.0	36.6	296.8
300.0	40.1	187.2	57.3	354.5	-17.3	90.0	32.7	301.7
310.0	30.1	184.7	47.9	356.7	-16.8	90.0	28.3	309.1
320.0	7.3	177.5	25.7	0.8	-16.4	90.0	24.2	319.5
330.0	4.2	23.8	15.1	6.3	-13.0	90.0	21.1	332.9
340.0	6.6	14.6	12.8	7.4	-7.3	90.0	19.5	348.2
350.0	10.3	10.9	9.2	11.9	1.4	90.0	19.9	15.2
360.0	13.6	1.4	5.6	3.4	9.4	90.0	21.7	27.7

6.21.5 Thruster loss

Case 21 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.85	0.81
10.0	0.85	0.85	0.80
20.0	0.86	0.79	0.80
30.0	0.87	0.81	0.81
40.0	0.87	0.80	0.82
50.0	0.88	0.80	0.84
60.0	0.90	0.81	0.86
70.0	0.91	0.83	0.85
80.0	0.91	0.81	0.84
90.0	0.92	0.81	0.83
100.0	0.93	0.80	0.84
110.0	0.92	0.81	0.84
120.0	0.87	0.84	0.85
130.0	0.88	0.85	0.85
140.0	0.90	0.86	0.85
150.0	0.92	0.88	0.86
160.0	0.93	0.88	0.87
170.0	0.93	0.88	0.88
180.0	0.95	0.92	0.90
190.0	0.91	0.92	0.90
200.0	0.89	0.91	0.90
210.0	0.88	0.89	0.90
220.0	0.88	0.88	0.91
230.0	0.86	0.87	0.92
240.0	0.84	0.87	0.85
250.0	0.83	0.86	0.84
260.0	0.82	0.86	0.84
270.0	0.81	0.86	0.83
280.0	0.84	0.89	0.84
290.0	0.83	0.89	0.85
300.0	0.81	0.88	0.86
310.0	0.80	0.88	0.84
320.0	0.79	0.87	0.82
330.0	0.87	0.85	0.81
340.0	0.86	0.84	0.80
350.0	0.85	0.83	0.81
360.0	0.85	0.85	0.81

Preliminary Design, @IDR5

6.22 Case 22 - Thrust Utilization: 35 knots wind @ 20 deg, 2 knots current, Sea State 5

6.22.1 Environment and thrust utilisation

Case 22 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	20.0	20.0	0.0	35.0	4.0	6.7	9.4	2.00	72.0
10.0	20.0	20.0	10.0	35.0	4.0	6.7	9.4	2.00	95.9
20.0	20.0	20.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	20.0	20.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	20.0	20.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	20.0	20.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	20.0	20.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	20.0	20.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	20.0	20.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	20.0	20.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	20.0	20.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	20.0	20.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	20.0	20.0	120.0	35.0	4.0	6.7	9.4	2.00	82.7
130.0	20.0	20.0	130.0	35.0	4.0	6.7	9.4	2.00	67.0
140.0	20.0	20.0	140.0	35.0	4.0	6.7	9.4	2.00	55.4
150.0	20.0	20.0	150.0	35.0	4.0	6.7	9.4	2.00	48.8
160.0	20.0	20.0	160.0	35.0	4.0	6.7	9.4	2.00	47.4
170.0	20.0	20.0	170.0	35.0	4.0	6.7	9.4	2.00	60.4
180.0	20.0	20.0	180.0	35.0	4.0	6.7	9.4	2.00	66.1
190.0	20.0	20.0	190.0	35.0	4.0	6.7	9.4	2.00	72.4
200.0	20.0	20.0	200.0	35.0	4.0	6.7	9.4	2.00	76.0
210.0	20.0	20.0	210.0	35.0	4.0	6.7	9.4	2.00	74.8
220.0	20.0	20.0	220.0	35.0	4.0	6.7	9.4	2.00	50.2
230.0	20.0	20.0	230.0	35.0	4.0	6.7	9.4	2.00	39.5
240.0	20.0	20.0	240.0	35.0	4.0	6.7	9.4	2.00	24.9
250.0	20.0	20.0	250.0	35.0	4.0	6.7	9.4	2.00	16.0
260.0	20.0	20.0	260.0	35.0	4.0	6.7	9.4	2.00	21.3
270.0	20.0	20.0	270.0	35.0	4.0	6.7	9.4	2.00	31.9
280.0	20.0	20.0	280.0	35.0	4.0	6.7	9.4	2.00	43.6
290.0	20.0	20.0	290.0	35.0	4.0	6.7	9.4	2.00	59.0
300.0	20.0	20.0	300.0	35.0	4.0	6.7	9.4	2.00	59.6
310.0	20.0	20.0	310.0	35.0	4.0	6.7	9.4	2.00	55.3
320.0	20.0	20.0	320.0	35.0	4.0	6.7	9.4	2.00	44.8
330.0	20.0	20.0	330.0	35.0	4.0	6.7	9.4	2.00	11.8
340.0	20.0	20.0	340.0	35.0	4.0	6.7	9.4	2.00	17.0
350.0	20.0	20.0	350.0	35.0	4.0	6.7	9.4	2.00	48.3
360.0	20.0	20.0	360.0	35.0	4.0	6.7	9.4	2.00	72.0

6.22.2 Relative contributions of force components

Case 22 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	44.6	26.9	8.3	0.0	20.2	100.0
10.0	40.0	23.8	18.3	0.0	17.8	100.0
20.0	35.6	21.0	27.9	0.0	15.6	100.0
30.0	31.4	18.3	36.7	0.0	13.6	100.0
40.0	27.6	16.0	44.6	0.0	11.8	100.0
50.0	24.4	14.0	51.2	0.0	10.3	100.0
60.0	22.0	12.5	56.4	0.0	9.2	100.0
70.0	20.2	11.5	60.0	0.0	8.4	100.0
80.0	19.2	10.8	62.1	0.0	7.9	100.0
90.0	18.8	10.6	62.9	0.0	7.7	100.0
100.0	19.1	10.8	62.3	0.0	7.8	100.0
110.0	20.1	11.3	60.3	0.0	8.3	100.0
120.0	21.9	12.3	56.7	0.0	9.0	100.0
130.0	24.5	13.9	51.5	0.0	10.1	100.0
140.0	28.1	15.9	44.3	0.0	11.7	100.0
150.0	32.7	18.6	35.0	0.0	13.7	100.0
160.0	38.4	22.0	23.4	0.0	16.2	100.0
170.0	45.3	26.2	9.2	0.0	19.3	100.0
180.0	53.7	31.4	-8.4	0.0	23.3	100.0
190.0	64.9	38.5	-32.0	0.0	28.7	100.0
200.0	78.7	47.7	-62.4	0.0	36.0	100.0
210.0	86.1	54.7	-82.3	0.0	42.0	100.0
220.0	-6.6	21.1	65.1	0.0	38.7	100.0
230.0	-21.2	-7.7	98.9	0.0	30.0	100.0
240.0	-23.4	-10.2	110.2	0.0	23.4	100.0
250.0	-22.5	-10.3	113.3	0.0	19.5	100.0
260.0	-21.2	-9.8	113.6	0.0	17.4	100.0
270.0	-20.1	-9.3	112.6	0.0	16.8	100.0
280.0	-19.2	-8.7	110.6	0.0	17.2	100.0
290.0	-17.8	-7.6	106.6	0.0	18.8	100.0
300.0	-14.7	-5.2	98.5	0.0	21.5	100.0
310.0	-7.2	-0.1	82.7	0.0	24.6	100.0
320.0	7.6	9.3	56.9	0.0	26.2	100.0
330.0	49.8	32.6	-7.7	0.0	25.3	100.0
340.0	51.9	32.6	-9.4	0.0	24.9	100.0
350.0	48.9	30.0	-1.6	0.0	22.7	100.0
360.0	44.6	26.9	8.3	0.0	20.2	100.0

6.22.3 Environment forces

Case 22 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-7.0	-5.0	-3.6	0.0	-4.0	-19.6
10.0	-7.0	-5.0	-3.6	0.0	-4.0	-19.6
20.0	-7.0	-5.0	-3.5	0.0	-4.0	-19.4
30.0	-7.0	-5.0	-3.2	0.0	-4.0	-19.2
40.0	-7.0	-5.0	-2.8	0.0	-4.0	-18.8
50.0	-7.0	-5.0	-2.3	0.0	-4.0	-18.2
60.0	-7.0	-5.0	-1.6	0.0	-4.0	-17.6
70.0	-7.0	-5.0	-0.9	0.0	-4.0	-16.9
80.0	-7.0	-5.0	-0.1	0.0	-4.0	-16.1
90.0	-7.0	-5.0	0.7	0.0	-4.0	-15.3
100.0	-7.0	-5.0	1.5	0.0	-4.0	-14.5
110.0	-7.0	-5.0	2.3	0.0	-4.0	-13.7
120.0	-7.0	-5.0	3.0	0.0	-4.0	-13.0
130.0	-7.0	-5.0	3.5	0.0	-4.0	-12.4
140.0	-7.0	-5.0	4.0	0.0	-4.0	-12.0
150.0	-7.0	-5.0	4.3	0.0	-4.0	-11.7
160.0	-7.0	-5.0	4.4	0.0	-4.0	-11.5
170.0	-7.0	-5.0	4.4	0.0	-4.0	-11.5
180.0	-7.0	-5.0	4.3	0.0	-4.0	-11.7
190.0	-7.0	-5.0	4.4	0.0	-4.0	-11.5
200.0	-7.0	-5.0	4.4	0.0	-4.0	-11.5
210.0	-7.0	-5.0	4.3	0.0	-4.0	-11.7
220.0	-7.0	-5.0	4.0	0.0	-4.0	-12.0
230.0	-7.0	-5.0	3.5	0.0	-4.0	-12.4
240.0	-7.0	-5.0	3.0	0.0	-4.0	-13.0
250.0	-7.0	-5.0	2.3	0.0	-4.0	-13.7
260.0	-7.0	-5.0	1.5	0.0	-4.0	-14.5
270.0	-7.0	-5.0	0.7	0.0	-4.0	-15.3
280.0	-7.0	-5.0	-0.1	0.0	-4.0	-16.1
290.0	-7.0	-5.0	-0.9	0.0	-4.0	-16.9
300.0	-7.0	-5.0	-1.6	0.0	-4.0	-17.6
310.0	-7.0	-5.0	-2.3	0.0	-4.0	-18.2
320.0	-7.0	-5.0	-2.8	0.0	-4.0	-18.8
330.0	-7.0	-5.0	-3.2	0.0	-4.0	-19.2
340.0	-7.0	-5.0	-3.5	0.0	-4.0	-19.4
350.0	-7.0	-5.0	-3.6	0.0	-4.0	-19.6
360.0	-7.0	-5.0	-3.6	0.0	-4.0	-19.6

Case 22 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-11.2	-6.0	0.0	0.0	-4.3	-21.5
10.0	-11.2	-6.0	-4.8	0.0	-4.3	-26.4
20.0	-11.2	-6.0	-10.0	0.0	-4.3	-31.5
30.0	-11.2	-6.0	-15.6	0.0	-4.3	-37.2
40.0	-11.2	-6.0	-21.7	0.0	-4.3	-43.3
50.0	-11.2	-6.0	-28.0	0.0	-4.3	-49.5
60.0	-11.2	-6.0	-33.8	0.0	-4.3	-55.4
70.0	-11.2	-6.0	-38.7	0.0	-4.3	-60.2
80.0	-11.2	-6.0	-41.9	0.0	-4.3	-63.4
90.0	-11.2	-6.0	-43.0	0.0	-4.3	-64.5
100.0	-11.2	-6.0	-41.9	0.0	-4.3	-63.4
110.0	-11.2	-6.0	-38.7	0.0	-4.3	-60.2
120.0	-11.2	-6.0	-33.8	0.0	-4.3	-55.4
130.0	-11.2	-6.0	-28.0	0.0	-4.3	-49.5
140.0	-11.2	-6.0	-21.7	0.0	-4.3	-43.3
150.0	-11.2	-6.0	-15.6	0.0	-4.3	-37.2
160.0	-11.2	-6.0	-10.0	0.0	-4.3	-31.5
170.0	-11.2	-6.0	-4.8	0.0	-4.3	-26.4
180.0	-11.2	-6.0	0.0	0.0	-4.3	-21.5
190.0	-11.2	-6.0	4.8	0.0	-4.3	-16.7
200.0	-11.2	-6.0	10.0	0.0	-4.3	-11.5
210.0	-11.2	-6.0	15.6	0.0	-4.3	-5.9
220.0	-11.2	-6.0	21.7	0.0	4.3	8.9
230.0	-11.2	-6.0	28.0	0.0	4.3	15.1
240.0	-11.2	-6.0	33.8	0.0	4.3	21.0
250.0	-11.2	-6.0	38.7	0.0	4.3	25.8
260.0	-11.2	-6.0	41.9	0.0	4.3	29.0
270.0	-11.2	-6.0	43.0	0.0	4.3	30.1
280.0	-11.2	-6.0	41.9	0.0	4.3	29.0
290.0	-11.2	-6.0	38.7	0.0	4.3	25.8
300.0	-11.2	-6.0	33.8	0.0	4.3	21.0
310.0	-11.2	-6.0	28.0	0.0	4.3	15.1
320.0	-11.2	-6.0	21.7	0.0	4.3	8.9
330.0	-11.2	-6.0	15.6	0.0	-4.3	-5.9
340.0	-11.2	-6.0	10.0	0.0	-4.3	-11.5
350.0	-11.2	-6.0	4.8	0.0	-4.3	-16.7
360.0	-11.2	-6.0	0.0	0.0	-4.3	-21.5

Case 22 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-351.6	-105.4	0.0	0.0	-104.4	-561.4
10.0	-351.6	-105.4	-316.6	0.0	-104.4	-878.0
20.0	-351.6	-105.4	-593.0	0.0	-104.4	-1154.3
30.0	-351.6	-105.4	-793.7	0.0	-104.4	-1355.0
40.0	-351.6	-105.4	-892.8	0.0	-104.4	-1454.1
50.0	-351.6	-105.4	-876.4	0.0	-104.4	-1437.8
60.0	-351.6	-105.4	-745.2	0.0	-104.4	-1306.6
70.0	-351.6	-105.4	-513.8	0.0	-104.4	-1075.2
80.0	-351.6	-105.4	-209.2	0.0	-104.4	-770.6
90.0	-351.6	-105.4	132.4	0.0	-104.4	-429.0
100.0	-351.6	-105.4	470.0	0.0	104.4	117.5
110.0	-351.6	-105.4	762.6	0.0	104.4	410.1
120.0	-351.6	-105.4	974.5	0.0	104.4	622.0
130.0	-351.6	-105.4	1079.2	0.0	104.4	728.7
140.0	-351.6	-105.4	1063.0	0.0	104.4	719.4
150.0	-351.6	-105.4	926.1	0.0	104.4	573.0
160.0	-351.6	-105.4	683.5	0.0	104.4	331.0
170.0	-351.6	-105.4	362.6	0.0	-104.4	-198.8
180.0	-351.6	-105.4	0.0	0.0	-104.4	-561.4
190.0	-351.6	-105.4	-362.6	0.0	-104.4	-924.0
200.0	-351.6	-105.4	-683.5	0.0	-104.4	-1244.9
210.0	-351.6	-105.4	-926.1	0.0	-104.4	-1487.4
220.0	-351.6	-105.4	-1063.0	0.0	-104.4	-1624.3
230.0	-351.6	-105.4	-1079.2	0.0	-104.4	-1640.6
240.0	-351.6	-105.4	-974.5	0.0	-104.4	-1535.9
250.0	-351.6	-105.4	-762.6	0.0	-104.4	-1324.0
260.0	-351.6	-105.4	-470.0	0.0	-104.4	-1031.3
270.0	-351.6	-105.4	-132.4	0.0	-104.4	-693.8
280.0	-351.6	-105.4	209.2	0.0	-104.4	-352.1
290.0	-351.6	-105.4	513.8	0.0	104.4	161.3
300.0	-351.6	-105.4	745.2	0.0	104.4	392.7
310.0	-351.6	-105.4	876.4	0.0	104.4	523.9
320.0	-351.6	-105.4	892.8	0.0	104.4	540.3
330.0	-351.6	-105.4	793.7	0.0	104.4	441.2
340.0	-351.6	-105.4	593.0	0.0	104.4	240.5
350.0	-351.6	-105.4	316.6	0.0	-104.4	-244.7
360.0	-351.6	-105.4	0.0	0.0	-104.4	-561.4

6.22.4 Thruster use

Case 22 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	39.3	4.0	19.8	172.4	16.2	90.0	29.1	47.7
10.0	89.9	3.4	70.3	175.9	16.0	90.0	32.8	53.4
20.0	96.5	0.1	82.5	175.4	16.0	90.0	26.8	57.9
30.0	97.1	0.0	87.1	178.0	16.2	90.0	21.8	62.5
40.0	94.4	0.5	86.8	180.0	16.4	90.0	18.8	66.1
50.0	93.4	0.8	86.6	180.0	16.8	90.0	19.3	69.4
60.0	93.5	2.6	86.4	180.0	17.3	90.0	22.8	72.1
70.0	94.2	5.6	86.3	180.0	17.1	90.0	27.3	74.2
80.0	95.9	9.4	86.2	180.0	16.9	90.0	33.6	75.5
90.0	98.4	13.5	86.1	180.0	16.7	90.0	40.9	76.5
100.0	100.8	10.8	88.7	169.4	16.7	90.0	53.3	77.2
110.0	102.8	14.9	87.4	170.1	16.8	90.0	59.8	77.2
120.0	69.6	17.3	56.3	161.7	17.0	90.0	56.9	76.8
130.0	36.2	28.8	24.5	142.0	17.0	90.0	51.1	75.9
140.0	17.7	68.8	11.2	60.2	17.0	90.0	44.9	74.5
150.0	15.5	63.5	9.6	60.2	15.0	90.0	39.0	72.5
160.0	13.2	53.3	7.4	60.2	14.5	90.0	33.6	69.9
170.0	14.6	21.0	4.2	119.8	17.5	90.0	26.8	66.4
180.0	22.5	5.0	10.9	171.8	18.0	90.0	24.1	61.6
190.0	34.8	358.8	23.2	181.4	18.0	90.0	20.3	55.4
200.0	42.1	355.1	30.6	185.4	18.0	90.0	16.3	45.0
210.0	40.1	350.5	28.4	191.4	18.1	90.0	13.1	26.7
220.0	17.4	316.5	11.7	267.1	14.8	90.0	14.9	323.6
230.0	17.6	310.8	13.3	274.2	11.4	90.0	19.6	309.5
240.0	17.0	305.8	14.3	282.5	6.7	90.0	24.7	301.8
250.0	15.6	301.5	17.9	291.7	1.4	90.0	29.2	298.0
260.0	13.7	297.8	15.1	300.5	-4.1	90.0	32.4	296.5
270.0	11.2	299.8	15.0	310.3	-9.0	90.0	33.8	296.9
280.0	8.3	299.8	14.8	322.6	-12.5	90.0	33.2	299.0
290.0	4.6	299.8	15.4	341.3	-16.9	90.0	30.8	303.2
300.0	2.8	315.1	15.8	352.2	-16.9	90.0	27.4	310.0
310.0	2.7	359.7	15.5	359.9	-15.1	90.0	23.7	320.4
320.0	4.6	18.0	14.4	5.6	-11.7	90.0	20.8	334.7
330.0	9.5	25.1	11.2	20.2	-2.0	90.0	20.1	17.1
340.0	11.8	19.8	9.2	24.9	3.7	90.0	22.6	30.7
350.0	15.2	8.0	5.0	23.9	12.6	90.0	25.7	40.5
360.0	39.3	4.0	19.8	172.4	16.2	90.0	29.1	47.7

6.22.5 Thruster loss

Case 22 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.82	0.81
10.0	0.85	0.80	0.80
20.0	0.86	0.80	0.80
30.0	0.87	0.79	0.81
40.0	0.87	0.77	0.82
50.0	0.88	0.77	0.84
60.0	0.89	0.77	0.86
70.0	0.90	0.77	0.85
80.0	0.90	0.77	0.84
90.0	0.91	0.77	0.83
100.0	0.93	0.80	0.84
110.0	0.93	0.78	0.84
120.0	0.93	0.79	0.85
130.0	0.93	0.80	0.85
140.0	0.89	0.86	0.85
150.0	0.92	0.88	0.86
160.0	0.92	0.88	0.87
170.0	0.94	0.83	0.88
180.0	0.95	0.74	0.90
190.0	0.95	0.71	0.90
200.0	0.94	0.74	0.90
210.0	0.92	0.78	0.90
220.0	0.88	0.86	0.91
230.0	0.87	0.86	0.92
240.0	0.85	0.86	0.93
250.0	0.83	0.86	0.93
260.0	0.82	0.86	0.84
270.0	0.81	0.86	0.83
280.0	0.80	0.86	0.84
290.0	0.80	0.87	0.85
300.0	0.80	0.88	0.86
310.0	0.88	0.88	0.84
320.0	0.88	0.86	0.82
330.0	0.88	0.84	0.81
340.0	0.86	0.83	0.83
350.0	0.85	0.82	0.81
360.0	0.85	0.82	0.81

Preliminary Design, @IDR5

6.23 Case 23 - Thrust Utilization: 35 knots wind @ 30 deg, 2 knots current, Sea State 5

6.23.1 Environment and thrust utilisation

Case 23 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	30.0	30.0	0.0	35.0	6.4	6.7	9.4	2.00	> 100.0
10.0	30.0	30.0	10.0	35.0	6.4	6.7	9.4	2.00	> 100.0
20.0	30.0	30.0	20.0	35.0	6.4	6.7	9.4	2.00	> 100.0
30.0	30.0	30.0	30.0	35.0	6.4	6.7	9.4	2.00	> 100.0
40.0	30.0	30.0	40.0	35.0	6.4	6.7	9.4	2.00	> 100.0
50.0	30.0	30.0	50.0	35.0	6.4	6.7	9.4	2.00	> 100.0
60.0	30.0	30.0	60.0	35.0	6.4	6.7	9.4	2.00	> 100.0
70.0	30.0	30.0	70.0	35.0	6.4	6.7	9.4	2.00	> 100.0
80.0	30.0	30.0	80.0	35.0	6.4	6.7	9.4	2.00	> 100.0
90.0	30.0	30.0	90.0	35.0	6.4	6.7	9.4	2.00	> 100.0
100.0	30.0	30.0	100.0	35.0	6.4	6.7	9.4	2.00	> 100.0
110.0	30.0	30.0	110.0	35.0	6.4	6.7	9.4	2.00	> 100.0
120.0	30.0	30.0	120.0	35.0	6.4	6.7	9.4	2.00	> 100.0
130.0	30.0	30.0	130.0	35.0	6.4	6.7	9.4	2.00	> 100.0
140.0	30.0	30.0	140.0	35.0	6.4	6.7	9.4	2.00	> 100.0
150.0	30.0	30.0	150.0	35.0	6.4	6.7	9.4	2.00	> 100.0
160.0	30.0	30.0	160.0	35.0	6.4	6.7	9.4	2.00	> 100.0
170.0	30.0	30.0	170.0	35.0	6.4	6.7	9.4	2.00	> 100.0
180.0	30.0	30.0	180.0	35.0	6.4	6.7	9.4	2.00	> 100.0
190.0	30.0	30.0	190.0	35.0	6.4	6.7	9.4	2.00	> 100.0
200.0	30.0	30.0	200.0	35.0	6.4	6.7	9.4	2.00	> 100.0
210.0	30.0	30.0	210.0	35.0	6.4	6.7	9.4	2.00	> 100.0
220.0	30.0	30.0	220.0	35.0	6.4	6.7	9.4	2.00	> 100.0
230.0	30.0	30.0	230.0	35.0	6.4	6.7	9.4	2.00	> 100.0
240.0	30.0	30.0	240.0	35.0	6.4	6.7	9.4	2.00	> 100.0
250.0	30.0	30.0	250.0	35.0	6.4	6.7	9.4	2.00	> 100.0
260.0	30.0	30.0	260.0	35.0	6.4	6.7	9.4	2.00	> 100.0
270.0	30.0	30.0	270.0	35.0	6.4	6.7	9.4	2.00	30.6
280.0	30.0	30.0	280.0	35.0	6.4	6.7	9.4	2.00	77.1
290.0	30.0	30.0	290.0	35.0	6.4	6.7	9.4	2.00	71.1
300.0	30.0	30.0	300.0	35.0	6.4	6.7	9.4	2.00	71.1
310.0	30.0	30.0	310.0	35.0	6.4	6.7	9.4	2.00	52.0
320.0	30.0	30.0	320.0	35.0	6.4	6.7	9.4	2.00	65.1
330.0	30.0	30.0	330.0	35.0	6.4	6.7	9.4	2.00	> 100.0
340.0	30.0	30.0	340.0	35.0	6.4	6.7	9.4	2.00	> 100.0
350.0	30.0	30.0	350.0	35.0	6.4	6.7	9.4	2.00	> 100.0
360.0	30.0	30.0	360.0	35.0	6.4	6.7	9.4	2.00	> 100.0

6.23.2 Relative contributions of force components

Case 23 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	28.5	41.7	2.7	0.0	27.2	100.0
10.0	26.9	39.2	8.4	0.0	25.5	100.0
20.0	25.3	36.9	13.9	0.0	23.9	100.0
30.0	23.8	34.5	19.3	0.0	22.4	100.0
40.0	22.3	32.2	24.6	0.0	20.9	100.0
50.0	20.9	30.2	29.4	0.0	19.5	100.0
60.0	19.8	28.4	33.5	0.0	18.3	100.0
70.0	18.9	27.1	36.6	0.0	17.4	100.0
80.0	18.4	26.3	38.5	0.0	16.9	100.0
90.0	18.2	26.0	39.1	0.0	16.7	100.0
100.0	18.4	26.3	38.4	0.0	16.9	100.0
110.0	19.0	27.2	36.4	0.0	17.4	100.0
120.0	20.0	28.6	33.1	0.0	18.4	100.0
130.0	21.3	30.5	28.6	0.0	19.6	100.0
140.0	22.9	32.8	23.2	0.0	21.1	100.0
150.0	24.6	35.4	17.2	0.0	22.8	100.0
160.0	26.5	38.1	10.8	0.0	24.6	100.0
170.0	28.4	41.0	4.2	0.0	26.5	100.0
180.0	30.3	43.9	-2.7	0.0	28.4	100.0
190.0	32.6	47.3	-10.6	0.0	30.7	100.0
200.0	35.2	51.4	-20.1	0.0	33.4	100.0
210.0	38.4	56.4	-31.5	0.0	36.8	100.0
220.0	42.0	62.1	-45.1	0.0	40.8	100.0
230.0	45.6	68.3	-59.0	0.0	45.0	100.0
240.0	49.1	73.0	-69.5	0.0	48.5	100.0
250.0	48.3	74.6	-72.8	0.0	49.9	100.0
260.0	46.7	73.1	-69.1	0.0	49.3	100.0
270.0	-7.5	-1.8	61.4	0.0	47.9	100.0
280.0	43.9	69.0	-59.5	0.0	46.6	100.0
290.0	43.3	67.3	-55.8	0.0	45.2	100.0
300.0	42.0	64.5	-49.5	0.0	43.0	100.0
310.0	39.8	60.4	-40.2	0.0	40.0	100.0
320.0	37.1	55.7	-29.6	0.0	36.7	100.0
330.0	34.5	51.3	-19.5	0.0	33.7	100.0
340.0	32.1	47.5	-10.8	0.0	31.1	100.0
350.0	30.2	44.4	-3.5	0.0	29.0	100.0
360.0	28.5	41.7	2.7	0.0	27.2	100.0

6.23.3 Environment forces

Case 23 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-7.1	-13.0	-3.6	0.0	-9.4	-33.1
10.0	-7.1	-13.0	-3.6	0.0	-9.4	-33.1
20.0	-7.1	-13.0	-3.5	0.0	-9.4	-33.0
30.0	-7.1	-13.0	-3.2	0.0	-9.4	-32.7
40.0	-7.1	-13.0	-2.8	0.0	-9.4	-32.3
50.0	-7.1	-13.0	-2.3	0.0	-9.4	-31.8
60.0	-7.1	-13.0	-1.6	0.0	-9.4	-31.1
70.0	-7.1	-13.0	-0.9	0.0	-9.4	-30.4
80.0	-7.1	-13.0	-0.1	0.0	-9.4	-29.6
90.0	-7.1	-13.0	0.7	0.0	-9.4	-28.8
100.0	-7.1	-13.0	1.5	0.0	-9.4	-28.0
110.0	-7.1	-13.0	2.3	0.0	-9.4	-27.2
120.0	-7.1	-13.0	3.0	0.0	-9.4	-26.6
130.0	-7.1	-13.0	3.5	0.0	-9.4	-26.0
140.0	-7.1	-13.0	4.0	0.0	-9.4	-25.5
150.0	-7.1	-13.0	4.3	0.0	-9.4	-25.2
160.0	-7.1	-13.0	4.4	0.0	-9.4	-25.1
170.0	-7.1	-13.0	4.4	0.0	-9.4	-25.1
180.0	-7.1	-13.0	4.3	0.0	-9.4	-25.2
190.0	-7.1	-13.0	4.4	0.0	-9.4	-25.1
200.0	-7.1	-13.0	4.4	0.0	-9.4	-25.1
210.0	-7.1	-13.0	4.3	0.0	-9.4	-25.2
220.0	-7.1	-13.0	4.0	0.0	-9.4	-25.5
230.0	-7.1	-13.0	3.5	0.0	-9.4	-26.0
240.0	-7.1	-13.0	3.0	0.0	-9.4	-26.6
250.0	-7.1	-13.0	2.3	0.0	-9.4	-27.2
260.0	-7.1	-13.0	1.5	0.0	-9.4	-28.0
270.0	-7.1	-13.0	0.7	0.0	-9.4	-28.8
280.0	-7.1	-13.0	-0.1	0.0	-9.4	-29.6
290.0	-7.1	-13.0	-0.9	0.0	-9.4	-30.4
300.0	-7.1	-13.0	-1.6	0.0	-9.4	-31.1
310.0	-7.1	-13.0	-2.3	0.0	-9.4	-31.8
320.0	-7.1	-13.0	-2.8	0.0	-9.4	-32.3
330.0	-7.1	-13.0	-3.2	0.0	-9.4	-32.7
340.0	-7.1	-13.0	-3.5	0.0	-9.4	-33.0
350.0	-7.1	-13.0	-3.6	0.0	-9.4	-33.1
360.0	-7.1	-13.0	-3.6	0.0	-9.4	-33.1

Case 23 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-17.9	-24.7	0.0	0.0	-15.6	-58.2
10.0	-17.9	-24.7	-4.8	0.0	-15.6	-63.0
20.0	-17.9	-24.7	-10.0	0.0	-15.6	-68.2
30.0	-17.9	-24.7	-15.6	0.0	-15.6	-73.8
40.0	-17.9	-24.7	-21.7	0.0	-15.6	-79.9
50.0	-17.9	-24.7	-28.0	0.0	-15.6	-86.2
60.0	-17.9	-24.7	-33.8	0.0	-15.6	-92.0
70.0	-17.9	-24.7	-38.7	0.0	-15.6	-96.9
80.0	-17.9	-24.7	-41.9	0.0	-15.6	-100.1
90.0	-17.9	-24.7	-43.0	0.0	-15.6	-101.2
100.0	-17.9	-24.7	-41.9	0.0	-15.6	-100.1
110.0	-17.9	-24.7	-38.7	0.0	-15.6	-96.9
120.0	-17.9	-24.7	-33.8	0.0	-15.6	-92.0
130.0	-17.9	-24.7	-28.0	0.0	-15.6	-86.2
140.0	-17.9	-24.7	-21.7	0.0	-15.6	-79.9
150.0	-17.9	-24.7	-15.6	0.0	-15.6	-73.8
160.0	-17.9	-24.7	-10.0	0.0	-15.6	-68.2
170.0	-17.9	-24.7	-4.8	0.0	-15.6	-63.0
180.0	-17.9	-24.7	0.0	0.0	-15.6	-58.2
190.0	-17.9	-24.7	4.8	0.0	-15.6	-53.4
200.0	-17.9	-24.7	10.0	0.0	-15.6	-48.2
210.0	-17.9	-24.7	15.6	0.0	-15.6	-42.6
220.0	-17.9	-24.7	21.7	0.0	-15.6	-36.5
230.0	-17.9	-24.7	28.0	0.0	-15.6	-30.2
240.0	-17.9	-24.7	33.8	0.0	-15.6	-24.4
250.0	-17.9	-24.7	38.7	0.0	-15.6	-19.5
260.0	-17.9	-24.7	41.9	0.0	-15.6	-16.3
270.0	-17.9	-24.7	43.0	0.0	15.6	16.0
280.0	-17.9	-24.7	41.9	0.0	-15.6	-16.3
290.0	-17.9	-24.7	38.7	0.0	-15.6	-19.5
300.0	-17.9	-24.7	33.8	0.0	-15.6	-24.4
310.0	-17.9	-24.7	28.0	0.0	-15.6	-30.2
320.0	-17.9	-24.7	21.7	0.0	-15.6	-36.5
330.0	-17.9	-24.7	15.6	0.0	-15.6	-42.6
340.0	-17.9	-24.7	10.0	0.0	-15.6	-48.2
350.0	-17.9	-24.7	4.8	0.0	-15.6	-53.4
360.0	-17.9	-24.7	0.0	0.0	-15.6	-58.2

Case 23 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-501.2	-375.0	0.0	0.0	-322.0	-1198.1
10.0	-501.2	-375.0	-316.6	0.0	-322.0	-1514.7
20.0	-501.2	-375.0	-593.0	0.0	-322.0	-1791.1
30.0	-501.2	-375.0	-793.7	0.0	-322.0	-1991.8
40.0	-501.2	-375.0	-892.8	0.0	-322.0	-2090.9
50.0	-501.2	-375.0	-876.4	0.0	-322.0	-2074.5
60.0	-501.2	-375.0	-745.2	0.0	-322.0	-1943.3
70.0	-501.2	-375.0	-513.8	0.0	-322.0	-1711.9
80.0	-501.2	-375.0	-209.2	0.0	-322.0	-1407.3
90.0	-501.2	-375.0	132.4	0.0	-322.0	-1065.7
100.0	-501.2	-375.0	470.0	0.0	-322.0	-728.1
110.0	-501.2	-375.0	762.6	0.0	-322.0	-435.5
120.0	-501.2	-375.0	974.5	0.0	322.0	420.4
130.0	-501.2	-375.0	1079.2	0.0	322.0	538.1
140.0	-501.2	-375.0	1063.0	0.0	322.0	503.8
150.0	-501.2	-375.0	926.1	0.0	322.0	371.9
160.0	-501.2	-375.0	683.5	0.0	-322.0	-514.6
170.0	-501.2	-375.0	362.6	0.0	-322.0	-835.5
180.0	-501.2	-375.0	0.0	0.0	-322.0	-1198.1
190.0	-501.2	-375.0	-362.6	0.0	-322.0	-1560.7
200.0	-501.2	-375.0	-683.5	0.0	-322.0	-1881.6
210.0	-501.2	-375.0	-926.1	0.0	-322.0	-2124.2
220.0	-501.2	-375.0	-1063.0	0.0	-322.0	-2261.1
230.0	-501.2	-375.0	-1079.2	0.0	-322.0	-2277.4
240.0	-501.2	-375.0	-974.5	0.0	-322.0	-2172.6
250.0	-501.2	-375.0	-762.6	0.0	-322.0	-1960.7
260.0	-501.2	-375.0	-470.0	0.0	-322.0	-1668.1
270.0	-501.2	-375.0	-132.4	0.0	-322.0	-1330.5
280.0	-501.2	-375.0	209.2	0.0	-322.0	-988.9
290.0	-501.2	-375.0	513.8	0.0	-322.0	-684.3
300.0	-501.2	-375.0	745.2	0.0	-322.0	-452.9
310.0	-501.2	-375.0	876.4	0.0	322.0	322.3
320.0	-501.2	-375.0	892.8	0.0	322.0	338.6
330.0	-501.2	-375.0	793.7	0.0	-322.0	-404.4
340.0	-501.2	-375.0	593.0	0.0	-322.0	-605.1
350.0	-501.2	-375.0	316.6	0.0	-322.0	-881.5
360.0	-501.2	-375.0	0.0	0.0	-322.0	-1198.1

6.23.4 Thruster use

Case 23 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	91.6	0.1	80.2	176.8	15.4	90.0	23.0	60.0
10.0	91.7	360.0	84.6	181.2	15.2	90.0	15.2	62.1
20.0	88.1	354.6	84.2	180.0	15.3	90.0	7.9	63.8
30.0	86.2	351.5	84.1	180.0	15.4	90.0	2.9	65.3
40.0	90.0	351.2	83.9	180.0	15.6	90.0	5.4	20.0
50.0	85.5	350.4	83.7	180.0	16.0	90.0	1.8	68.8
60.0	86.1	352.6	83.5	180.0	16.5	90.0	5.7	71.1
70.0	86.8	356.0	83.3	180.0	16.3	90.0	10.6	72.3
80.0	88.2	0.3	83.2	180.0	16.1	90.0	17.3	73.2
90.0	90.5	5.0	83.2	180.0	15.9	90.0	24.8	73.8
100.0	91.8	9.4	81.8	180.0	16.0	90.0	32.2	74.1
110.0	93.5	13.1	80.4	180.0	16.0	90.0	38.8	74.1
120.0	99.0	12.7	82.4	167.0	16.2	90.0	58.8	73.9
130.0	99.4	13.4	81.4	166.2	16.2	90.0	61.2	73.2
140.0	100.1	13.3	81.1	166.3	16.2	90.0	61.3	72.3
150.0	100.5	10.5	82.5	165.1	16.4	90.0	59.1	71.1
160.0	91.5	12.1	76.1	180.0	16.6	90.0	38.2	69.4
170.0	88.4	8.0	75.8	180.0	16.9	90.0	31.4	68.0
180.0	85.3	2.9	75.7	180.0	17.2	90.0	23.1	66.2
190.0	82.3	357.5	75.8	180.0	17.2	90.0	15.0	64.5
200.0	80.1	352.2	76.1	180.0	17.2	90.0	7.1	62.2
210.0	78.9	348.1	76.6	180.0	17.3	90.0	1.2	57.6
220.0	81.0	353.3	80.6	185.5	17.4	90.0	0.3	55.0
230.0	82.2	353.5	81.0	185.4	17.6	90.0	0.6	49.3
240.0	82.6	348.7	79.3	180.0	17.7	90.0	2.4	40.9
250.0	91.6	353.5	80.4	180.0	17.8	90.0	12.9	35.1
260.0	100.8	361.0	75.9	182.5	17.8	90.0	28.8	29.9
270.0	109.9	327.2	16.3	313.6	7.1	90.0	32.9	331.0
280.0	109.9	359.0	19.4	182.1	17.9	90.0	33.8	28.9
290.0	34.5	1.3	4.1	169.8	18.0	90.0	36.1	32.7
300.0	33.8	5.3	4.0	129.0	18.1	90.0	39.5	38.0
310.0	22.3	22.1	13.9	36.9	13.5	90.0	43.9	43.6
320.0	25.1	23.1	13.5	46.8	16.8	90.0	48.7	48.5
330.0	92.7	0.2	67.1	162.7	16.3	90.0	46.4	51.9
340.0	92.1	0.2	71.5	167.0	15.8	90.0	39.2	55.1
350.0	91.7	0.1	75.9	172.0	15.5	90.0	31.1	57.8
360.0	91.6	0.1	80.2	176.8	15.4	90.0	23.0	60.0

6.23.5 Thruster loss

Case 23 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.82	0.77	0.77
10.0	0.82	0.76	0.76
20.0	0.81	0.75	0.76
30.0	0.81	0.75	0.77
40.0	0.82	0.75	0.78
50.0	0.83	0.75	0.80
60.0	0.84	0.74	0.82
70.0	0.86	0.74	0.81
80.0	0.88	0.74	0.80
90.0	0.89	0.74	0.80
100.0	0.89	0.73	0.80
110.0	0.89	0.72	0.80
120.0	0.89	0.75	0.81
130.0	0.89	0.75	0.81
140.0	0.89	0.74	0.81
150.0	0.90	0.74	0.82
160.0	0.90	0.68	0.83
170.0	0.90	0.68	0.84
180.0	0.91	0.67	0.86
190.0	0.90	0.68	0.86
200.0	0.88	0.68	0.85
210.0	0.87	0.68	0.86
220.0	0.88	0.72	0.87
230.0	0.88	0.73	0.88
240.0	0.87	0.71	0.89
250.0	0.88	0.72	0.89
260.0	0.90	0.74	0.89
270.0	0.90	0.83	0.89
280.0	0.88	0.76	0.89
290.0	0.87	0.80	0.90
300.0	0.86	0.86	0.90
310.0	0.86	0.85	0.87
320.0	0.85	0.85	0.84
330.0	0.83	0.83	0.81
340.0	0.82	0.82	0.79
350.0	0.82	0.80	0.77
360.0	0.82	0.77	0.77

Preliminary Design, @IDR5

6.24 Case 24 - Thrust Utilization: 35 knots wind @ 40 deg, 2 knots current, Sea State 5

6.24.1 Environment and thrust utilisation

Case 24 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	40.0	40.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	40.0	40.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	40.0	40.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	40.0	40.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	40.0	40.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	40.0	40.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	40.0	40.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	40.0	40.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	40.0	40.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	40.0	40.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	40.0	40.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	40.0	40.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	40.0	40.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	40.0	40.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	40.0	40.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	40.0	40.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	40.0	40.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	40.0	40.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	40.0	40.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	40.0	40.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	40.0	40.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	40.0	40.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	40.0	40.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	40.0	40.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	40.0	40.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	40.0	40.0	250.0	35.0	4.0	6.7	9.4	2.00	51.4
260.0	40.0	40.0	260.0	35.0	4.0	6.7	9.4	2.00	34.5
270.0	40.0	40.0	270.0	35.0	4.0	6.7	9.4	2.00	20.1
280.0	40.0	40.0	280.0	35.0	4.0	6.7	9.4	2.00	11.7
290.0	40.0	40.0	290.0	35.0	4.0	6.7	9.4	2.00	10.2
300.0	40.0	40.0	300.0	35.0	4.0	6.7	9.4	2.00	37.3
310.0	40.0	40.0	310.0	35.0	4.0	6.7	9.4	2.00	30.0
320.0	40.0	40.0	320.0	35.0	4.0	6.7	9.4	2.00	42.0
330.0	40.0	40.0	330.0	35.0	4.0	6.7	9.4	2.00	58.9
340.0	40.0	40.0	340.0	35.0	4.0	6.7	9.4	2.00	94.5
350.0	40.0	40.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	40.0	40.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.24.2 Relative contributions of force components

Case 24 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	48.9	28.3	2.6	0.0	20.2	100.0
10.0	45.1	26.0	10.3	0.0	18.6	100.0
20.0	41.6	24.0	17.3	0.0	17.1	100.0
30.0	38.4	22.0	24.0	0.0	15.7	100.0
40.0	35.3	20.2	30.1	0.0	14.4	100.0
50.0	32.6	18.6	35.6	0.0	13.2	100.0
60.0	30.4	17.3	40.0	0.0	12.3	100.0
70.0	28.8	16.3	43.3	0.0	11.6	100.0
80.0	27.8	15.8	45.2	0.0	11.2	100.0
90.0	27.5	15.6	45.9	0.0	11.0	100.0
100.0	27.8	15.8	45.2	0.0	11.2	100.0
110.0	28.9	16.3	43.2	0.0	11.6	100.0
120.0	30.6	17.3	39.8	0.0	12.3	100.0
130.0	32.9	18.6	35.2	0.0	13.2	100.0
140.0	35.9	20.3	29.4	0.0	14.4	100.0
150.0	39.3	22.3	22.6	0.0	15.8	100.0
160.0	43.1	24.4	15.1	0.0	17.1	100.0
170.0	47.1	26.8	7.0	0.0	19.1	100.0
180.0	51.7	29.5	-2.1	0.0	21.0	100.0
190.0	57.1	32.7	-13.1	0.0	23.3	100.0
200.0	64.3	36.9	-21.4	0.0	26.3	100.0
210.0	74.0	42.7	-47.1	0.0	30.5	100.0
220.0	87.3	50.1	-74.5	0.0	36.3	100.0
230.0	103.9	61.2	-109.1	0.0	44.0	100.0
240.0	117.8	71.0	-140.0	0.0	51.3	100.0
250.0	-53.9	-22.7	123.9	0.0	52.6	100.0
260.0	-59.4	-27.3	138.4	0.0	48.3	100.0
270.0	-57.0	-26.4	137.9	0.0	45.5	100.0
280.0	-50.2	-22.2	128.1	0.0	44.3	100.0
290.0	-34.9	-12.7	104.9	0.0	42.8	100.0
300.0	91.2	56.0	-87.9	0.0	40.7	100.0
310.0	83.8	50.5	-70.7	0.0	36.4	100.0
320.0	74.1	44.0	-49.8	0.0	31.7	100.0
330.0	65.4	38.5	-31.4	0.0	27.6	100.0
340.0	58.5	34.2	-17.1	0.0	24.5	100.0
350.0	53.1	30.9	-6.1	0.0	22.1	100.0
360.0	48.9	28.3	2.6	0.0	20.2	100.0

6.24.3 Environment forces

Case 24 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	-5.3	-3.6	0.0	-4.0	-19.6
10.0	-6.7	-5.3	-3.6	0.0	-4.0	-19.6
20.0	-6.7	-5.3	-3.5	0.0	-4.0	-19.5
30.0	-6.7	-5.3	-3.2	0.0	-4.0	-19.2
40.0	-6.7	-5.3	-2.8	0.0	-4.0	-18.8
50.0	-6.7	-5.3	-2.3	0.0	-4.0	-18.3
60.0	-6.7	-5.3	-1.6	0.0	-4.0	-17.6
70.0	-6.7	-5.3	-0.9	0.0	-4.0	-16.9
80.0	-6.7	-5.3	-0.1	0.0	-4.0	-16.1
90.0	-6.7	-5.3	0.7	0.0	-4.0	-15.3
100.0	-6.7	-5.3	1.5	0.0	-4.0	-14.5
110.0	-6.7	-5.3	2.3	0.0	-4.0	-13.7
120.0	-6.7	-5.3	3.0	0.0	-4.0	-13.0
130.0	-6.7	-5.3	3.5	0.0	-4.0	-12.5
140.0	-6.7	-5.3	4.0	0.0	-4.0	-12.0
150.0	-6.7	-5.3	4.3	0.0	-4.0	-11.7
160.0	-6.7	-5.3	4.4	0.0	-4.0	-11.6
170.0	-6.7	-5.3	4.4	0.0	-4.0	-11.6
180.0	-6.7	-5.3	4.3	0.0	-4.0	-11.7
190.0	-6.7	-5.3	4.4	0.0	-4.0	-11.6
200.0	-6.7	-5.3	4.4	0.0	-4.0	-11.6
210.0	-6.7	-5.3	4.3	0.0	-4.0	-11.7
220.0	-6.7	-5.3	4.0	0.0	-4.0	-12.0
230.0	-6.7	-5.3	3.5	0.0	-4.0	-12.5
240.0	-6.7	-5.3	3.0	0.0	-4.0	-13.0
250.0	-6.7	-5.3	2.3	0.0	-4.0	-13.7
260.0	-6.7	-5.3	1.5	0.0	-4.0	-14.5
270.0	-6.7	-5.3	0.7	0.0	-4.0	-15.3
280.0	-6.7	-5.3	-0.1	0.0	-4.0	-16.1
290.0	-6.7	-5.3	-0.9	0.0	-4.0	-16.9
300.0	-6.7	-5.3	-1.6	0.0	-4.0	-17.6
310.0	-6.7	-5.3	-2.3	0.0	-4.0	-18.3
320.0	-6.7	-5.3	-2.8	0.0	-4.0	-18.8
330.0	-6.7	-5.3	-3.2	0.0	-4.0	-19.2
340.0	-6.7	-5.3	-3.5	0.0	-4.0	-19.5
350.0	-6.7	-5.3	-3.6	0.0	-4.0	-19.6
360.0	-6.7	-5.3	-3.6	0.0	-4.0	-19.6

Case 24 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-24.5	-13.6	0.0	0.0	-9.6	-47.8
10.0	-24.5	-13.6	-4.8	0.0	-9.6	-52.7
20.0	-24.5	-13.6	-10.0	0.0	-9.6	-57.8
30.0	-24.5	-13.6	-15.6	0.0	-9.6	-63.5
40.0	-24.5	-13.6	-21.7	0.0	-9.6	-69.6
50.0	-24.5	-13.6	-28.0	0.0	-9.6	-75.8
60.0	-24.5	-13.6	-33.8	0.0	-9.6	-81.7
70.0	-24.5	-13.6	-38.7	0.0	-9.6	-86.5
80.0	-24.5	-13.6	-41.9	0.0	-9.6	-89.7
90.0	-24.5	-13.6	-43.0	0.0	-9.6	-90.8
100.0	-24.5	-13.6	-41.9	0.0	-9.6	-89.7
110.0	-24.5	-13.6	-38.7	0.0	-9.6	-86.5
120.0	-24.5	-13.6	-33.8	0.0	-9.6	-81.7
130.0	-24.5	-13.6	-28.0	0.0	-9.6	-75.8
140.0	-24.5	-13.6	-21.7	0.0	-9.6	-69.6
150.0	-24.5	-13.6	-15.6	0.0	-9.6	-63.5
160.0	-24.5	-13.6	-10.0	0.0	-9.6	-57.8
170.0	-24.5	-13.6	-4.8	0.0	-9.6	-52.7
180.0	-24.5	-13.6	0.0	0.0	-9.6	-47.8
190.0	-24.5	-13.6	4.8	0.0	-9.6	-43.0
200.0	-24.5	-13.6	10.0	0.0	-9.6	-37.9
210.0	-24.5	-13.6	15.6	0.0	-9.6	-32.2
220.0	-24.5	-13.6	21.7	0.0	-9.6	-26.1
230.0	-24.5	-13.6	28.0	0.0	-9.6	-19.8
240.0	-24.5	-13.6	33.8	0.0	-9.6	-14.0
250.0	-24.5	-13.6	38.7	0.0	9.6	10.1
260.0	-24.5	-13.6	41.9	0.0	9.6	13.3
270.0	-24.5	-13.6	43.0	0.0	9.6	14.4
280.0	-24.5	-13.6	41.9	0.0	9.6	13.3
290.0	-24.5	-13.6	38.7	0.0	9.6	10.1
300.0	-24.5	-13.6	33.8	0.0	-9.6	-14.0
310.0	-24.5	-13.6	28.0	0.0	-9.6	-19.8
320.0	-24.5	-13.6	21.7	0.0	-9.6	-26.1
330.0	-24.5	-13.6	15.6	0.0	-9.6	-32.2
340.0	-24.5	-13.6	10.0	0.0	-9.6	-37.9
350.0	-24.5	-13.6	4.8	0.0	-9.6	-43.0
360.0	-24.5	-13.6	0.0	0.0	-9.6	-47.8

Case 24 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-601.9	-187.8	0.0	0.0	-174.2	-963.9
10.0	-601.9	-187.8	-316.6	0.0	-174.2	-1280.5
20.0	-601.9	-187.8	-593.0	0.0	-174.2	-1556.9
30.0	-601.9	-187.8	-793.7	0.0	-174.2	-1757.6
40.0	-601.9	-187.8	-892.8	0.0	-174.2	-1856.7
50.0	-601.9	-187.8	-876.4	0.0	-174.2	-1840.3
60.0	-601.9	-187.8	-745.2	0.0	-174.2	-1709.1
70.0	-601.9	-187.8	-513.8	0.0	-174.2	-1477.7
80.0	-601.9	-187.8	-209.2	0.0	-174.2	-1173.1
90.0	-601.9	-187.8	132.4	0.0	-174.2	-831.5
100.0	-601.9	-187.8	470.0	0.0	-174.2	-493.9
110.0	-601.9	-187.8	762.6	0.0	-174.2	-201.3
120.0	-601.9	-187.8	974.5	0.0	174.2	358.9
130.0	-601.9	-187.8	1079.2	0.0	174.2	465.7
140.0	-601.9	-187.8	1063.0	0.0	174.2	447.4
150.0	-601.9	-187.8	926.1	0.0	174.2	310.3
160.0	-601.9	-187.8	683.5	0.0	-174.2	-780.4
170.0	-601.9	-187.8	362.6	0.0	-174.2	-601.3
180.0	-601.9	-187.8	0.0	0.0	-174.2	-963.9
190.0	-601.9	-187.8	-362.6	0.0	-174.2	-1326.5
200.0	-601.9	-187.8	-683.5	0.0	-174.2	-1647.4
210.0	-601.9	-187.8	-926.1	0.0	-174.2	-1890.0
220.0	-601.9	-187.8	-1063.0	0.0	-174.2	-2026.9
230.0	-601.9	-187.8	-1079.2	0.0	-174.2	-2043.1
240.0	-601.9	-187.8	-974.5	0.0	-174.2	-1938.4
250.0	-601.9	-187.8	-762.6	0.0	-174.2	-1726.5
260.0	-601.9	-187.8	-470.0	0.0	-174.2	-1433.9
270.0	-601.9	-187.8	-132.4	0.0	-174.2	-1096.3
280.0	-601.9	-187.8	209.2	0.0	-174.2	-754.7
290.0	-601.9	-187.8	513.8	0.0	-174.2	-450.1
300.0	-601.9	-187.8	745.2	0.0	-174.2	-218.7
310.0	-601.9	-187.8	876.4	0.0	174.2	260.8
320.0	-601.9	-187.8	892.8	0.0	174.2	277.2
330.0	-601.9	-187.8	793.7	0.0	174.2	178.1
340.0	-601.9	-187.8	593.0	0.0	-174.2	-370.9
350.0	-601.9	-187.8	316.6	0.0	-174.2	-647.3
360.0	-601.9	-187.8	0.0	0.0	-174.2	-963.9

6.24.4 Thruster use

Case 24 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.1	85.3	172.7	16.2	90.0	29.5	67.4
10.0	96.1	0.1	88.5	177.0	16.0	90.0	22.0	69.5
20.0	92.1	358.9	87.2	180.0	16.0	90.0	15.0	71.1
30.0	90.3	356.0	87.0	180.0	16.2	90.0	10.3	72.9
40.0	89.4	354.6	86.8	180.0	16.4	90.0	8.3	74.7
50.0	89.2	354.9	86.6	180.0	16.8	90.0	9.2	76.2
60.0	89.4	357.0	86.5	180.0	17.3	90.0	13.0	77.6
70.0	89.7	0.1	86.3	180.0	17.1	90.0	17.5	78.8
80.0	90.7	4.2	86.2	180.0	16.8	90.0	23.8	79.7
90.0	92.5	8.7	86.2	180.0	16.7	90.0	31.1	80.3
100.0	93.2	13.0	84.7	180.0	16.7	90.0	38.1	80.7
110.0	94.3	16.6	83.3	180.0	16.8	90.0	44.4	80.8
120.0	99.1	23.2	82.0	180.0	17.0	90.0	56.7	80.7
130.0	99.5	24.4	80.9	180.0	17.0	90.0	58.9	80.5
140.0	98.9	24.3	80.0	180.0	17.0	90.0	58.6	80.0
150.0	97.1	22.8	79.3	180.0	17.2	90.0	55.8	79.4
160.0	90.8	15.9	78.8	180.0	17.4	90.0	43.0	78.5
170.0	88.2	11.8	78.4	180.0	17.7	90.0	36.5	77.4
180.0	86.0	6.9	78.3	180.0	18.0	90.0	29.2	76.0
190.0	84.0	1.6	78.4	180.0	18.0	90.0	21.1	74.7
200.0	83.1	356.9	78.8	180.0	18.0	90.0	14.2	72.7
210.0	82.9	353.3	79.3	180.0	18.1	90.0	8.9	69.7
220.0	83.6	351.4	80.0	180.0	18.2	90.0	6.4	64.8
230.0	85.7	351.7	80.3	180.0	18.4	90.0	7.2	57.4
240.0	91.5	354.3	82.0	180.0	18.6	90.0	13.1	46.6
250.0	18.5	316.4	12.7	271.5	15.4	90.0	17.0	323.6
260.0	16.4	317.2	12.1	283.8	9.9	90.0	19.7	317.4
270.0	14.0	316.3	11.2	297.6	5.1	90.0	21.0	316.6
280.0	11.5	320.9	10.4	313.1	1.6	90.0	20.9	320.4
290.0	9.8	330.5	9.8	329.1	-0.3	90.0	19.7	329.1
300.0	12.9	7.2	5.0	18.5	10.8	90.0	22.5	38.4
310.0	13.4	26.0	8.4	42.8	8.2	90.0	27.0	47.4
320.0	15.5	28.1	8.8	54.4	11.6	90.0	32.2	54.2
330.0	17.1	29.1	8.5	60.2	16.5	90.0	37.5	59.2
340.0	88.7	7.0	69.3	171.3	16.6	90.0	42.6	62.8
350.0	96.1	0.2	82.3	168.0	16.3	90.0	37.2	65.2
360.0	96.0	0.1	85.3	172.7	16.2	90.0	29.5	67.4

6.24.5 Thruster loss

Case 24 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.82	0.81
10.0	0.86	0.79	0.80
20.0	0.86	0.78	0.80
30.0	0.86	0.78	0.81
40.0	0.86	0.77	0.82
50.0	0.87	0.77	0.84
60.0	0.89	0.77	0.86
70.0	0.91	0.77	0.85
80.0	0.91	0.77	0.84
90.0	0.92	0.77	0.83
100.0	0.93	0.75	0.84
110.0	0.93	0.74	0.84
120.0	0.93	0.73	0.85
130.0	0.93	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.94	0.70	0.87
170.0	0.94	0.70	0.88
180.0	0.95	0.70	0.90
190.0	0.95	0.70	0.90
200.0	0.94	0.70	0.90
210.0	0.93	0.71	0.90
220.0	0.92	0.71	0.91
230.0	0.92	0.72	0.92
240.0	0.93	0.73	0.93
250.0	0.85	0.85	0.93
260.0	0.83	0.85	0.93
270.0	0.82	0.85	0.93
280.0	0.82	0.85	0.94
290.0	0.82	0.86	0.85
300.0	0.90	0.88	0.95
310.0	0.90	0.88	0.91
320.0	0.89	0.88	0.88
330.0	0.88	0.88	0.85
340.0	0.86	0.83	0.83
350.0	0.86	0.84	0.81
360.0	0.86	0.82	0.81

Preliminary Design, @IDR5

6.25 Case 25 - Thrust Utilization: 35 knots wind @ 50 deg, 2 knots current, Sea State 5

6.25.1 Environment and thrust utilisation

Case 25 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	50.0	50.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	50.0	50.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	50.0	50.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	50.0	50.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	50.0	50.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	50.0	50.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	50.0	50.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	50.0	50.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	50.0	50.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	50.0	50.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	50.0	50.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	50.0	50.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	50.0	50.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	50.0	50.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	50.0	50.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	50.0	50.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	50.0	50.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	50.0	50.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	50.0	50.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	50.0	50.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	50.0	50.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	50.0	50.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	50.0	50.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	50.0	50.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	50.0	50.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	50.0	50.0	250.0	35.0	4.0	6.7	9.4	2.00	> 100.0
260.0	50.0	50.0	260.0	35.0	4.0	6.7	9.4	2.00	91.4
270.0	50.0	50.0	270.0	35.0	4.0	6.7	9.4	2.00	74.3
280.0	50.0	50.0	280.0	35.0	4.0	6.7	9.4	2.00	63.3
290.0	50.0	50.0	290.0	35.0	4.0	6.7	9.4	2.00	57.6
300.0	50.0	50.0	300.0	35.0	4.0	6.7	9.4	2.00	57.5
310.0	50.0	50.0	310.0	35.0	4.0	6.7	9.4	2.00	50.5
320.0	50.0	50.0	320.0	35.0	4.0	6.7	9.4	2.00	63.0
330.0	50.0	50.0	330.0	35.0	4.0	6.7	9.4	2.00	95.4
340.0	50.0	50.0	340.0	35.0	4.0	6.7	9.4	2.00	> 100.0
350.0	50.0	50.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	50.0	50.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.25.2 Relative contributions of force components

Case 25 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	48.2	29.4	1.8	0.0	20.7	100.0
10.0	44.9	27.3	8.5	0.0	19.2	100.0
20.0	41.9	25.4	14.9	0.0	17.9	100.0
30.0	39.0	23.6	20.9	0.0	16.6	100.0
40.0	36.2	21.9	26.6	0.0	15.4	100.0
50.0	33.8	20.3	31.6	0.0	14.3	100.0
60.0	31.7	19.1	35.8	0.0	13.4	100.0
70.0	30.2	18.1	38.9	0.0	12.7	100.0
80.0	29.3	17.6	40.8	0.0	12.3	100.0
90.0	29.0	17.4	41.4	0.0	12.2	100.0
100.0	29.4	17.6	40.8	0.0	12.3	100.0
110.0	30.3	18.1	38.8	0.0	12.7	100.0
120.0	31.9	19.1	35.6	0.0	13.4	100.0
130.0	34.1	20.4	31.3	0.0	14.3	100.0
140.0	36.7	22.0	25.9	0.0	15.4	100.0
150.0	39.7	23.8	19.8	0.0	16.7	100.0
160.0	42.9	25.7	13.3	0.0	18.1	100.0
170.0	46.4	27.8	6.3	0.0	19.5	100.0
180.0	50.1	30.1	-1.3	0.0	21.1	100.0
190.0	54.4	32.8	-10.2	0.0	23.0	100.0
200.0	59.9	36.2	-2.5	0.0	25.4	100.0
210.0	67.3	40.7	-36.5	0.0	28.6	100.0
220.0	77.2	47.1	-57.2	0.0	33.0	100.0
230.0	89.1	55.2	-84.2	0.0	38.9	100.0
240.0	103.0	65.0	-115.8	0.0	45.9	100.0
250.0	117.9	73.9	-144.1	0.0	52.3	100.0
260.0	123.4	78.5	-157.6	0.0	55.7	100.0
270.0	120.9	77.6	-153.6	0.0	55.1	100.0
280.0	114.0	73.0	-138.9	0.0	51.9	100.0
290.0	104.2	66.2	-117.4	0.0	47.0	100.0
300.0	92.4	58.2	-91.8	0.0	41.2	100.0
310.0	80.7	50.3	-66.5	0.0	35.6	100.0
320.0	70.5	43.7	-45.0	0.0	30.8	100.0
330.0	62.6	38.5	-28.3	0.0	27.2	100.0
340.0	56.5	34.7	-15.6	0.0	24.4	100.0
350.0	51.9	31.7	-6.0	0.0	22.3	100.0
360.0	48.2	29.4	1.8	0.0	20.7	100.0

6.25.3 Environment forces

Case 25 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.6	-5.3	-3.6	0.0	-4.0	-18.5
10.0	-5.6	-5.3	-3.6	0.0	-4.0	-18.5
20.0	-5.6	-5.3	-3.5	0.0	-4.0	-18.3
30.0	-5.6	-5.3	-3.2	0.0	-4.0	-18.1
40.0	-5.6	-5.3	-2.8	0.0	-4.0	-17.7
50.0	-5.6	-5.3	-2.3	0.0	-4.0	-17.1
60.0	-5.6	-5.3	-1.6	0.0	-4.0	-16.5
70.0	-5.6	-5.3	-0.9	0.0	-4.0	-15.7
80.0	-5.6	-5.3	-0.1	0.0	-4.0	-15.0
90.0	-5.6	-5.3	0.7	0.0	-4.0	-14.1
100.0	-5.6	-5.3	1.5	0.0	-4.0	-13.3
110.0	-5.6	-5.3	2.3	0.0	-4.0	-12.6
120.0	-5.6	-5.3	3.0	0.0	-4.0	-11.9
130.0	-5.6	-5.3	3.5	0.0	-4.0	-11.3
140.0	-5.6	-5.3	4.0	0.0	-4.0	-10.9
150.0	-5.6	-5.3	4.3	0.0	-4.0	-10.6
160.0	-5.6	-5.3	4.4	0.0	-4.0	-10.4
170.0	-5.6	-5.3	4.4	0.0	-4.0	-10.4
180.0	-5.6	-5.3	4.3	0.0	-4.0	-10.5
190.0	-5.6	-5.3	4.4	0.0	-4.0	-10.4
200.0	-5.6	-5.3	4.4	0.0	-4.0	-10.4
210.0	-5.6	-5.3	4.3	0.0	-4.0	-10.6
220.0	-5.6	-5.3	4.0	0.0	-4.0	-10.9
230.0	-5.6	-5.3	3.5	0.0	-4.0	-11.3
240.0	-5.6	-5.3	3.0	0.0	-4.0	-11.9
250.0	-5.6	-5.3	2.3	0.0	-4.0	-12.6
260.0	-5.6	-5.3	1.5	0.0	-4.0	-13.3
270.0	-5.6	-5.3	0.7	0.0	-4.0	-14.1
280.0	-5.6	-5.3	-0.1	0.0	-4.0	-15.0
290.0	-5.6	-5.3	-0.9	0.0	-4.0	-15.7
300.0	-5.6	-5.3	-1.6	0.0	-4.0	-16.5
310.0	-5.6	-5.3	-2.3	0.0	-4.0	-17.1
320.0	-5.6	-5.3	-2.8	0.0	-4.0	-17.7
330.0	-5.6	-5.3	-3.2	0.0	-4.0	-18.1
340.0	-5.6	-5.3	-3.5	0.0	-4.0	-18.3
350.0	-5.6	-5.3	-3.6	0.0	-4.0	-18.5
360.0	-5.6	-5.3	-3.6	0.0	-4.0	-18.5

Case 25 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.3	-17.2	0.0	0.0	-12.1	-58.6
10.0	-29.3	-17.2	-4.8	0.0	-12.1	-63.4
20.0	-29.3	-17.2	-10.0	0.0	-12.1	-68.5
30.0	-29.3	-17.2	-15.6	0.0	-12.1	-74.2
40.0	-29.3	-17.2	-21.7	0.0	-12.1	-80.3
50.0	-29.3	-17.2	-28.0	0.0	-12.1	-86.5
60.0	-29.3	-17.2	-33.8	0.0	-12.1	-92.4
70.0	-29.3	-17.2	-38.7	0.0	-12.1	-97.2
80.0	-29.3	-17.2	-41.9	0.0	-12.1	-100.4
90.0	-29.3	-17.2	-43.0	0.0	-12.1	-101.6
100.0	-29.3	-17.2	-41.9	0.0	-12.1	-100.4
110.0	-29.3	-17.2	-38.7	0.0	-12.1	-97.2
120.0	-29.3	-17.2	-33.8	0.0	-12.1	-92.4
130.0	-29.3	-17.2	-28.0	0.0	-12.1	-86.5
140.0	-29.3	-17.2	-21.7	0.0	-12.1	-80.3
150.0	-29.3	-17.2	-15.6	0.0	-12.1	-74.2
160.0	-29.3	-17.2	-10.0	0.0	-12.1	-68.5
170.0	-29.3	-17.2	-4.8	0.0	-12.1	-63.4
180.0	-29.3	-17.2	0.0	0.0	-12.1	-58.6
190.0	-29.3	-17.2	4.8	0.0	-12.1	-53.7
200.0	-29.3	-17.2	10.0	0.0	-12.1	-48.6
210.0	-29.3	-17.2	15.6	0.0	-12.1	-42.9
220.0	-29.3	-17.2	21.7	0.0	-12.1	-36.8
230.0	-29.3	-17.2	28.0	0.0	-12.1	-30.6
240.0	-29.3	-17.2	33.8	0.0	-12.1	-24.7
250.0	-29.3	-17.2	38.7	0.0	-12.1	-19.9
260.0	-29.3	-17.2	41.9	0.0	-12.1	-16.7
270.0	-29.3	-17.2	43.0	0.0	-12.1	-15.6
280.0	-29.3	-17.2	41.9	0.0	-12.1	-16.7
290.0	-29.3	-17.2	38.7	0.0	-12.1	-19.9
300.0	-29.3	-17.2	33.8	0.0	-12.1	-24.7
310.0	-29.3	-17.2	28.0	0.0	-12.1	-30.6
320.0	-29.3	-17.2	21.7	0.0	-12.1	-36.8
330.0	-29.3	-17.2	15.6	0.0	-12.1	-42.9
340.0	-29.3	-17.2	10.0	0.0	-12.1	-48.6
350.0	-29.3	-17.2	4.8	0.0	-12.1	-53.7
360.0	-29.3	-17.2	0.0	0.0	-12.1	-58.6

Case 25 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-615.1	-204.5	0.0	0.0	-179.0	-998.6
10.0	-615.1	-204.5	-316.6	0.0	-179.0	-1315.2
20.0	-615.1	-204.5	-593.0	0.0	-179.0	-1591.6
30.0	-615.1	-204.5	-793.7	0.0	-179.0	-1792.3
40.0	-615.1	-204.5	-892.8	0.0	-179.0	-1891.4
50.0	-615.1	-204.5	-876.4	0.0	-179.0	-1875.0
60.0	-615.1	-204.5	-745.2	0.0	-179.0	-1743.8
70.0	-615.1	-204.5	-513.8	0.0	-179.0	-1512.4
80.0	-615.1	-204.5	-209.2	0.0	-179.0	-1207.8
90.0	-615.1	-204.5	132.4	0.0	-179.0	-866.2
100.0	-615.1	-204.5	470.0	0.0	-179.0	-528.6
110.0	-615.1	-204.5	762.6	0.0	-179.0	-236.0
120.0	-615.1	-204.5	974.5	0.0	179.0	333.9
130.0	-615.1	-204.5	1079.2	0.0	179.0	423.6
140.0	-615.1	-204.5	1063.0	0.0	179.0	423.3
150.0	-615.1	-204.5	926.1	0.0	179.0	235.4
160.0	-615.1	-204.5	683.5	0.0	-179.0	-115.1
170.0	-615.1	-204.5	362.6	0.0	-179.0	-636.0
180.0	-615.1	-204.5	0.0	0.0	-179.0	-998.6
190.0	-615.1	-204.5	-362.6	0.0	-179.0	-1361.2
200.0	-615.1	-204.5	-683.5	0.0	-179.0	-1682.1
210.0	-615.1	-204.5	-926.1	0.0	-179.0	-1924.7
220.0	-615.1	-204.5	-1063.0	0.0	-179.0	-2061.6
230.0	-615.1	-204.5	-1079.2	0.0	-179.0	-2077.8
240.0	-615.1	-204.5	-974.5	0.0	-179.0	-1973.1
250.0	-615.1	-204.5	-762.6	0.0	-179.0	-1761.2
260.0	-615.1	-204.5	-470.0	0.0	-179.0	-1468.6
270.0	-615.1	-204.5	-132.4	0.0	-179.0	-1131.0
280.0	-615.1	-204.5	209.2	0.0	-179.0	-789.4
290.0	-615.1	-204.5	513.8	0.0	-179.0	-484.8
300.0	-615.1	-204.5	745.2	0.0	-179.0	-253.4
310.0	-615.1	-204.5	876.4	0.0	179.0	235.8
320.0	-615.1	-204.5	892.8	0.0	179.0	252.1
330.0	-615.1	-204.5	793.7	0.0	-179.0	-204.9
340.0	-615.1	-204.5	593.0	0.0	-179.0	-405.6
350.0	-615.1	-204.5	316.6	0.0	-179.0	-682.0
360.0	-615.1	-204.5	0.0	0.0	-179.0	-998.6

6.25.4 Thruster use

Case 25 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.1	88.1	173.2	16.2	90.0	28.2	72.3
10.0	93.1	2.1	87.3	180.0	16.0	90.0	20.2	73.5
20.0	90.9	358.3	87.2	180.0	16.0	90.0	13.8	74.9
30.0	89.5	355.4	87.0	180.0	16.2	90.0	9.3	76.1
40.0	88.9	354.0	86.8	180.0	16.4	90.0	7.3	77.4
50.0	88.7	354.4	86.6	180.0	16.8	90.0	8.3	78.6
60.0	88.7	356.4	86.4	180.0	17.3	90.0	11.9	79.7
70.0	89.0	359.5	86.3	180.0	17.1	90.0	16.6	80.7
80.0	89.8	3.7	86.2	180.0	16.9	90.0	22.8	81.4
90.0	91.3	8.2	86.2	180.0	16.7	90.0	30.1	81.9
100.0	91.8	12.6	84.7	180.0	16.7	90.0	37.1	82.3
110.0	92.7	16.4	83.3	180.0	16.8	90.0	43.3	82.5
120.0	97.1	23.2	82.0	180.0	17.0	90.0	55.7	82.5
130.0	97.3	24.5	80.9	180.0	17.0	90.0	57.8	82.4
140.0	96.4	24.4	80.0	180.0	17.0	90.0	57.4	82.2
150.0	94.6	22.9	79.3	180.0	17.2	90.0	54.6	81.7
160.0	88.4	15.6	78.8	180.0	17.4	90.0	41.7	81.2
170.0	85.9	11.4	78.4	180.0	17.7	90.0	33.1	80.5
180.0	83.8	6.4	78.3	180.0	18.0	90.0	27.5	79.7
190.0	82.3	1.0	78.4	180.0	18.0	90.0	19.8	78.9
200.0	81.7	356.2	78.8	179.9	18.0	90.0	13.0	77.7
210.0	81.8	352.5	79.3	180.0	18.1	90.0	7.7	75.9
220.0	82.6	350.7	80.0	180.0	18.2	90.0	5.1	73.3
230.0	83.9	350.9	80.3	180.0	18.4	90.0	5.5	69.4
240.0	86.6	353.1	82.0	180.0	18.6	90.0	9.1	63.9
250.0	92.3	350.9	86.3	180.0	18.6	90.0	16.3	57.3
260.0	80.9	350.2	67.5	180.7	18.6	90.0	21.4	51.4
270.0	65.9	357.9	31.7	182.5	18.6	90.0	21.0	47.8
280.0	49.0	356.8	4.2	193.8	18.8	90.0	22.4	48.1
290.0	14.6	4.9	1.7	45.7	17.4	90.0	25.4	51.6
300.0	15.0	14.7	4.0	60.2	17.4	90.0	29.7	56.3
310.0	15.6	33.3	8.3	60.2	14.9	90.0	35.0	60.8
320.0	25.3	39.8	3.5	119.8	17.6	90.0	40.8	64.4
330.0	91.7	8.3	73.8	170.1	17.0	90.0	46.6	67.2
340.0	96.5	0.2	84.4	164.5	16.6	90.0	42.4	69.0
350.0	96.1	0.2	86.1	168.7	16.3	90.0	35.4	70.8
360.0	96.0	0.1	88.1	173.2	16.2	90.0	28.2	72.3

6.25.5 Thruster loss

Case 25 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.82	0.81
10.0	0.86	0.78	0.80
20.0	0.86	0.78	0.80
30.0	0.86	0.78	0.81
40.0	0.86	0.77	0.82
50.0	0.87	0.77	0.84
60.0	0.89	0.77	0.86
70.0	0.91	0.77	0.85
80.0	0.92	0.77	0.84
90.0	0.92	0.77	0.83
100.0	0.93	0.75	0.84
110.0	0.93	0.74	0.84
120.0	0.93	0.73	0.85
130.0	0.93	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.94	0.70	0.87
170.0	0.94	0.70	0.88
180.0	0.95	0.70	0.90
190.0	0.95	0.70	0.90
200.0	0.94	0.70	0.90
210.0	0.93	0.71	0.90
220.0	0.92	0.71	0.91
230.0	0.92	0.72	0.92
240.0	0.92	0.73	0.93
250.0	0.93	0.74	0.93
260.0	0.94	0.76	0.93
270.0	0.93	0.78	0.93
280.0	0.91	0.86	0.94
290.0	0.91	0.88	0.94
300.0	0.91	0.88	0.95
310.0	0.91	0.88	0.91
320.0	0.91	0.89	0.88
330.0	0.87	0.83	0.85
340.0	0.86	0.85	0.83
350.0	0.86	0.84	0.81
360.0	0.86	0.82	0.81

Preliminary Design, @IDR5

6.26 Case 26 - Thrust Utilization: 35 knots wind @ 60 deg, 2 knots current, Sea State 5

6.26.1 Environment and thrust utilisation

Case 26 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	60.0	60.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	60.0	60.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	60.0	60.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	60.0	60.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	60.0	60.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	60.0	60.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	60.0	60.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	60.0	60.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	60.0	60.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	60.0	60.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	60.0	60.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	60.0	60.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	60.0	60.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	60.0	60.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	60.0	60.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	60.0	60.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	60.0	60.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	60.0	60.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	60.0	60.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	60.0	60.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	60.0	60.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	60.0	60.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	60.0	60.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	60.0	60.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	60.0	60.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	60.0	60.0	250.0	35.0	4.0	6.7	9.4	2.00	> 100.0
260.0	60.0	60.0	260.0	35.0	4.0	6.7	9.4	2.00	> 100.0
270.0	60.0	60.0	270.0	35.0	4.0	6.7	9.4	2.00	84.5
280.0	60.0	60.0	280.0	35.0	4.0	6.7	9.4	2.00	71.9
290.0	60.0	60.0	290.0	35.0	4.0	6.7	9.4	2.00	66.2
300.0	60.0	60.0	300.0	35.0	4.0	6.7	9.4	2.00	53.6
310.0	60.0	60.0	310.0	35.0	4.0	6.7	9.4	2.00	60.8
320.0	60.0	60.0	320.0	35.0	4.0	6.7	9.4	2.00	73.5
330.0	60.0	60.0	330.0	35.0	4.0	6.7	9.4	2.00	91.1
340.0	60.0	60.0	340.0	35.0	4.0	6.7	9.4	2.00	> 100.0
350.0	60.0	60.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	60.0	60.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.26.2 Relative contributions of force components

Case 26 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	45.8	31.3	1.3	0.0	21.6	100.0
10.0	42.9	29.3	7.6	0.0	20.2	100.0
20.0	40.2	27.4	13.5	0.0	18.9	100.0
30.0	37.6	25.6	19.2	0.0	17.6	100.0
40.0	35.1	23.9	24.6	0.0	16.4	100.0
50.0	32.9	22.3	29.5	0.0	15.3	100.0
60.0	31.1	21.0	33.5	0.0	14.4	100.0
70.0	29.7	20.0	36.5	0.0	13.8	100.0
80.0	28.8	19.4	38.4	0.0	13.4	100.0
90.0	28.6	19.2	39.0	0.0	13.2	100.0
100.0	28.9	19.4	38.3	0.0	13.4	100.0
110.0	29.8	20.0	36.4	0.0	13.8	100.0
120.0	31.2	21.0	33.3	0.0	14.4	100.0
130.0	33.2	22.3	29.2	0.0	15.3	100.0
140.0	35.5	23.9	24.1	0.0	16.4	100.0
150.0	38.2	25.7	18.4	0.0	17.5	100.0
160.0	41.0	27.6	12.4	0.0	18.9	100.0
170.0	44.0	29.7	6.0	0.0	20.4	100.0
180.0	47.1	31.8	-0.9	0.0	21.9	100.0
190.0	50.8	34.4	-8.8	0.0	23.6	100.0
200.0	55.4	37.5	-18.7	0.0	25.8	100.0
210.0	61.4	41.7	-31.7	0.0	28.7	100.0
220.0	69.4	47.1	-49.2	0.0	32.5	100.0
230.0	79.7	54.6	-71.9	0.0	37.6	100.0
240.0	93.0	63.4	-99.1	0.0	43.7	100.0
250.0	104.0	72.3	-126.2	0.0	49.9	100.0
260.0	111.8	78.5	-144.5	0.0	54.2	100.0
270.0	112.6	79.5	-147.1	0.0	54.9	100.0
280.0	106.7	75.4	-134.1	0.0	52.1	100.0
290.0	96.5	68.0	-111.4	0.0	46.9	100.0
300.0	85.0	59.5	-85.5	0.0	41.1	100.0
310.0	74.2	51.7	-61.5	0.0	35.6	100.0
320.0	65.3	45.2	-41.7	0.0	31.2	100.0
330.0	58.3	40.3	-26.3	0.0	27.7	100.0
340.0	53.1	36.5	-14.8	0.0	25.2	100.0
350.0	49.0	33.7	-5.9	0.0	23.2	100.0
360.0	45.8	31.3	1.3	0.0	21.6	100.0

6.26.3 Environment forces

Case 26 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-4.1	-5.2	-3.6	0.0	-3.8	-16.7
10.0	-4.1	-5.2	-3.6	0.0	-3.8	-16.7
20.0	-4.1	-5.2	-3.5	0.0	-3.8	-16.6
30.0	-4.1	-5.2	-3.2	0.0	-3.8	-16.3
40.0	-4.1	-5.2	-2.8	0.0	-3.8	-15.9
50.0	-4.1	-5.2	-2.3	0.0	-3.8	-15.4
60.0	-4.1	-5.2	-1.6	0.0	-3.8	-14.8
70.0	-4.1	-5.2	-0.9	0.0	-3.8	-14.0
80.0	-4.1	-5.2	-0.1	0.0	-3.8	-13.2
90.0	-4.1	-5.2	0.7	0.0	-3.8	-12.4
100.0	-4.1	-5.2	1.5	0.0	-3.8	-11.6
110.0	-4.1	-5.2	2.3	0.0	-3.8	-10.9
120.0	-4.1	-5.2	3.0	0.0	-3.8	-10.2
130.0	-4.1	-5.2	3.5	0.0	-3.8	-9.6
140.0	-4.1	-5.2	4.0	0.0	-3.8	-9.2
150.0	-4.1	-5.2	4.3	0.0	-3.8	-8.9
160.0	-4.1	-5.2	4.4	0.0	-3.8	-8.7
170.0	-4.1	-5.2	4.4	0.0	-3.8	-8.7
180.0	-4.1	-5.2	4.3	0.0	-3.8	-8.8
190.0	-4.1	-5.2	4.4	0.0	-3.8	-8.7
200.0	-4.1	-5.2	4.4	0.0	-3.8	-8.7
210.0	-4.1	-5.2	4.3	0.0	-3.8	-8.9
220.0	-4.1	-5.2	4.0	0.0	-3.8	-9.2
230.0	-4.1	-5.2	3.5	0.0	-3.8	-9.6
240.0	-4.1	-5.2	3.0	0.0	-3.8	-10.2
250.0	-4.1	-5.2	2.3	0.0	-3.8	-10.9
260.0	-4.1	-5.2	1.5	0.0	-3.8	-11.6
270.0	-4.1	-5.2	0.7	0.0	-3.8	-12.4
280.0	-4.1	-5.2	-0.1	0.0	-3.8	-13.2
290.0	-4.1	-5.2	-0.9	0.0	-3.8	-14.0
300.0	-4.1	-5.2	-1.6	0.0	-3.8	-14.8
310.0	-4.1	-5.2	-2.3	0.0	-3.8	-15.4
320.0	-4.1	-5.2	-2.8	0.0	-3.8	-15.9
330.0	-4.1	-5.2	-3.2	0.0	-3.8	-16.3
340.0	-4.1	-5.2	-3.5	0.0	-3.8	-16.6
350.0	-4.1	-5.2	-3.6	0.0	-3.8	-16.7
360.0	-4.1	-5.2	-3.6	0.0	-3.8	-16.7

Case 26 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-31.0	-20.6	0.0	0.0	-14.1	-65.7
10.0	-31.0	-20.6	-4.8	0.0	-14.1	-70.5
20.0	-31.0	-20.6	-10.0	0.0	-14.1	-75.7
30.0	-31.0	-20.6	-15.6	0.0	-14.1	-81.3
40.0	-31.0	-20.6	-21.7	0.0	-14.1	-87.4
50.0	-31.0	-20.6	-28.0	0.0	-14.1	-93.7
60.0	-31.0	-20.6	-33.8	0.0	-14.1	-99.5
70.0	-31.0	-20.6	-38.7	0.0	-14.1	-104.4
80.0	-31.0	-20.6	-41.9	0.0	-14.1	-107.6
90.0	-31.0	-20.6	-43.0	0.0	-14.1	-108.7
100.0	-31.0	-20.6	-41.9	0.0	-14.1	-107.6
110.0	-31.0	-20.6	-38.7	0.0	-14.1	-104.4
120.0	-31.0	-20.6	-33.8	0.0	-14.1	-99.5
130.0	-31.0	-20.6	-28.0	0.0	-14.1	-85.7
140.0	-31.0	-20.6	-21.7	0.0	-14.1	-87.4
150.0	-31.0	-20.6	-15.6	0.0	-14.1	-81.3
160.0	-31.0	-20.6	-10.0	0.0	-14.1	-75.7
170.0	-31.0	-20.6	-4.8	0.0	-14.1	-70.5
180.0	-31.0	-20.6	0.0	0.0	-14.1	-65.7
190.0	-31.0	-20.6	4.8	0.0	-14.1	-60.9
200.0	-31.0	-20.6	10.0	0.0	-14.1	-55.7
210.0	-31.0	-20.6	15.6	0.0	-14.1	-50.1
220.0	-31.0	-20.6	21.7	0.0	-14.1	-44.0
230.0	-31.0	-20.6	28.0	0.0	-14.1	-37.7
240.0	-31.0	-20.6	33.8	0.0	-14.1	-31.9
250.0	-31.0	-20.6	38.7	0.0	-14.1	-27.0
260.0	-31.0	-20.6	41.9	0.0	-14.1	-23.8
270.0	-31.0	-20.6	43.0	0.0	-14.1	-22.7
280.0	-31.0	-20.6	41.9	0.0	-14.1	-23.8
290.0	-31.0	-20.6	38.7	0.0	-14.1	-27.0
300.0	-31.0	-20.6	33.8	0.0	-14.1	-31.9
310.0	-31.0	-20.6	28.0	0.0	-14.1	-37.7
320.0	-31.0	-20.6	21.7	0.0	-14.1	-44.0
330.0	-31.0	-20.6	15.6	0.0	-14.1	-50.1
340.0	-31.0	-20.6	10.0	0.0	-14.1	-55.7
350.0	-31.0	-20.6	4.8	0.0	-14.1	-60.9
360.0	-31.0	-20.6	0.0	0.0	-14.1	-65.7

Case 26 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-543.1	-199.0	0.0	0.0	-161.4	-903.5
10.0	-543.1	-199.0	-316.6	0.0	-161.4	-1220.1
20.0	-543.1	-199.0	-593.0	0.0	-161.4	-1496.4
30.0	-543.1	-199.0	-793.7	0.0	-161.4	-1697.2
40.0	-543.1	-199.0	-892.8	0.0	-161.4	-1796.3
50.0	-543.1	-199.0	-876.4	0.0	-161.4	-1779.9
60.0	-543.1	-199.0	-745.2	0.0	-161.4	-1648.7
70.0	-543.1	-199.0	-513.8	0.0	-161.4	-1417.3
80.0	-543.1	-199.0	-209.2	0.0	-161.4	-1112.7
90.0	-543.1	-199.0	132.4	0.0	-161.4	-771.1
100.0	-543.1	-199.0	470.0	0.0	-161.4	-433.5
110.0	-543.1	-199.0	762.6	0.0	161.4	182.0
120.0	-543.1	-199.0	974.5	0.0	161.4	393.9
130.0	-543.1	-199.0	1079.2	0.0	161.4	498.6
140.0	-543.1	-199.0	1063.0	0.0	161.4	483.3
150.0	-543.1	-199.0	926.1	0.0	161.4	315.4
160.0	-543.1	-199.0	683.5	0.0	-161.4	-20.0
170.0	-543.1	-199.0	362.6	0.0	-161.4	-540.9
180.0	-543.1	-199.0	0.0	0.0	-161.4	-903.5
190.0	-543.1	-199.0	-362.6	0.0	-161.4	-1266.1
200.0	-543.1	-199.0	-683.5	0.0	-161.4	-1587.0
210.0	-543.1	-199.0	-926.1	0.0	-161.4	-1829.6
220.0	-543.1	-199.0	-1063.0	0.0	-161.4	-1966.4
230.0	-543.1	-199.0	-1079.2	0.0	-161.4	-1982.7
240.0	-543.1	-199.0	-974.5	0.0	-161.4	-1878.0
250.0	-543.1	-199.0	-762.6	0.0	-161.4	-1666.1
260.0	-543.1	-199.0	-470.0	0.0	-161.4	-1373.5
270.0	-543.1	-199.0	-132.4	0.0	-161.4	-1035.9
280.0	-543.1	-199.0	209.2	0.0	-161.4	-694.3
290.0	-543.1	-199.0	513.8	0.0	-161.4	-389.7
300.0	-543.1	-199.0	745.2	0.0	161.4	164.6
310.0	-543.1	-199.0	876.4	0.0	161.4	295.8
320.0	-543.1	-199.0	892.8	0.0	161.4	312.1
330.0	-543.1	-199.0	793.7	0.0	161.4	213.0
340.0	-543.1	-199.0	593.0	0.0	-161.4	-310.5
350.0	-543.1	-199.0	316.6	0.0	-161.4	-586.9
360.0	-543.1	-199.0	0.0	0.0	-161.4	-903.5

6.26.4 Thruster use

Case 26 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.1	89.4	171.9	16.2	90.0	30.0	75.5
10.0	92.6	3.3	87.3	179.9	16.0	90.0	22.0	76.4
20.0	90.6	359.5	87.2	180.0	16.0	90.0	15.7	77.5
30.0	89.5	356.8	87.1	179.9	16.2	90.0	11.5	78.4
40.0	88.8	355.4	86.8	180.0	16.4	90.0	9.4	79.5
50.0	88.6	355.7	86.6	180.0	16.8	90.0	10.3	80.5
60.0	88.6	357.8	86.5	180.0	17.3	90.0	14.0	81.4
70.0	88.8	0.8	86.3	180.0	17.1	90.0	18.5	82.2
80.0	89.6	5.0	86.2	180.0	16.9	90.0	24.8	82.9
90.0	91.1	9.5	86.2	180.0	16.7	90.0	31.9	83.4
100.0	91.6	13.9	84.7	180.0	16.7	90.0	39.0	83.7
110.0	95.4	21.5	83.3	180.0	16.8	90.0	52.1	84.0
120.0	96.3	24.2	82.0	180.0	17.0	90.0	56.7	84.1
130.0	96.3	25.5	80.9	180.0	17.0	90.0	58.7	84.1
140.0	95.4	25.4	80.0	180.0	17.0	90.0	58.3	83.9
150.0	93.4	23.9	79.3	180.0	17.2	90.0	55.4	83.7
160.0	87.6	17.0	78.8	180.0	17.4	90.0	43.4	83.3
170.0	85.1	12.8	78.4	180.0	17.7	90.0	36.8	82.9
180.0	83.1	7.8	78.3	180.0	18.0	90.0	29.7	82.2
190.0	81.6	2.3	78.5	180.0	18.0	90.0	21.6	81.7
200.0	81.2	357.6	78.8	180.0	18.0	90.0	14.8	80.9
210.0	81.4	353.9	79.3	180.0	18.1	90.0	9.7	79.8
220.0	82.2	352.1	80.0	180.0	18.2	90.0	7.1	78.0
230.0	83.5	352.2	80.3	180.0	18.4	90.0	7.4	75.5
240.0	85.7	354.3	82.0	180.0	18.6	90.0	10.7	72.0
250.0	89.7	357.9	86.3	180.0	18.6	90.0	16.7	67.8
260.0	95.9	2.3	84.7	180.0	18.6	90.0	25.1	63.6
270.0	106.6	1.9	54.2	178.0	18.6	90.0	25.9	61.3
280.0	109.0	3.9	26.6	175.0	18.8	90.0	27.3	61.0
290.0	25.5	9.5	11.8	160.5	18.9	90.0	30.4	62.6
300.0	14.3	38.7	7.2	60.2	16.7	90.0	35.1	65.2
310.0	21.1	50.2	3.8	60.2	18.2	90.0	40.7	67.8
320.0	45.3	17.0	30.4	154.4	17.6	90.0	46.8	70.1
330.0	83.8	11.5	67.8	166.1	17.1	90.0	52.7	71.9
340.0	96.6	0.3	87.5	163.5	16.6	90.0	43.9	73.2
350.0	96.2	0.2	88.3	167.5	16.3	90.0	37.1	74.4
360.0	96.0	0.1	89.4	171.9	16.2	90.0	30.0	75.5

6.26.5 Thruster loss

Case 26 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.83	0.81
10.0	0.85	0.78	0.80
20.0	0.86	0.78	0.80
30.0	0.86	0.78	0.81
40.0	0.87	0.77	0.82
50.0	0.88	0.77	0.84
60.0	0.89	0.77	0.86
70.0	0.91	0.77	0.85
80.0	0.91	0.77	0.84
90.0	0.92	0.77	0.83
100.0	0.92	0.75	0.84
110.0	0.92	0.74	0.84
120.0	0.93	0.73	0.85
130.0	0.93	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.94	0.70	0.87
170.0	0.94	0.70	0.88
180.0	0.95	0.70	0.90
190.0	0.95	0.70	0.90
200.0	0.94	0.70	0.90
210.0	0.93	0.71	0.90
220.0	0.92	0.71	0.91
230.0	0.92	0.72	0.92
240.0	0.93	0.73	0.93
250.0	0.94	0.74	0.93
260.0	0.94	0.75	0.93
270.0	0.94	0.78	0.93
280.0	0.93	0.80	0.94
290.0	0.92	0.86	0.94
300.0	0.92	0.88	0.95
310.0	0.92	0.88	0.91
320.0	0.88	0.88	0.88
330.0	0.87	0.85	0.85
340.0	0.86	0.86	0.83
350.0	0.86	0.84	0.81
360.0	0.86	0.83	0.81

Preliminary Design, @IDR5

6.27 Case 27 - Thrust Utilization: 35 knots wind @ 70 deg, 2 knots current, Sea State 5

6.27.1 Environment and thrust utilisation

Case 27 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	70.0	70.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	70.0	70.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	70.0	70.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	70.0	70.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	70.0	70.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	70.0	70.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	70.0	70.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	70.0	70.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	70.0	70.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	70.0	70.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	70.0	70.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	70.0	70.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	70.0	70.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	70.0	70.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	70.0	70.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	70.0	70.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	70.0	70.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	70.0	70.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	70.0	70.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	70.0	70.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	70.0	70.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	70.0	70.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	70.0	70.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	70.0	70.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	70.0	70.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	70.0	70.0	250.0	35.0	4.0	6.7	9.4	2.00	> 100.0
260.0	70.0	70.0	260.0	35.0	4.0	6.7	9.4	2.00	> 100.0
270.0	70.0	70.0	270.0	35.0	4.0	6.7	9.4	2.00	86.6
280.0	70.0	70.0	280.0	35.0	4.0	6.7	9.4	2.00	72.9
290.0	70.0	70.0	290.0	35.0	4.0	6.7	9.4	2.00	66.8
300.0	70.0	70.0	300.0	35.0	4.0	6.7	9.4	2.00	59.0
310.0	70.0	70.0	310.0	35.0	4.0	6.7	9.4	2.00	66.3
320.0	70.0	70.0	320.0	35.0	4.0	6.7	9.4	2.00	79.3
330.0	70.0	70.0	330.0	35.0	4.0	6.7	9.4	2.00	96.9
340.0	70.0	70.0	340.0	35.0	4.0	6.7	9.4	2.00	> 100.0
350.0	70.0	70.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	70.0	70.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.27.2 Relative contributions of force components

Case 27 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	41.4	34.3	0.9	0.0	23.4	100.0
10.0	38.9	32.2	6.8	0.0	22.0	100.0
20.0	36.6	30.3	12.4	0.0	20.7	100.0
30.0	34.4	28.4	17.8	0.0	19.4	100.0
40.0	32.2	26.6	23.0	0.0	18.1	100.0
50.0	30.3	25.0	27.7	0.0	17.0	100.0
60.0	28.7	23.6	31.6	0.0	16.1	100.0
70.0	27.5	22.6	34.5	0.0	15.4	100.0
80.0	26.8	22.0	36.3	0.0	15.0	100.0
90.0	26.5	21.8	36.9	0.0	14.8	100.0
100.0	26.8	22.0	36.3	0.0	15.0	100.0
110.0	27.6	22.6	34.4	0.0	15.4	100.0
120.0	28.8	23.6	31.5	0.0	16.1	100.0
130.0	30.5	25.0	27.5	0.0	17.0	100.0
140.0	32.5	26.7	22.7	0.0	18.2	100.0
150.0	34.8	28.5	17.3	0.0	19.1	100.0
160.0	37.1	30.4	11.7	0.0	20.3	100.0
170.0	39.6	32.5	5.8	0.0	22.1	100.0
180.0	42.2	34.6	-0.5	0.0	23.6	100.0
190.0	45.2	37.1	-7.6	0.0	25.3	100.0
200.0	48.9	40.2	-16.4	0.0	27.4	100.0
210.0	53.7	44.1	-27.3	0.0	30.1	100.0
220.0	60.0	49.1	-43.0	0.0	33.7	100.0
230.0	68.0	56.2	-62.5	0.0	38.3	100.0
240.0	77.6	64.3	-85.8	0.0	43.8	100.0
250.0	87.5	72.7	-109.8	0.0	49.6	100.0
260.0	94.7	79.1	-127.8	0.0	54.0	100.0
270.0	96.7	81.0	-132.8	0.0	55.2	100.0
280.0	92.4	77.5	-122.9	0.0	52.9	100.0
290.0	84.1	70.5	-102.6	0.0	48.1	100.0
300.0	74.3	62.2	-79.0	0.0	42.4	100.0
310.0	65.3	54.5	-57.0	0.0	37.2	100.0
320.0	57.8	48.2	-38.9	0.0	32.9	100.0
330.0	52.0	43.3	-24.8	0.0	29.5	100.0
340.0	47.6	39.5	-14.1	0.0	27.0	100.0
350.0	44.2	36.7	-5.8	0.0	25.0	100.0
360.0	41.4	34.3	0.9	0.0	23.4	100.0

6.27.3 Environment forces

Case 27 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-2.6	-4.4	-3.6	0.0	-3.0	-13.5
10.0	-2.6	-4.4	-3.6	0.0	-3.0	-13.5
20.0	-2.6	-4.4	-3.5	0.0	-3.0	-13.4
30.0	-2.6	-4.4	-3.2	0.0	-3.0	-13.1
40.0	-2.6	-4.4	-2.8	0.0	-3.0	-12.7
50.0	-2.6	-4.4	-2.3	0.0	-3.0	-12.2
60.0	-2.6	-4.4	-1.6	0.0	-3.0	-11.6
70.0	-2.6	-4.4	-0.9	0.0	-3.0	-10.8
80.0	-2.6	-4.4	-0.1	0.0	-3.0	-10.0
90.0	-2.6	-4.4	0.7	0.0	-3.0	-9.2
100.0	-2.6	-4.4	1.5	0.0	-3.0	-8.4
110.0	-2.6	-4.4	2.3	0.0	-3.0	-7.7
120.0	-2.6	-4.4	3.0	0.0	-3.0	-7.0
130.0	-2.6	-4.4	3.5	0.0	-3.0	-6.4
140.0	-2.6	-4.4	4.0	0.0	-3.0	-6.0
150.0	-2.6	-4.4	4.3	0.0	-3.0	-5.7
160.0	-2.6	-4.4	4.4	0.0	-3.0	-5.5
170.0	-2.6	-4.4	4.4	0.0	-3.0	-5.5
180.0	-2.6	-4.4	4.3	0.0	-3.0	-5.6
190.0	-2.6	-4.4	4.4	0.0	-3.0	-5.5
200.0	-2.6	-4.4	4.4	0.0	-3.0	-5.5
210.0	-2.6	-4.4	4.3	0.0	-3.0	-5.7
220.0	-2.6	-4.4	4.0	0.0	-3.0	-6.0
230.0	-2.6	-4.4	3.5	0.0	-3.0	-6.4
240.0	-2.6	-4.4	3.0	0.0	-3.0	-7.0
250.0	-2.6	-4.4	2.3	0.0	-3.0	-7.7
260.0	-2.6	-4.4	1.5	0.0	-3.0	-8.4
270.0	-2.6	-4.4	0.7	0.0	-3.0	-9.2
280.0	-2.6	-4.4	-0.1	0.0	-3.0	-10.0
290.0	-2.6	-4.4	-0.9	0.0	-3.0	-10.8
300.0	-2.6	-4.4	-1.6	0.0	-3.0	-11.6
310.0	-2.6	-4.4	-2.3	0.0	-3.0	-12.2
320.0	-2.6	-4.4	-2.8	0.0	-3.0	-12.7
330.0	-2.6	-4.4	-3.2	0.0	-3.0	-13.1
340.0	-2.6	-4.4	-3.5	0.0	-3.0	-13.4
350.0	-2.6	-4.4	-3.6	0.0	-3.0	-13.5
360.0	-2.6	-4.4	-3.6	0.0	-3.0	-13.5

Case 27 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.7	-25.0	0.0	0.0	-17.0	-72.7
10.0	-30.7	-25.0	-4.8	0.0	-17.0	-77.5
20.0	-30.7	-25.0	-10.0	0.0	-17.0	-82.6
30.0	-30.7	-25.0	-15.6	0.0	-17.0	-88.3
40.0	-30.7	-25.0	-21.7	0.0	-17.0	-94.4
50.0	-30.7	-25.0	-28.0	0.0	-17.0	-100.6
60.0	-30.7	-25.0	-33.8	0.0	-17.0	-106.5
70.0	-30.7	-25.0	-38.7	0.0	-17.0	-111.3
80.0	-30.7	-25.0	-41.9	0.0	-17.0	-114.5
90.0	-30.7	-25.0	-43.0	0.0	-17.0	-115.6
100.0	-30.7	-25.0	-41.9	0.0	-17.0	-114.5
110.0	-30.7	-25.0	-38.7	0.0	-17.0	-111.3
120.0	-30.7	-25.0	-33.8	0.0	-17.0	-106.5
130.0	-30.7	-25.0	-28.0	0.0	-17.0	-100.6
140.0	-30.7	-25.0	-21.7	0.0	-17.0	-94.4
150.0	-30.7	-25.0	-15.6	0.0	-17.0	-88.3
160.0	-30.7	-25.0	-10.0	0.0	-17.0	-82.6
170.0	-30.7	-25.0	-4.8	0.0	-17.0	-77.5
180.0	-30.7	-25.0	0.0	0.0	-17.0	-72.7
190.0	-30.7	-25.0	4.8	0.0	-17.0	-67.8
200.0	-30.7	-25.0	10.0	0.0	-17.0	-62.7
210.0	-30.7	-25.0	15.6	0.0	-17.0	-57.0
220.0	-30.7	-25.0	21.7	0.0	-17.0	-50.9
230.0	-30.7	-25.0	28.0	0.0	-17.0	-44.7
240.0	-30.7	-25.0	33.8	0.0	-17.0	-38.8
250.0	-30.7	-25.0	38.7	0.0	-17.0	-34.0
260.0	-30.7	-25.0	41.9	0.0	-17.0	-30.8
270.0	-30.7	-25.0	43.0	0.0	-17.0	-29.7
280.0	-30.7	-25.0	41.9	0.0	-17.0	-30.8
290.0	-30.7	-25.0	38.7	0.0	-17.0	-34.0
300.0	-30.7	-25.0	33.8	0.0	-17.0	-38.8
310.0	-30.7	-25.0	28.0	0.0	-17.0	-44.7
320.0	-30.7	-25.0	21.7	0.0	-17.0	-50.9
330.0	-30.7	-25.0	15.6	0.0	-17.0	-57.0
340.0	-30.7	-25.0	10.0	0.0	-17.0	-62.7
350.0	-30.7	-25.0	4.8	0.0	-17.0	-67.8
360.0	-30.7	-25.0	0.0	0.0	-17.0	-72.7

Case 27 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-430.1	-89.4	0.0	0.0	-100.4	-619.9
10.0	-430.1	-89.4	-316.6	0.0	-100.4	-936.5
20.0	-430.1	-89.4	-593.0	0.0	-100.4	-1212.9
30.0	-430.1	-89.4	-793.7	0.0	-100.4	-1413.6
40.0	-430.1	-89.4	-892.8	0.0	-100.4	-1512.7
50.0	-430.1	-89.4	-876.4	0.0	-100.4	-1496.3
60.0	-430.1	-89.4	-745.2	0.0	-100.4	-1365.1
70.0	-430.1	-89.4	-513.8	0.0	-100.4	-1133.8
80.0	-430.1	-89.4	-209.2	0.0	-100.4	-829.1
90.0	-430.1	-89.4	132.4	0.0	-100.4	-487.5
100.0	-430.1	-89.4	470.0	0.0	-100.4	-149.9
110.0	-430.1	-89.4	762.6	0.0	100.4	343.5
120.0	-430.1	-89.4	974.5	0.0	100.4	555.4
130.0	-430.1	-89.4	1079.2	0.0	100.4	660.1
140.0	-430.1	-89.4	1063.0	0.0	100.4	643.8
150.0	-430.1	-89.4	926.1	0.0	100.4	506.9
160.0	-430.1	-89.4	683.5	0.0	100.4	264.4
170.0	-430.1	-89.4	362.6	0.0	-100.4	-257.3
180.0	-430.1	-89.4	0.0	0.0	-100.4	-619.9
190.0	-430.1	-89.4	-362.6	0.0	-100.4	-982.5
200.0	-430.1	-89.4	-683.5	0.0	-100.4	-1303.5
210.0	-430.1	-89.4	-926.1	0.0	-100.4	-1546.0
220.0	-430.1	-89.4	-1063.0	0.0	-100.4	-1682.9
230.0	-430.1	-89.4	-1079.2	0.0	-100.4	-1699.2
240.0	-430.1	-89.4	-974.5	0.0	-100.4	-1594.4
250.0	-430.1	-89.4	-762.6	0.0	-100.4	-1382.6
260.0	-430.1	-89.4	-470.0	0.0	-100.4	-1089.9
270.0	-430.1	-89.4	-132.4	0.0	-100.4	-752.3
280.0	-430.1	-89.4	209.2	0.0	-100.4	-410.7
290.0	-430.1	-89.4	513.8	0.0	-100.4	-106.1
300.0	-430.1	-89.4	745.2	0.0	100.4	326.1
310.0	-430.1	-89.4	876.4	0.0	100.4	457.3
320.0	-430.1	-89.4	892.8	0.0	100.4	473.6
330.0	-430.1	-89.4	793.7	0.0	100.4	374.5
340.0	-430.1	-89.4	593.0	0.0	100.4	173.8
350.0	-430.1	-89.4	316.6	0.0	-100.4	-303.3
360.0	-430.1	-89.4	0.0	0.0	-100.4	-619.9

6.27.4 Thruster use

Case 27 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.2	91.3	168.2	16.2	90.0	35.8	79.3
10.0	96.2	0.1	92.0	172.4	16.0	90.0	28.8	80.1
20.0	90.9	3.4	87.2	180.0	16.0	90.0	21.7	80.6
30.0	89.6	0.6	87.0	180.0	16.2	90.0	17.4	81.4
40.0	89.0	359.3	86.8	180.0	16.4	90.0	15.5	82.2
50.0	88.7	359.7	86.6	180.0	16.8	90.0	16.4	83.0
60.0	88.7	1.6	86.5	180.0	17.3	90.0	20.0	83.7
70.0	89.0	4.7	86.3	180.0	17.1	90.0	24.6	84.4
80.0	90.0	8.8	86.2	180.0	16.9	90.0	30.8	84.9
90.0	91.7	13.3	86.2	180.0	16.7	90.0	37.9	85.4
100.0	92.3	17.6	84.7	180.0	16.7	90.0	44.8	85.8
110.0	95.2	23.7	83.3	180.0	16.8	90.0	55.3	86.0
120.0	96.0	26.4	82.0	180.0	17.0	90.0	59.8	86.2
130.0	95.9	27.7	80.9	180.0	17.0	90.0	61.7	86.3
140.0	94.8	27.7	80.0	180.0	17.1	90.0	61.3	86.3
150.0	92.7	26.3	79.3	180.0	17.2	90.0	58.4	86.3
160.0	89.8	23.5	78.8	180.0	17.4	90.0	53.4	86.1
170.0	85.2	16.9	78.4	180.0	17.7	90.0	42.6	85.9
180.0	82.9	11.9	78.3	180.0	18.0	90.0	35.2	85.5
190.0	81.2	6.6	78.4	180.0	18.0	90.0	27.5	85.3
200.0	80.6	1.8	78.8	180.0	18.0	90.0	20.6	84.8
210.0	80.9	358.2	79.3	180.0	18.1	90.0	15.7	84.2
220.0	81.8	356.4	80.0	180.0	18.3	90.0	13.3	83.2
230.0	83.0	356.5	80.3	180.0	18.4	90.0	13.5	81.7
240.0	85.0	358.4	82.0	180.0	18.6	90.0	16.5	79.7
250.0	88.2	17.7	86.3	180.0	18.6	90.0	21.8	77.1
260.0	93.0	7.9	84.7	180.0	18.6	90.0	29.3	74.5
270.0	138.9	5.0	59.7	175.1	18.6	90.0	31.1	72.7
280.0	12.0	8.7	32.3	169.9	18.8	90.0	32.4	72.0
290.0	28.3	15.9	18.0	156.0	18.9	90.0	35.7	72.3
300.0	20.7	39.2	9.1	119.8	17.9	90.0	40.5	73.4
310.0	29.9	26.5	19.6	137.9	18.2	90.0	46.3	74.7
320.0	59.0	16.5	46.8	159.3	17.6	90.0	52.5	76.0
330.0	97.2	11.2	84.9	165.7	17.1	90.0	58.5	77.0
340.0	96.6	0.4	92.2	157.5	16.6	90.0	53.7	77.7
350.0	96.2	0.3	91.2	163.9	16.3	90.0	42.8	78.5
360.0	96.0	0.2	91.3	168.2	16.2	90.0	35.8	79.3

6.27.5 Thruster loss

Case 27 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.84	0.81
10.0	0.86	0.82	0.80
20.0	0.86	0.78	0.80
30.0	0.87	0.78	0.81
40.0	0.87	0.77	0.82
50.0	0.88	0.77	0.84
60.0	0.89	0.77	0.86
70.0	0.90	0.77	0.85
80.0	0.90	0.77	0.84
90.0	0.91	0.77	0.83
100.0	0.92	0.75	0.84
110.0	0.92	0.74	0.84
120.0	0.93	0.73	0.85
130.0	0.93	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.94	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.95	0.70	0.90
200.0	0.95	0.70	0.90
210.0	0.95	0.71	0.90
220.0	0.94	0.71	0.91
230.0	0.94	0.72	0.92
240.0	0.94	0.73	0.93
250.0	0.94	0.74	0.93
260.0	0.94	0.75	0.93
270.0	0.94	0.80	0.93
280.0	0.93	0.83	0.94
290.0	0.92	0.87	0.94
300.0	0.92	0.89	0.95
310.0	0.90	0.89	0.91
320.0	0.88	0.87	0.88
330.0	0.87	0.85	0.85
340.0	0.86	0.87	0.83
350.0	0.86	0.85	0.81
360.0	0.86	0.84	0.81

Preliminary Design, @IDR5

6.28 Case 28 - Thrust Utilization: 35 knots wind @ 80 deg, 2 knots current, Sea State 5

6.28.1 Environment and thrust utilisation

Case 28 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	80.0	80.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	80.0	80.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	80.0	80.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	80.0	80.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	80.0	80.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	80.0	80.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	80.0	80.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	80.0	80.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	80.0	80.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	80.0	80.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	80.0	80.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	80.0	80.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	80.0	80.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	80.0	80.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	80.0	80.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	80.0	80.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	80.0	80.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	80.0	80.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	80.0	80.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	80.0	80.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	80.0	80.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	80.0	80.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	80.0	80.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	80.0	80.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	80.0	80.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	80.0	80.0	250.0	35.0	4.0	6.7	9.4	2.00	> 100.0
260.0	80.0	80.0	260.0	35.0	4.0	6.7	9.4	2.00	> 100.0
270.0	80.0	80.0	270.0	35.0	4.0	6.7	9.4	2.00	88.2
280.0	80.0	80.0	280.0	35.0	4.0	6.7	9.4	2.00	75.4
290.0	80.0	80.0	290.0	35.0	4.0	6.7	9.4	2.00	61.8
300.0	80.0	80.0	300.0	35.0	4.0	6.7	9.4	2.00	61.7
310.0	80.0	80.0	310.0	35.0	4.0	6.7	9.4	2.00	69.2
320.0	80.0	80.0	320.0	35.0	4.0	6.7	9.4	2.00	82.3
330.0	80.0	80.0	330.0	35.0	4.0	6.7	9.4	2.00	99.9
340.0	80.0	80.0	340.0	35.0	4.0	6.7	9.4	2.00	> 100.0
350.0	80.0	80.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	80.0	80.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.28.2 Relative contributions of force components

Case 28 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	37.9	36.6	0.6	0.0	24.9	100.0
10.0	35.7	34.5	6.3	0.0	23.4	100.0
20.0	33.7	32.5	11.7	0.0	22.1	100.0
30.0	31.7	30.6	16.9	0.0	20.8	100.0
40.0	29.8	28.7	21.9	0.0	19.5	100.0
50.0	28.1	27.0	26.5	0.0	18.4	100.0
60.0	26.7	25.6	30.3	0.0	17.4	100.0
70.0	25.6	24.6	33.1	0.0	16.7	100.0
80.0	24.9	23.9	34.9	0.0	16.3	100.0
90.0	24.7	23.7	35.5	0.0	16.1	100.0
100.0	24.9	23.9	34.9	0.0	16.3	100.0
110.0	25.6	24.6	33.1	0.0	16.7	100.0
120.0	26.7	25.6	30.2	0.0	17.4	100.0
130.0	28.2	27.0	26.4	0.0	18.4	100.0
140.0	30.0	28.7	21.7	0.0	19.5	100.0
150.0	32.0	30.6	16.6	0.0	20.8	100.0
160.0	34.0	32.6	11.2	0.0	22.2	100.0
170.0	36.1	34.6	5.7	0.0	23.5	100.0
180.0	38.4	36.8	-0.2	0.0	25.0	100.0
190.0	40.9	39.2	-6.8	0.0	26.7	100.0
200.0	44.0	42.2	-14.9	0.0	28.7	100.0
210.0	48.0	46.1	-25.1	0.0	31.3	100.0
220.0	53.3	51.1	-39.1	0.0	34.7	100.0
230.0	59.9	57.5	-56.5	0.0	39.1	100.0
240.0	67.7	65.2	-77.2	0.0	44.3	100.0
250.0	75.8	73.1	-98.6	0.0	49.7	100.0
260.0	82.0	79.3	-115.1	0.0	53.9	100.0
270.0	84.0	81.4	-120.7	0.0	55.3	100.0
280.0	81.0	78.5	-112.8	0.0	53.3	100.0
290.0	74.2	72.0	-95.1	0.0	48.9	100.0
300.0	66.1	64.1	-73.8	0.0	43.6	100.0
310.0	58.5	56.7	-53.7	0.0	38.5	100.0
320.0	52.1	50.5	-36.9	0.0	34.3	100.0
330.0	47.1	45.6	-23.8	0.0	31.0	100.0
340.0	43.3	41.9	-13.7	0.0	28.5	100.0
350.0	40.3	39.0	-5.8	0.0	26.5	100.0
360.0	37.9	36.6	0.6	0.0	24.9	100.0

6.28.3 Environment forces

Case 28 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-1.2	-3.3	-3.6	0.0	-2.2	-10.3
10.0	-1.2	-3.3	-3.6	0.0	-2.2	-10.3
20.0	-1.2	-3.3	-3.5	0.0	-2.2	-10.2
30.0	-1.2	-3.3	-3.2	0.0	-2.2	-9.9
40.0	-1.2	-3.3	-2.8	0.0	-2.2	-9.5
50.0	-1.2	-3.3	-2.3	0.0	-2.2	-9.0
60.0	-1.2	-3.3	-1.6	0.0	-2.2	-8.3
70.0	-1.2	-3.3	-0.9	0.0	-2.2	-7.6
80.0	-1.2	-3.3	-0.1	0.0	-2.2	-6.8
90.0	-1.2	-3.3	0.7	0.0	-2.2	-6.0
100.0	-1.2	-3.3	1.5	0.0	-2.2	-5.2
110.0	-1.2	-3.3	2.3	0.0	-2.2	-4.4
120.0	-1.2	-3.3	3.0	0.0	-2.2	-3.7
130.0	-1.2	-3.3	3.5	0.0	-2.2	-3.2
140.0	-1.2	-3.3	4.0	0.0	-2.2	-2.7
150.0	-1.2	-3.3	4.3	0.0	-2.2	-2.4
160.0	-1.2	-3.3	4.4	0.0	-2.2	-2.3
170.0	-1.2	-3.3	4.4	0.0	-2.2	-2.3
180.0	-1.2	-3.3	4.3	0.0	-2.2	-2.4
190.0	-1.2	-3.3	4.4	0.0	-2.2	-2.3
200.0	-1.2	-3.3	4.4	0.0	-2.2	-2.3
210.0	-1.2	-3.3	4.3	0.0	-2.2	-2.4
220.0	-1.2	-3.3	4.0	0.0	-2.2	-2.7
230.0	-1.2	-3.3	3.5	0.0	-2.2	-3.2
240.0	-1.2	-3.3	3.0	0.0	-2.2	-3.7
250.0	-1.2	-3.3	2.3	0.0	-2.2	-4.4
260.0	-1.2	-3.3	1.5	0.0	-2.2	-5.2
270.0	-1.2	-3.3	0.7	0.0	-2.2	-6.0
280.0	-1.2	-3.3	-0.1	0.0	-2.2	-6.8
290.0	-1.2	-3.3	-0.9	0.0	-2.2	-7.6
300.0	-1.2	-3.3	-1.6	0.0	-2.2	-8.3
310.0	-1.2	-3.3	-2.3	0.0	-2.2	-9.0
320.0	-1.2	-3.3	-2.8	0.0	-2.2	-9.5
330.0	-1.2	-3.3	-3.2	0.0	-2.2	-9.9
340.0	-1.2	-3.3	-3.5	0.0	-2.2	-10.2
350.0	-1.2	-3.3	-3.6	0.0	-2.2	-10.3
360.0	-1.2	-3.3	-3.6	0.0	-2.2	-10.3

Case 28 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.8	-28.5	0.0	0.0	-19.4	-77.7
10.0	-29.8	-28.5	-4.8	0.0	-19.4	-82.5
20.0	-29.8	-28.5	-10.0	0.0	-19.4	-87.7
30.0	-29.8	-28.5	-15.6	0.0	-19.4	-93.3
40.0	-29.8	-28.5	-21.7	0.0	-19.4	-99.4
50.0	-29.8	-28.5	-28.0	0.0	-19.4	-105.7
60.0	-29.8	-28.5	-33.8	0.0	-19.4	-111.5
70.0	-29.8	-28.5	-38.7	0.0	-19.4	-116.4
80.0	-29.8	-28.5	-41.9	0.0	-19.4	-119.6
90.0	-29.8	-28.5	-43.0	0.0	-19.4	-120.7
100.0	-29.8	-28.5	-41.9	0.0	-19.4	-119.6
110.0	-29.8	-28.5	-38.7	0.0	-19.4	-116.4
120.0	-29.8	-28.5	-33.8	0.0	-19.4	-111.5
130.0	-29.8	-28.5	-28.0	0.0	-19.4	-105.7
140.0	-29.8	-28.5	-21.7	0.0	-19.4	-99.4
150.0	-29.8	-28.5	-15.6	0.0	-19.4	-93.3
160.0	-29.8	-28.5	-10.0	0.0	-19.4	-87.7
170.0	-29.8	-28.5	-4.8	0.0	-19.4	-82.5
180.0	-29.8	-28.5	0.0	0.0	-19.4	-77.7
190.0	-29.8	-28.5	4.8	0.0	-19.4	-72.9
200.0	-29.8	-28.5	10.0	0.0	-19.4	-67.7
210.0	-29.8	-28.5	15.6	0.0	-19.4	-62.1
220.0	-29.8	-28.5	21.7	0.0	-19.4	-55.9
230.0	-29.8	-28.5	28.0	0.0	-19.4	-49.7
240.0	-29.8	-28.5	33.8	0.0	-19.4	-43.8
250.0	-29.8	-28.5	38.7	0.0	-19.4	-39.0
260.0	-29.8	-28.5	41.9	0.0	-19.4	-35.8
270.0	-29.8	-28.5	43.0	0.0	-19.4	-34.7
280.0	-29.8	-28.5	41.9	0.0	-19.4	-35.8
290.0	-29.8	-28.5	38.7	0.0	-19.4	-39.0
300.0	-29.8	-28.5	33.8	0.0	-19.4	-43.8
310.0	-29.8	-28.5	28.0	0.0	-19.4	-49.7
320.0	-29.8	-28.5	21.7	0.0	-19.4	-55.9
330.0	-29.8	-28.5	15.6	0.0	-19.4	-62.1
340.0	-29.8	-28.5	10.0	0.0	-19.4	-67.7
350.0	-29.8	-28.5	4.8	0.0	-19.4	-72.9
360.0	-29.8	-28.5	0.0	0.0	-19.4	-77.7

Case 28 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-314.1	-25.9	0.0	0.0	-70.2	-410.1
10.0	-314.1	-25.9	-316.6	0.0	-70.2	-726.7
20.0	-314.1	-25.9	-593.0	0.0	-70.2	-1003.1
30.0	-314.1	-25.9	-793.7	0.0	-70.2	-1203.8
40.0	-314.1	-25.9	-892.8	0.0	-70.2	-1302.9
50.0	-314.1	-25.9	-876.4	0.0	-70.2	-1286.6
60.0	-314.1	-25.9	-745.2	0.0	-70.2	-1155.4
70.0	-314.1	-25.9	-513.8	0.0	-70.2	-924.0
80.0	-314.1	-25.9	-209.2	0.0	-70.2	-619.4
90.0	-314.1	-25.9	132.4	0.0	-70.2	-277.7
100.0	-314.1	-25.9	470.0	0.0	70.2	200.2
110.0	-314.1	-25.9	762.6	0.0	70.2	492.8
120.0	-314.1	-25.9	974.5	0.0	70.2	704.7
130.0	-314.1	-25.9	1079.2	0.0	70.2	809.5
140.0	-314.1	-25.9	1063.0	0.0	70.2	793.2
150.0	-314.1	-25.9	926.1	0.0	70.2	606.6
160.0	-314.1	-25.9	683.5	0.0	70.2	413.7
170.0	-314.1	-25.9	362.6	0.0	70.2	92.8
180.0	-314.1	-25.9	0.0	0.0	-70.2	-410.1
190.0	-314.1	-25.9	-362.6	0.0	-70.2	-772.7
200.0	-314.1	-25.9	-683.5	0.0	-70.2	-1093.7
210.0	-314.1	-25.9	-926.1	0.0	-70.2	-1336.2
220.0	-314.1	-25.9	-1063.0	0.0	-70.2	-1473.1
230.0	-314.1	-25.9	-1079.2	0.0	-70.2	-1489.4
240.0	-314.1	-25.9	-974.5	0.0	-70.2	-1384.7
250.0	-314.1	-25.9	-762.6	0.0	-70.2	-1172.8
260.0	-314.1	-25.9	-470.0	0.0	-70.2	-880.1
270.0	-314.1	-25.9	-132.4	0.0	-70.2	-542.5
280.0	-314.1	-25.9	209.2	0.0	-70.2	-200.9
290.0	-314.1	-25.9	513.8	0.0	70.2	244.0
300.0	-314.1	-25.9	745.2	0.0	70.2	475.4
310.0	-314.1	-25.9	876.4	0.0	70.2	606.6
320.0	-314.1	-25.9	892.8	0.0	70.2	623.0
330.0	-314.1	-25.9	793.7	0.0	70.2	523.9
340.0	-314.1	-25.9	593.0	0.0	70.2	323.2
350.0	-314.1	-25.9	316.6	0.0	-70.2	-93.5
360.0	-314.1	-25.9	0.0	0.0	-70.2	-410.1

6.28.4 Thruster use

Case 28 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	96.0	0.2	93.6	165.6	16.2	90.0	40.2	82.4
10.0	96.2	0.2	93.5	169.7	16.0	90.0	33.2	82.8
20.0	90.7	6.2	87.2	180.0	16.0	90.0	26.0	83.3
30.0	89.6	3.4	87.1	179.9	16.2	90.0	21.8	83.8
40.0	88.8	2.2	86.8	180.0	16.4	90.0	19.9	84.4
50.0	88.5	2.5	86.6	180.0	16.8	90.0	20.8	85.1
60.0	88.6	4.5	86.4	180.0	17.3	90.0	24.4	85.7
70.0	89.0	7.6	86.3	180.0	17.1	90.0	28.9	86.2
80.0	90.1	11.6	86.2	180.0	16.9	90.0	35.1	86.7
90.0	91.9	16.1	86.2	180.0	16.7	90.0	42.2	87.1
100.0	93.8	22.1	84.6	180.0	16.8	90.0	52.1	87.5
110.0	95.0	25.8	83.3	180.0	16.8	90.0	58.2	87.8
120.0	95.7	28.5	82.0	180.0	17.0	90.0	62.6	88.0
130.0	95.6	29.9	80.9	180.0	17.0	90.0	64.6	88.2
140.0	94.4	29.9	80.0	180.0	17.1	90.0	64.1	88.4
150.0	92.1	28.6	79.3	180.0	17.2	90.0	61.2	88.5
160.0	89.1	25.8	78.8	180.0	17.4	90.0	56.3	88.5
170.0	86.0	21.9	78.4	180.0	17.7	90.0	49.8	88.4
180.0	82.4	15.1	78.3	180.0	18.0	90.0	39.7	88.2
190.0	80.6	9.8	78.4	180.0	18.0	90.0	31.7	88.2
200.0	79.9	5.0	78.8	180.0	18.0	90.0	24.9	88.0
210.0	80.1	1.3	79.3	180.0	18.1	90.0	20.0	87.7
220.0	80.9	359.4	80.0	180.0	18.3	90.0	17.5	87.2
230.0	82.1	359.5	80.0	180.0	18.4	90.0	17.7	86.3
240.0	83.8	1.3	82.0	180.0	18.6	90.0	20.6	85.0
250.0	86.5	4.5	80.3	180.0	18.6	90.0	25.7	83.4
260.0	90.4	7.7	84.6	180.0	18.6	90.0	32.7	81.7
270.0	89.8	7.1	63.8	173.3	18.6	90.0	35.2	80.2
280.0	83.4	11.9	36.6	167.3	18.8	90.0	36.5	79.2
290.0	18.3	34.1	12.4	127.3	18.9	90.0	39.7	79.0
300.0	20.3	45.2	12.0	119.8	19.0	90.0	44.6	79.2
310.0	36.5	25.8	28.5	146.9	18.2	90.0	50.5	79.8
320.0	65.6	17.2	56.5	160.3	17.6	90.0	56.7	80.4
330.0	97.3	11.8	88.7	164.6	17.1	90.0	61.4	80.9
340.0	96.6	0.4	96.1	156.2	16.6	90.0	56.7	81.3
350.0	96.2	0.3	94.3	161.5	16.3	90.0	47.2	81.8
360.0	96.0	0.2	93.6	165.6	16.2	90.0	40.2	82.4

6.28.5 Thruster loss

Case 28 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.86	0.85	0.81
10.0	0.86	0.84	0.80
20.0	0.85	0.78	0.80
30.0	0.86	0.78	0.81
40.0	0.87	0.77	0.82
50.0	0.88	0.77	0.84
60.0	0.89	0.77	0.86
70.0	0.89	0.77	0.85
80.0	0.90	0.77	0.84
90.0	0.90	0.77	0.83
100.0	0.91	0.75	0.84
110.0	0.92	0.74	0.84
120.0	0.93	0.73	0.85
130.0	0.93	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.94	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.95	0.70	0.90
200.0	0.95	0.70	0.91
210.0	0.95	0.71	0.90
220.0	0.95	0.71	0.91
230.0	0.95	0.72	0.92
240.0	0.94	0.73	0.93
250.0	0.94	0.74	0.93
260.0	0.94	0.75	0.93
270.0	0.94	0.81	0.93
280.0	0.93	0.84	0.94
290.0	0.93	0.89	0.94
300.0	0.92	0.89	0.95
310.0	0.90	0.88	0.91
320.0	0.88	0.86	0.88
330.0	0.87	0.85	0.85
340.0	0.86	0.87	0.83
350.0	0.86	0.86	0.81
360.0	0.86	0.85	0.81

Preliminary Design, @IDR5

6.29 Case 29 - Thrust Utilization: 35 knots wind @ 90 deg, 2 knots current, Sea State 5

6.29.1 Environment and thrust utilisation

Case 29 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	90.0	90.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	90.0	90.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	90.0	90.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	90.0	90.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	90.0	90.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	90.0	90.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	90.0	90.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	90.0	90.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	90.0	90.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	90.0	90.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	90.0	90.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	90.0	90.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	90.0	90.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	90.0	90.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	90.0	90.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	90.0	90.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	90.0	90.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	90.0	90.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	90.0	90.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	90.0	90.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	90.0	90.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	90.0	90.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	90.0	90.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	90.0	90.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	90.0	90.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	90.0	90.0	250.0	35.0	4.0	6.7	9.4	2.00	> 100.0
260.0	90.0	90.0	260.0	35.0	4.0	6.7	9.4	2.00	> 100.0
270.0	90.0	90.0	270.0	35.0	4.0	6.7	9.4	2.00	90.4
280.0	90.0	90.0	280.0	35.0	4.0	6.7	9.4	2.00	77.8
290.0	90.0	90.0	290.0	35.0	4.0	6.7	9.4	2.00	65.3
300.0	90.0	90.0	300.0	35.0	4.0	6.7	9.4	2.00	64.9
310.0	90.0	90.0	310.0	35.0	4.0	6.7	9.4	2.00	72.4
320.0	90.0	90.0	320.0	35.0	4.0	6.7	9.4	2.00	85.4
330.0	90.0	90.0	330.0	35.0	4.0	6.7	9.4	2.00	> 100.0
340.0	90.0	90.0	340.0	35.0	4.0	6.7	9.4	2.00	> 100.0
350.0	90.0	90.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	90.0	90.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.29.2 Relative contributions of force components

Case 29 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	35.7	38.0	0.4	0.0	25.8	100.0
10.0	33.8	35.9	5.9	0.0	24.4	100.0
20.0	31.9	33.9	11.1	0.0	23.1	100.0
30.0	30.1	32.0	16.2	0.0	21.7	100.0
40.0	28.3	30.1	21.1	0.0	20.5	100.0
50.0	26.7	28.4	25.5	0.0	19.3	100.0
60.0	25.4	27.0	29.3	0.0	18.3	100.0
70.0	24.4	25.9	32.1	0.0	17.6	100.0
80.0	23.8	25.2	33.8	0.0	17.1	100.0
90.0	23.6	25.0	34.4	0.0	17.0	100.0
100.0	23.8	25.2	33.8	0.0	17.1	100.0
110.0	24.4	25.8	32.1	0.0	17.6	100.0
120.0	25.5	26.9	29.3	0.0	18.3	100.0
130.0	26.8	28.3	25.6	0.0	19.3	100.0
140.0	28.4	30.0	21.1	0.0	20.5	100.0
150.0	30.2	31.9	16.2	0.0	21.7	100.0
160.0	32.0	33.8	11.1	0.0	23.1	100.0
170.0	33.9	35.8	5.8	0.0	24.5	100.0
180.0	35.9	37.9	0.2	0.0	25.9	100.0
190.0	38.2	40.3	-6.0	0.0	27.5	100.0
200.0	40.9	43.1	-13.5	0.0	29.5	100.0
210.0	44.4	46.5	-23.2	0.0	32.0	100.0
220.0	48.0	51.1	-35.7	0.0	35.3	100.0
230.0	51.6	57.6	-51.6	0.0	39.4	100.0
240.0	61.3	64.7	-70.2	0.0	44.2	100.0
250.0	68.2	72.1	-89.5	0.0	49.2	100.0
260.0	73.6	78.2	-105.0	0.0	53.1	100.0
270.0	75.6	80.4	-110.5	0.0	54.6	100.0
280.0	73.2	78.0	-104.2	0.0	53.0	100.0
290.0	67.7	72.1	-88.7	0.0	49.0	100.0
300.0	60.8	64.8	-69.5	0.0	44.0	100.0
310.0	54.1	57.7	-51.0	0.0	39.2	100.0
320.0	48.5	51.7	-35.4	0.0	35.1	100.0
330.0	44.1	47.0	-22.9	0.0	31.9	100.0
340.0	40.6	43.3	-13.3	0.0	29.4	100.0
350.0	37.9	40.4	-5.8	0.0	27.5	100.0
360.0	35.7	38.0	0.4	0.0	25.8	100.0

6.29.3 Environment forces

Case 29 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	-2.1	-3.6	0.0	-1.4	-7.1
10.0	0.0	-2.1	-3.6	0.0	-1.4	-7.1
20.0	0.0	-2.1	-3.5	0.0	-1.4	-6.9
30.0	0.0	-2.1	-3.2	0.0	-1.4	-6.7
40.0	0.0	-2.1	-2.8	0.0	-1.4	-6.3
50.0	0.0	-2.1	-2.3	0.0	-1.4	-5.7
60.0	0.0	-2.1	-1.6	0.0	-1.4	-5.1
70.0	0.0	-2.1	-0.9	0.0	-1.4	-4.3
80.0	0.0	-2.1	-0.1	0.0	-1.4	-3.6
90.0	0.0	-2.1	0.7	0.0	-1.4	-2.7
100.0	0.0	-2.1	1.5	0.0	-1.4	-1.9
110.0	0.0	-2.1	2.3	0.0	1.4	1.6
120.0	0.0	-2.1	3.0	0.0	1.4	2.3
130.0	0.0	-2.1	3.5	0.0	1.4	2.9
140.0	0.0	-2.1	4.0	0.0	1.4	3.3
150.0	0.0	-2.1	4.3	0.0	1.4	3.6
160.0	0.0	-2.1	4.4	0.0	1.4	3.8
170.0	0.0	-2.1	4.4	0.0	1.4	3.8
180.0	0.0	-2.1	4.3	0.0	1.4	3.6
190.0	0.0	-2.1	4.4	0.0	1.4	3.8
200.0	0.0	-2.1	4.4	0.0	1.4	3.8
210.0	0.0	-2.1	4.3	0.0	1.4	3.6
220.0	0.0	-2.1	4.0	0.0	1.4	3.3
230.0	0.0	-2.1	3.5	0.0	1.4	2.9
240.0	0.0	-2.1	3.0	0.0	1.4	2.3
250.0	0.0	-2.1	2.3	0.0	1.4	1.6
260.0	0.0	-2.1	1.5	0.0	-1.4	-1.9
270.0	0.0	-2.1	0.7	0.0	-1.4	-2.7
280.0	0.0	-2.1	-0.1	0.0	-1.4	-3.6
290.0	0.0	-2.1	-0.9	0.0	-1.4	-4.3
300.0	0.0	-2.1	-1.6	0.0	-1.4	-5.1
310.0	0.0	-2.1	-2.3	0.0	-1.4	-5.7
320.0	0.0	-2.1	-2.8	0.0	-1.4	-6.3
330.0	0.0	-2.1	-3.2	0.0	-1.4	-6.7
340.0	0.0	-2.1	-3.5	0.0	-1.4	-6.9
350.0	0.0	-2.1	-3.6	0.0	-1.4	-7.1
360.0	0.0	-2.1	-3.6	0.0	-1.4	-7.1

Case 29 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.4	-31.2	0.0	0.0	-21.2	-81.7
10.0	-29.4	-31.2	-4.8	0.0	-21.2	-86.6
20.0	-29.4	-31.2	-10.0	0.0	-21.2	-91.7
30.0	-29.4	-31.2	-15.6	0.0	-21.2	-97.4
40.0	-29.4	-31.2	-21.7	0.0	-21.2	-103.5
50.0	-29.4	-31.2	-28.0	0.0	-21.2	-109.7
60.0	-29.4	-31.2	-33.8	0.0	-21.2	-115.6
70.0	-29.4	-31.2	-38.7	0.0	-21.2	-120.4
80.0	-29.4	-31.2	-41.9	0.0	-21.2	-123.6
90.0	-29.4	-31.2	-43.0	0.0	-21.2	-124.7
100.0	-29.4	-31.2	-41.9	0.0	-21.2	-123.6
110.0	-29.4	-31.2	-38.7	0.0	-21.2	-120.4
120.0	-29.4	-31.2	-33.8	0.0	-21.2	-115.6
130.0	-29.4	-31.2	-28.0	0.0	-21.2	-109.7
140.0	-29.4	-31.2	-21.7	0.0	-21.2	-103.5
150.0	-29.4	-31.2	-15.6	0.0	-21.2	-97.4
160.0	-29.4	-31.2	-10.0	0.0	-21.2	-91.7
170.0	-29.4	-31.2	-4.8	0.0	-21.2	-86.6
180.0	-29.4	-31.2	0.0	0.0	-21.2	-81.7
190.0	-29.4	-31.2	4.8	0.0	-21.2	-76.9
200.0	-29.4	-31.2	10.0	0.0	-21.2	-71.8
210.0	-29.4	-31.2	15.6	0.0	-21.2	-66.1
220.0	-29.4	-31.2	21.7	0.0	-21.2	-60.0
230.0	-29.4	-31.2	28.0	0.0	-21.2	-53.8
240.0	-29.4	-31.2	33.8	0.0	-21.2	-47.9
250.0	-29.4	-31.2	38.7	0.0	-21.2	-43.1
260.0	-29.4	-31.2	41.9	0.0	-21.2	-39.9
270.0	-29.4	-31.2	43.0	0.0	-21.2	-38.8
280.0	-29.4	-31.2	41.9	0.0	-21.2	-39.9
290.0	-29.4	-31.2	38.7	0.0	-21.2	-43.1
300.0	-29.4	-31.2	33.8	0.0	-21.2	-47.9
310.0	-29.4	-31.2	28.0	0.0	-21.2	-53.8
320.0	-29.4	-31.2	21.7	0.0	-21.2	-60.0
330.0	-29.4	-31.2	15.6	0.0	-21.2	-66.1
340.0	-29.4	-31.2	10.0	0.0	-21.2	-71.8
350.0	-29.4	-31.2	4.8	0.0	-21.2	-76.9
360.0	-29.4	-31.2	0.0	0.0	-21.2	-81.7

Case 29 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-207.2	-8.3	0.0	0.0	-48.3	-263.8
10.0	-207.2	-8.3	-316.6	0.0	-48.3	-580.4
20.0	-207.2	-8.3	-593.0	0.0	-48.3	-856.8
30.0	-207.2	-8.3	-793.7	0.0	-48.3	-1057.5
40.0	-207.2	-8.3	-892.8	0.0	-48.3	-1156.6
50.0	-207.2	-8.3	-876.4	0.0	-48.3	-1140.3
60.0	-207.2	-8.3	-745.2	0.0	-48.3	-1009.1
70.0	-207.2	-8.3	-513.8	0.0	-48.3	-777.7
80.0	-207.2	-8.3	-209.2	0.0	-48.3	-473.1
90.0	-207.2	-8.3	132.4	0.0	-48.3	-131.4
100.0	-207.2	-8.3	470.0	0.0	48.3	302.8
110.0	-207.2	-8.3	762.6	0.0	48.3	595.4
120.0	-207.2	-8.3	974.5	0.0	48.3	807.3
130.0	-207.2	-8.3	1079.2	0.0	48.3	912.1
140.0	-207.2	-8.3	1063.0	0.0	48.3	895.8
150.0	-207.2	-8.3	926.1	0.0	48.3	758.9
160.0	-207.2	-8.3	683.5	0.0	48.3	516.3
170.0	-207.2	-8.3	362.6	0.0	48.3	195.4
180.0	-207.2	-8.3	0.0	0.0	-48.3	-263.8
190.0	-207.2	-8.3	-362.6	0.0	-48.3	-626.4
200.0	-207.2	-8.3	-683.5	0.0	-48.3	-947.4
210.0	-207.2	-8.3	-926.1	0.0	-48.3	-1189.9
220.0	-207.2	-8.3	-1063.0	0.0	-48.3	-1326.8
230.0	-207.2	-8.3	-1079.2	0.0	-48.3	-1343.1
240.0	-207.2	-8.3	-974.5	0.0	-48.3	-1238.4
250.0	-207.2	-8.3	-762.6	0.0	-48.3	-1026.5
260.0	-207.2	-8.3	-470.0	0.0	-48.3	-733.8
270.0	-207.2	-8.3	-132.4	0.0	-48.3	-396.2
280.0	-207.2	-8.3	209.2	0.0	-48.3	-54.6
290.0	-207.2	-8.3	513.8	0.0	48.3	346.6
300.0	-207.2	-8.3	745.2	0.0	48.3	578.0
310.0	-207.2	-8.3	876.4	0.0	48.3	709.2
320.0	-207.2	-8.3	892.8	0.0	48.3	725.6
330.0	-207.2	-8.3	793.7	0.0	48.3	626.5
340.0	-207.2	-8.3	593.0	0.0	48.3	425.8
350.0	-207.2	-8.3	316.6	0.0	48.3	149.4
360.0	-207.2	-8.3	0.0	0.0	-48.3	-263.8

6.29.4 Thruster use

Case 29 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	95.4	8.1	91.7	171.8	16.2	90.0	42.9	85.1
10.0	93.7	6.1	90.7	174.0	16.0	90.0	35.6	85.3
20.0	90.3	8.2	87.2	180.0	16.0	90.0	29.0	85.6
30.0	89.1	5.4	87.0	179.9	16.2	90.0	24.8	86.0
40.0	88.5	4.1	86.9	179.9	16.4	90.0	22.9	86.5
50.0	88.2	4.6	86.6	180.0	16.8	90.0	23.8	87.0
60.0	88.2	6.6	86.4	180.0	17.3	90.0	27.4	87.4
70.0	88.7	9.6	86.3	180.0	17.1	90.0	31.9	87.9
80.0	89.8	13.7	86.2	180.0	16.9	90.0	38.1	88.3
90.0	91.7	18.1	86.2	180.0	16.7	90.0	45.1	88.7
100.0	93.3	23.6	84.7	180.0	16.7	90.0	54.1	89.1
110.0	93.0	27.6	83.3	180.0	16.8	90.0	60.0	90.8
120.0	93.6	30.4	82.0	180.0	17.0	90.0	64.4	91.2
130.0	93.3	31.9	80.9	180.0	17.0	90.0	66.4	91.5
140.0	91.9	32.1	80.0	180.0	17.0	90.0	65.9	91.9
150.0	89.5	30.8	79.3	180.0	17.2	90.0	63.0	92.2
160.0	86.4	28.0	78.8	180.0	17.4	90.0	58.0	92.4
170.0	83.3	24.0	78.4	180.0	17.7	90.0	51.6	92.5
180.0	80.2	17.6	78.3	180.0	18.0	90.0	42.2	92.6
190.0	78.5	12.1	78.4	180.0	18.0	90.0	34.6	92.9
200.0	77.9	7.2	78.8	180.0	18.0	90.0	27.8	93.1
210.0	78.2	3.4	79.3	180.0	18.1	90.0	22.9	93.2
220.0	78.9	1.5	80.0	180.0	18.3	90.0	20.4	93.2
230.0	79.8	1.5	80.3	180.0	18.4	90.0	20.5	93.1
240.0	81.0	3.3	82.0	180.0	18.6	90.0	23.4	92.8
250.0	82.7	6.5	83.3	180.0	18.6	90.0	28.2	92.2
260.0	87.9	11.8	84.6	180.0	18.6	90.0	35.2	87.2
270.0	92.4	18.5	69.5	172.3	18.6	90.0	38.9	86.0
280.0	96.1	13.9	42.5	166.4	18.8	90.0	40.0	84.9
290.0	24.7	30.0	20.8	145.4	18.9	90.0	43.3	84.2
300.0	25.3	35.6	21.0	137.6	19.0	90.0	48.2	83.9
310.0	43.1	24.7	37.7	152.4	18.2	90.0	54.1	83.9
320.0	72.2	17.3	66.1	161.5	17.6	90.0	60.3	84.1
330.0	97.3	13.8	91.0	165.5	17.1	90.0	63.3	84.2
340.0	96.3	8.0	94.1	162.5	16.6	90.0	58.6	84.5
350.0	95.9	4.8	94.9	163.1	16.3	90.0	52.2	84.8
360.0	95.4	8.1	91.7	171.8	16.2	90.0	42.9	85.1

6.29.5 Thruster loss

Case 29 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.83	0.81
10.0	0.85	0.81	0.80
20.0	0.85	0.78	0.80
30.0	0.86	0.78	0.81
40.0	0.87	0.77	0.82
50.0	0.88	0.77	0.84
60.0	0.88	0.77	0.86
70.0	0.89	0.77	0.85
80.0	0.89	0.77	0.84
90.0	0.90	0.77	0.83
100.0	0.91	0.75	0.84
110.0	0.91	0.74	0.84
120.0	0.92	0.73	0.85
130.0	0.93	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.94	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.94	0.70	0.90
200.0	0.95	0.70	0.91
210.0	0.95	0.71	0.90
220.0	0.95	0.71	0.91
230.0	0.95	0.72	0.92
240.0	0.94	0.73	0.93
250.0	0.94	0.74	0.93
260.0	0.93	0.75	0.93
270.0	0.93	0.81	0.93
280.0	0.93	0.84	0.94
290.0	0.93	0.88	0.94
300.0	0.92	0.89	0.95
310.0	0.90	0.88	0.91
320.0	0.88	0.86	0.88
330.0	0.87	0.85	0.85
340.0	0.86	0.86	0.83
350.0	0.85	0.86	0.81
360.0	0.85	0.83	0.81

Preliminary Design, @IDR5

6.30 Case 30 - Thrust Utilization: 35 knots wind @ 100 deg, 2 knots current, Sea State 5

6.30.1 Environment and thrust utilisation

Case 30 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	100.0	100.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	100.0	100.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	100.0	100.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	100.0	100.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	100.0	100.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	100.0	100.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	100.0	100.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	100.0	100.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	100.0	100.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	100.0	100.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	100.0	100.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	100.0	100.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	100.0	100.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	100.0	100.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	100.0	100.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	100.0	100.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	100.0	100.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	100.0	100.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	100.0	100.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	100.0	100.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	100.0	100.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	100.0	100.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	100.0	100.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	100.0	100.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	100.0	100.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	100.0	100.0	250.0	35.0	4.0	6.7	9.4	2.00	> 100.0
260.0	100.0	100.0	260.0	35.0	4.0	6.7	9.4	2.00	93.7
270.0	100.0	100.0	270.0	35.0	4.0	6.7	9.4	2.00	76.5
280.0	100.0	100.0	280.0	35.0	4.0	6.7	9.4	2.00	59.3
290.0	100.0	100.0	290.0	35.0	4.0	6.7	9.4	2.00	52.2
300.0	100.0	100.0	300.0	35.0	4.0	6.7	9.4	2.00	50.2
310.0	100.0	100.0	310.0	35.0	4.0	6.7	9.4	2.00	56.9
320.0	100.0	100.0	320.0	35.0	4.0	6.7	9.4	2.00	69.5
330.0	100.0	100.0	330.0	35.0	4.0	6.7	9.4	2.00	86.9
340.0	100.0	100.0	340.0	35.0	4.0	6.7	9.4	2.00	> 100.0
350.0	100.0	100.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	100.0	100.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.30.2 Relative contributions of force components

Case 30 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	38.5	36.6	0.1	0.0	24.8	100.0
10.0	36.2	34.4	6.0	0.0	23.4	100.0
20.0	34.1	32.4	11.5	0.0	22.0	100.0
30.0	32.0	30.4	16.9	0.0	20.7	100.0
40.0	30.0	28.6	22.0	0.0	19.4	100.0
50.0	28.3	26.9	26.6	0.0	18.2	100.0
60.0	26.8	25.5	30.4	0.0	17.3	100.0
70.0	25.7	24.4	33.3	0.0	16.6	100.0
80.0	25.0	23.7	35.1	0.0	16.1	100.0
90.0	24.8	23.5	35.7	0.0	16.0	100.0
100.0	25.0	23.7	35.2	0.0	16.1	100.0
110.0	25.7	24.4	33.4	0.0	16.5	100.0
120.0	26.8	25.4	30.5	0.0	17.3	100.0
130.0	28.3	26.8	26.7	0.0	18.2	100.0
140.0	30.0	28.5	22.1	0.0	19.3	100.0
150.0	32.0	30.3	17.1	0.0	20.5	100.0
160.0	34.0	32.3	11.8	0.0	21.9	100.0
170.0	36.1	34.3	6.3	0.0	23.3	100.0
180.0	38.4	36.4	0.5	0.0	24.7	100.0
190.0	40.9	38.7	-6.0	0.0	26.3	100.0
200.0	43.9	41.7	-13.9	0.0	28.3	100.0
210.0	47.9	45.4	-24.2	0.0	30.9	100.0
220.0	53.4	50.1	-37.6	0.0	34.2	100.0
230.0	59.7	56.6	-54.8	0.0	38.5	100.0
240.0	67.7	64.1	-75.5	0.0	43.6	100.0
250.0	76.2	72.2	-97.5	0.0	49.1	100.0
260.0	83.2	78.9	-115.7	0.0	53.7	100.0
270.0	86.3	81.8	-123.7	0.0	55.6	100.0
280.0	83.9	79.6	-117.5	0.0	54.1	100.0
290.0	77.2	73.2	-100.1	0.0	49.7	100.0
300.0	68.6	65.2	-78.1	0.0	44.2	100.0
310.0	60.4	57.4	-56.7	0.0	39.0	100.0
320.0	53.5	50.9	-39.0	0.0	34.6	100.0
330.0	48.2	45.8	-25.2	0.0	31.2	100.0
340.0	44.1	42.0	-14.7	0.0	28.5	100.0
350.0	41.0	39.0	-6.5	0.0	26.5	100.0
360.0	38.5	36.6	0.1	0.0	24.8	100.0

6.30.3 Environment forces

Case 30 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	1.4	0.8	-3.6	0.0	-1.0	-2.4
10.0	1.4	0.8	-3.6	0.0	-1.0	-2.4
20.0	1.4	0.8	-3.5	0.0	-1.0	-2.3
30.0	1.4	0.8	-3.2	0.0	-1.0	-2.0
40.0	1.4	0.8	-2.8	0.0	-1.0	-1.6
50.0	1.4	0.8	-2.3	0.0	-1.0	-1.1
60.0	1.4	0.8	-1.6	0.0	1.0	1.6
70.0	1.4	0.8	-0.9	0.0	1.0	2.4
80.0	1.4	0.8	-0.1	0.0	1.0	3.2
90.0	1.4	0.8	0.7	0.0	1.0	4.0
100.0	1.4	0.8	1.5	0.0	1.0	4.8
110.0	1.4	0.8	2.3	0.0	1.0	5.5
120.0	1.4	0.8	3.0	0.0	1.0	6.2
130.0	1.4	0.8	3.5	0.0	1.0	6.8
140.0	1.4	0.8	4.0	0.0	1.0	7.2
150.0	1.4	0.8	4.3	0.0	1.0	7.5
160.0	1.4	0.8	4.4	0.0	1.0	7.7
170.0	1.4	0.8	4.4	0.0	1.0	7.7
180.0	1.4	0.8	4.3	0.0	1.0	7.6
190.0	1.4	0.8	4.4	0.0	1.0	7.7
200.0	1.4	0.8	4.4	0.0	1.0	7.7
210.0	1.4	0.8	4.3	0.0	1.0	7.5
220.0	1.4	0.8	4.0	0.0	1.0	7.2
230.0	1.4	0.8	3.5	0.0	1.0	6.8
240.0	1.4	0.8	3.0	0.0	1.0	6.2
250.0	1.4	0.8	2.3	0.0	1.0	5.5
260.0	1.4	0.8	1.5	0.0	1.0	4.8
270.0	1.4	0.8	0.7	0.0	1.0	4.0
280.0	1.4	0.8	-0.1	0.0	1.0	3.2
290.0	1.4	0.8	-0.9	0.0	1.0	2.4
300.0	1.4	0.8	-1.6	0.0	1.0	1.6
310.0	1.4	0.8	-2.3	0.0	-1.0	-1.1
320.0	1.4	0.8	-2.8	0.0	-1.0	-1.6
330.0	1.4	0.8	-3.2	0.0	-1.0	-2.0
340.0	1.4	0.8	-3.5	0.0	-1.0	-2.3
350.0	1.4	0.8	-3.6	0.0	-1.0	-2.4
360.0	1.4	0.8	-3.6	0.0	-1.0	-2.4

Case 30 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-29.8	-28.3	0.0	0.0	-19.2	-77.2
10.0	-29.8	-28.3	-4.8	0.0	-19.2	-82.1
20.0	-29.8	-28.3	-10.0	0.0	-19.2	-87.2
30.0	-29.8	-28.3	-15.6	0.0	-19.2	-92.9
40.0	-29.8	-28.3	-21.7	0.0	-19.2	-99.0
50.0	-29.8	-28.3	-28.0	0.0	-19.2	-105.2
60.0	-29.8	-28.3	-33.8	0.0	-19.2	-111.1
70.0	-29.8	-28.3	-38.7	0.0	-19.2	-115.9
80.0	-29.8	-28.3	-41.9	0.0	-19.2	-119.1
90.0	-29.8	-28.3	-43.0	0.0	-19.2	-120.2
100.0	-29.8	-28.3	-41.9	0.0	-19.2	-119.1
110.0	-29.8	-28.3	-38.7	0.0	-19.2	-115.9
120.0	-29.8	-28.3	-33.8	0.0	-19.2	-111.1
130.0	-29.8	-28.3	-28.0	0.0	-19.2	-105.2
140.0	-29.8	-28.3	-21.7	0.0	-19.2	-99.0
150.0	-29.8	-28.3	-15.6	0.0	-19.2	-92.9
160.0	-29.8	-28.3	-10.0	0.0	-19.2	-87.2
170.0	-29.8	-28.3	-4.8	0.0	-19.2	-82.1
180.0	-29.8	-28.3	0.0	0.0	-19.2	-77.2
190.0	-29.8	-28.3	4.8	0.0	-19.2	-72.4
200.0	-29.8	-28.3	10.0	0.0	-19.2	-67.2
210.0	-29.8	-28.3	15.6	0.0	-19.2	-61.6
220.0	-29.8	-28.3	21.7	0.0	-19.2	-55.5
230.0	-29.8	-28.3	28.0	0.0	-19.2	-49.2
240.0	-29.8	-28.3	33.8	0.0	-19.2	-43.4
250.0	-29.8	-28.3	38.7	0.0	-19.2	-38.5
260.0	-29.8	-28.3	41.9	0.0	-19.2	-35.3
270.0	-29.8	-28.3	43.0	0.0	-19.2	-34.2
280.0	-29.8	-28.3	41.9	0.0	-19.2	-35.3
290.0	-29.8	-28.3	38.7	0.0	-19.2	-38.5
300.0	-29.8	-28.3	33.8	0.0	-19.2	-43.4
310.0	-29.8	-28.3	28.0	0.0	-19.2	-49.2
320.0	-29.8	-28.3	21.7	0.0	-19.2	-55.5
330.0	-29.8	-28.3	15.6	0.0	-19.2	-61.6
340.0	-29.8	-28.3	10.0	0.0	-19.2	-67.2
350.0	-29.8	-28.3	4.8	0.0	-19.2	-72.4
360.0	-29.8	-28.3	0.0	0.0	-19.2	-77.2

Case 30 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-105.5	60.1	0.0	0.0	-54.2	-99.6
10.0	-105.5	60.1	-316.6	0.0	-54.2	-416.2
20.0	-105.5	60.1	-593.0	0.0	-54.2	-692.6
30.0	-105.5	60.1	-793.7	0.0	-54.2	-893.3
40.0	-105.5	60.1	-892.8	0.0	-54.2	-992.4
50.0	-105.5	60.1	-876.4	0.0	-54.2	-976.0
60.0	-105.5	60.1	-745.2	0.0	-54.2	-844.8
70.0	-105.5	60.1	-513.8	0.0	-54.2	-613.4
80.0	-105.5	60.1	-209.2	0.0	-54.2	-308.8
90.0	-105.5	60.1	132.4	0.0	54.2	141.1
100.0	-105.5	60.1	470.0	0.0	54.2	478.7
110.0	-105.5	60.1	762.6	0.0	54.2	771.4
120.0	-105.5	60.1	974.5	0.0	54.2	983.3
130.0	-105.5	60.1	1079.2	0.0	54.2	1088.0
140.0	-105.5	60.1	1063.0	0.0	54.2	1071.7
150.0	-105.5	60.1	926.1	0.0	54.2	934.8
160.0	-105.5	60.1	683.5	0.0	54.2	692.3
170.0	-105.5	60.1	362.6	0.0	54.2	371.3
180.0	-105.5	60.1	0.0	0.0	-54.2	-99.6
190.0	-105.5	60.1	-362.6	0.0	-54.2	-462.2
200.0	-105.5	60.1	-683.5	0.0	-54.2	-783.1
210.0	-105.5	60.1	-926.1	0.0	-54.2	-1025.7
220.0	-105.5	60.1	-1063.0	0.0	-54.2	-1162.6
230.0	-105.5	60.1	-1079.2	0.0	-54.2	-1178.9
240.0	-105.5	60.1	-974.5	0.0	-54.2	-1074.1
250.0	-105.5	60.1	-762.6	0.0	-54.2	-862.2
260.0	-105.5	60.1	-470.0	0.0	-54.2	-569.6
270.0	-105.5	60.1	-132.4	0.0	-54.2	-232.0
280.0	-105.5	60.1	209.2	0.0	54.2	218.0
290.0	-105.5	60.1	513.8	0.0	54.2	522.6
300.0	-105.5	60.1	745.2	0.0	54.2	754.0
310.0	-105.5	60.1	876.4	0.0	54.2	885.2
320.0	-105.5	60.1	892.8	0.0	54.2	901.5
330.0	-105.5	60.1	793.7	0.0	54.2	802.4
340.0	-105.5	60.1	593.0	0.0	54.2	601.7
350.0	-105.5	60.1	316.6	0.0	54.2	325.4
360.0	-105.5	60.1	0.0	0.0	-54.2	-99.6

6.30.4 Thruster use

Case 30 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	93.9	9.3	92.4	170.8	16.2	90.0	46.2	88.2
10.0	91.1	14.1	87.3	180.0	16.0	90.0	38.1	88.3
20.0	89.5	10.4	87.2	180.0	16.0	90.0	32.2	88.5
30.0	88.4	7.7	87.0	180.0	16.2	90.0	28.1	88.7
40.0	87.8	6.5	86.8	180.0	16.4	90.0	26.3	89.1
50.0	87.5	6.8	86.6	180.0	16.8	90.0	27.2	89.4
60.0	87.0	8.9	86.4	180.0	17.3	90.0	30.7	90.9
70.0	87.5	12.0	86.3	180.0	17.1	90.0	35.2	91.2
80.0	88.5	16.0	86.2	180.0	16.9	90.0	41.3	91.6
90.0	91.0	21.9	86.2	180.0	16.7	90.0	50.7	91.9
100.0	91.8	26.3	84.6	180.0	16.7	90.0	57.5	92.3
110.0	92.7	30.2	83.3	180.0	16.8	90.0	63.6	92.8
120.0	93.2	33.1	82.0	180.0	17.0	90.0	68.0	93.3
130.0	92.8	34.7	80.9	180.0	17.0	90.0	69.9	93.8
140.0	91.3	34.9	80.0	180.0	17.0	90.0	69.5	94.2
150.0	88.7	33.7	79.3	180.0	17.2	90.0	66.6	94.7
160.0	85.4	31.0	78.8	180.0	17.4	90.0	61.6	95.1
170.0	82.1	27.0	78.4	180.0	17.7	90.0	55.2	95.4
180.0	78.7	20.4	78.3	180.0	18.0	90.0	45.7	95.7
190.0	76.9	14.9	78.4	180.0	18.0	90.0	38.0	96.2
200.0	76.3	9.8	78.8	180.0	18.0	90.0	31.3	96.6
210.0	76.5	6.0	79.3	180.0	18.1	90.0	26.4	97.1
220.0	77.0	4.0	80.0	180.0	18.3	90.0	23.8	97.6
230.0	77.7	3.9	80.3	180.0	18.4	90.0	24.0	98.0
240.0	78.5	5.8	82.0	180.0	18.6	90.0	26.8	98.3
250.0	79.7	9.1	86.3	180.0	18.6	90.0	31.6	98.4
260.0	69.8	7.4	74.4	174.1	18.6	90.0	35.7	97.7
270.0	55.1	7.6	38.8	169.1	18.6	90.0	34.5	96.6
280.0	40.1	62.7	11.6	132.3	17.7	90.0	35.5	95.1
290.0	12.3	70.5	12.9	120.3	15.9	90.0	38.6	93.5
300.0	16.1	69.4	14.7	119.8	15.6	90.0	43.4	92.2
310.0	20.2	63.2	16.2	119.8	17.2	90.0	49.2	88.8
320.0	36.8	31.2	35.3	147.8	17.6	90.0	55.5	88.4
330.0	73.7	17.7	71.8	162.0	17.1	90.0	61.6	88.1
340.0	96.0	13.8	93.9	166.1	16.6	90.0	62.0	88.1
350.0	95.6	10.8	94.6	166.9	16.3	90.0	55.7	88.1
360.0	93.9	9.3	92.4	170.8	16.2	90.0	46.2	88.2

6.30.5 Thruster loss

Case 30 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.83	0.81
10.0	0.85	0.78	0.80
20.0	0.85	0.78	0.80
30.0	0.86	0.78	0.81
40.0	0.86	0.77	0.82
50.0	0.87	0.77	0.84
60.0	0.88	0.77	0.86
70.0	0.88	0.77	0.85
80.0	0.89	0.77	0.84
90.0	0.89	0.77	0.83
100.0	0.90	0.75	0.84
110.0	0.91	0.74	0.84
120.0	0.92	0.73	0.85
130.0	0.92	0.72	0.85
140.0	0.93	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.93	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.94	0.70	0.90
200.0	0.94	0.70	0.90
210.0	0.95	0.71	0.90
220.0	0.95	0.71	0.91
230.0	0.94	0.72	0.92
240.0	0.94	0.73	0.93
250.0	0.94	0.74	0.93
260.0	0.94	0.80	0.93
270.0	0.93	0.83	0.93
280.0	0.93	0.89	0.94
290.0	0.93	0.89	0.94
300.0	0.93	0.89	0.95
310.0	0.93	0.89	0.91
320.0	0.90	0.88	0.88
330.0	0.87	0.86	0.85
340.0	0.86	0.85	0.83
350.0	0.85	0.85	0.81
360.0	0.85	0.83	0.81

Preliminary Design, @IDR5

6.31 Case 31 - Thrust Utilization: 35 knots wind @ 110 deg, 2 knots current, Sea State 5

6.31.1 Environment and thrust utilisation

Case 31 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	110.0	110.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	110.0	110.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	110.0	110.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	110.0	110.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	110.0	110.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	110.0	110.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	110.0	110.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	110.0	110.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	110.0	110.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	110.0	110.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	110.0	110.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	110.0	110.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	110.0	110.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	110.0	110.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	110.0	110.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	110.0	110.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	110.0	110.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	110.0	110.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	110.0	110.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	110.0	110.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	110.0	110.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	110.0	110.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	110.0	110.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	110.0	110.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	110.0	110.0	240.0	35.0	4.0	6.7	9.4	2.00	> 100.0
250.0	110.0	110.0	250.0	35.0	4.0	6.7	9.4	2.00	96.2
260.0	110.0	110.0	260.0	35.0	4.0	6.7	9.4	2.00	76.8
270.0	110.0	110.0	270.0	35.0	4.0	6.7	9.4	2.00	59.7
280.0	110.0	110.0	280.0	35.0	4.0	6.7	9.4	2.00	41.5
290.0	110.0	110.0	290.0	35.0	4.0	6.7	9.4	2.00	34.3
300.0	110.0	110.0	300.0	35.0	4.0	6.7	9.4	2.00	33.3
310.0	110.0	110.0	310.0	35.0	4.0	6.7	9.4	2.00	39.3
320.0	110.0	110.0	320.0	35.0	4.0	6.7	9.4	2.00	51.4
330.0	110.0	110.0	330.0	35.0	4.0	6.7	9.4	2.00	68.8
340.0	110.0	110.0	340.0	35.0	4.0	6.7	9.4	2.00	89.5
350.0	110.0	110.0	350.0	35.0	4.0	6.7	9.4	2.00	> 100.0
360.0	110.0	110.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.31.2 Relative contributions of force components

Case 31 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	43.0	34.0	-0.4	0.0	23.4	100.0
10.0	40.2	31.9	6.0	0.0	21.9	100.0
20.0	37.7	29.8	12.0	0.0	20.5	100.0
30.0	35.2	27.9	17.7	0.0	19.2	100.0
40.0	32.9	26.1	23.1	0.0	17.9	100.0
50.0	30.8	24.4	28.0	0.0	16.8	100.0
60.0	29.1	23.0	32.0	0.0	15.9	100.0
70.0	27.8	22.0	35.0	0.0	15.2	100.0
80.0	27.0	21.4	36.8	0.0	14.7	100.0
90.0	26.8	21.2	37.5	0.0	14.6	100.0
100.0	27.0	21.4	36.9	0.0	14.7	100.0
110.0	27.8	22.0	35.1	0.0	15.2	100.0
120.0	29.0	23.0	32.2	0.0	15.8	100.0
130.0	30.7	24.3	28.2	0.0	16.8	100.0
140.0	32.7	25.9	23.6	0.0	17.9	100.0
150.0	34.9	27.7	18.4	0.0	19.0	100.0
160.0	37.2	29.5	12.9	0.0	20.4	100.0
170.0	39.6	31.5	7.2	0.0	21.7	100.0
180.0	42.2	33.5	1.1	0.0	23.2	100.0
190.0	45.1	35.8	-5.7	0.0	24.8	100.0
200.0	48.6	38.7	-14.0	0.0	26.7	100.0
210.0	53.2	42.4	-24.3	0.0	29.3	100.0
220.0	59.2	47.1	-39.2	0.0	32.7	100.0
230.0	67.0	53.5	-57.6	0.0	37.1	100.0
240.0	76.5	61.1	-79.9	0.0	42.4	100.0
250.0	86.7	69.3	-104.1	0.0	48.1	100.0
260.0	95.5	76.4	-124.9	0.0	53.1	100.0
270.0	100.1	80.0	-135.6	0.0	55.5	100.0
280.0	98.2	78.4	-131.0	0.0	54.4	100.0
290.0	90.6	72.2	-112.8	0.0	50.0	100.0
300.0	80.3	63.8	-88.2	0.0	44.1	100.0
310.0	70.1	55.7	-64.2	0.0	38.4	100.0
320.0	61.6	48.8	-44.1	0.0	33.7	100.0
330.0	54.9	43.6	-28.5	0.0	30.0	100.0
340.0	49.9	39.6	-16.7	0.0	27.2	100.0
350.0	46.1	36.5	-7.7	0.0	25.1	100.0
360.0	43.0	34.0	-0.4	0.0	23.4	100.0

6.31.3 Environment forces

Case 31 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	3.0	3.3	-3.6	0.0	2.9	5.5
10.0	3.0	3.3	-3.6	0.0	2.9	5.5
20.0	3.0	3.3	-3.5	0.0	2.9	5.6
30.0	3.0	3.3	-3.2	0.0	2.9	5.9
40.0	3.0	3.3	-2.8	0.0	2.9	6.3
50.0	3.0	3.3	-2.3	0.0	2.9	6.8
60.0	3.0	3.3	-1.6	0.0	2.9	7.5
70.0	3.0	3.3	-0.9	0.0	2.9	8.2
80.0	3.0	3.3	-0.1	0.0	2.9	9.0
90.0	3.0	3.3	0.7	0.0	2.9	9.8
100.0	3.0	3.3	1.5	0.0	2.9	10.6
110.0	3.0	3.3	2.3	0.0	2.9	11.4
120.0	3.0	3.3	3.0	0.0	2.9	12.1
130.0	3.0	3.3	3.5	0.0	2.9	12.6
140.0	3.0	3.3	4.0	0.0	2.9	13.1
150.0	3.0	3.3	4.3	0.0	2.9	13.4
160.0	3.0	3.3	4.4	0.0	2.9	13.5
170.0	3.0	3.3	4.4	0.0	2.9	13.5
180.0	3.0	3.3	4.3	0.0	2.9	13.4
190.0	3.0	3.3	4.4	0.0	2.9	13.5
200.0	3.0	3.3	4.4	0.0	2.9	13.5
210.0	3.0	3.3	4.3	0.0	2.9	13.4
220.0	3.0	3.3	4.0	0.0	2.9	13.1
230.0	3.0	3.3	3.5	0.0	2.9	12.6
240.0	3.0	3.3	3.0	0.0	2.9	12.1
250.0	3.0	3.3	2.3	0.0	2.9	11.4
260.0	3.0	3.3	1.5	0.0	2.9	10.6
270.0	3.0	3.3	0.7	0.0	2.9	9.8
280.0	3.0	3.3	-0.1	0.0	2.9	9.0
290.0	3.0	3.3	-0.9	0.0	2.9	8.2
300.0	3.0	3.3	-1.6	0.0	2.9	7.5
310.0	3.0	3.3	-2.3	0.0	2.9	6.8
320.0	3.0	3.3	-2.8	0.0	2.9	6.3
330.0	3.0	3.3	-3.2	0.0	2.9	5.9
340.0	3.0	3.3	-3.5	0.0	2.9	5.6
350.0	3.0	3.3	-3.6	0.0	2.9	5.5
360.0	3.0	3.3	-3.6	0.0	2.9	5.5

Case 31 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.5	-24.1	0.0	0.0	-16.5	-71.1
10.0	-30.5	-24.1	-4.8	0.0	-16.5	-75.9
20.0	-30.5	-24.1	-10.0	0.0	-16.5	-81.1
30.0	-30.5	-24.1	-15.6	0.0	-16.5	-86.7
40.0	-30.5	-24.1	-21.7	0.0	-16.5	-92.8
50.0	-30.5	-24.1	-28.0	0.0	-16.5	-99.1
60.0	-30.5	-24.1	-33.8	0.0	-16.5	-104.9
70.0	-30.5	-24.1	-38.7	0.0	-16.5	-109.8
80.0	-30.5	-24.1	-41.9	0.0	-16.5	-112.9
90.0	-30.5	-24.1	-43.0	0.0	-16.5	-114.1
100.0	-30.5	-24.1	-41.9	0.0	-16.5	-112.9
110.0	-30.5	-24.1	-38.7	0.0	-16.5	-109.8
120.0	-30.5	-24.1	-33.8	0.0	-16.5	-104.9
130.0	-30.5	-24.1	-28.0	0.0	-16.5	-99.1
140.0	-30.5	-24.1	-21.7	0.0	-16.5	-92.8
150.0	-30.5	-24.1	-15.6	0.0	-16.5	-86.7
160.0	-30.5	-24.1	-10.0	0.0	-16.5	-81.1
170.0	-30.5	-24.1	-4.8	0.0	-16.5	-75.9
180.0	-30.5	-24.1	0.0	0.0	-16.5	-71.1
190.0	-30.5	-24.1	4.8	0.0	-16.5	-66.2
200.0	-30.5	-24.1	10.0	0.0	-16.5	-61.1
210.0	-30.5	-24.1	15.6	0.0	-16.5	-55.4
220.0	-30.5	-24.1	21.7	0.0	-16.5	-49.3
230.0	-30.5	-24.1	28.0	0.0	-16.5	-43.1
240.0	-30.5	-24.1	33.8	0.0	-16.5	-37.2
250.0	-30.5	-24.1	38.7	0.0	-16.5	-32.4
260.0	-30.5	-24.1	41.9	0.0	-16.5	-29.2
270.0	-30.5	-24.1	43.0	0.0	-16.5	-28.1
280.0	-30.5	-24.1	41.9	0.0	-16.5	-29.2
290.0	-30.5	-24.1	38.7	0.0	-16.5	-32.4
300.0	-30.5	-24.1	33.8	0.0	-16.5	-37.2
310.0	-30.5	-24.1	28.0	0.0	-16.5	-43.1
320.0	-30.5	-24.1	21.7	0.0	-16.5	-49.3
330.0	-30.5	-24.1	15.6	0.0	-16.5	-55.4
340.0	-30.5	-24.1	10.0	0.0	-16.5	-61.1
350.0	-30.5	-24.1	4.8	0.0	-16.5	-66.2
360.0	-30.5	-24.1	0.0	0.0	-16.5	-71.1

Case 31 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	-1.5	119.1	0.0	0.0	66.3	184.0
10.0	-1.5	119.1	-316.6	0.0	-66.3	-265.3
20.0	-1.5	119.1	-593.0	0.0	-66.3	-541.7
30.0	-1.5	119.1	-793.7	0.0	-66.3	-742.4
40.0	-1.5	119.1	-892.8	0.0	-66.3	-841.5
50.0	-1.5	119.1	-876.4	0.0	-66.3	-825.1
60.0	-1.5	119.1	-745.2	0.0	-66.3	-693.9
70.0	-1.5	119.1	-513.8	0.0	-66.3	-462.5
80.0	-1.5	119.1	-209.2	0.0	-66.3	-157.9
90.0	-1.5	119.1	132.4	0.0	66.3	316.4
100.0	-1.5	119.1	470.0	0.0	66.3	654.0
110.0	-1.5	119.1	762.6	0.0	66.3	946.6
120.0	-1.5	119.1	974.5	0.0	66.3	1158.5
130.0	-1.5	119.1	1079.2	0.0	66.3	1265.2
140.0	-1.5	119.1	1063.0	0.0	66.3	1247.0
150.0	-1.5	119.1	926.1	0.0	66.3	1110.1
160.0	-1.5	119.1	683.5	0.0	66.3	867.5
170.0	-1.5	119.1	362.6	0.0	66.3	546.6
180.0	-1.5	119.1	0.0	0.0	66.3	184.0
190.0	-1.5	119.1	-362.6	0.0	-66.3	-311.3
200.0	-1.5	119.1	-683.5	0.0	-66.3	-632.2
210.0	-1.5	119.1	-926.1	0.0	-66.3	-874.8
220.0	-1.5	119.1	-1063.0	0.0	-66.3	-1011.6
230.0	-1.5	119.1	-1079.2	0.0	-66.3	-1027.9
240.0	-1.5	119.1	-974.5	0.0	-66.3	-923.2
250.0	-1.5	119.1	-762.6	0.0	-66.3	-711.3
260.0	-1.5	119.1	-470.0	0.0	-66.3	-418.7
270.0	-1.5	119.1	-132.4	0.0	-66.3	-81.1
280.0	-1.5	119.1	209.2	0.0	66.3	393.2
290.0	-1.5	119.1	513.8	0.0	66.3	697.8
300.0	-1.5	119.1	745.2	0.0	66.3	929.2
310.0	-1.5	119.1	876.4	0.0	66.3	1060.4
320.0	-1.5	119.1	892.8	0.0	66.3	1076.8
330.0	-1.5	119.1	793.7	0.0	66.3	977.7
340.0	-1.5	119.1	593.0	0.0	66.3	777.0
350.0	-1.5	119.1	316.6	0.0	66.3	500.6
360.0	-1.5	119.1	0.0	0.0	66.3	184.0

6.31.4 Thruster use

Case 31 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	90.1	22.5	87.3	180.0	16.2	90.0	50.8	94.5
10.0	87.8	16.4	87.2	180.0	16.0	90.0	41.0	94.2
20.0	86.8	12.7	87.1	180.0	16.0	90.0	35.1	94.0
30.0	86.1	9.9	87.0	180.0	16.2	90.0	31.1	94.0
40.0	85.7	8.6	86.8	180.0	16.4	90.0	29.3	94.0
50.0	85.5	9.0	86.6	180.0	16.8	90.0	30.2	94.0
60.0	85.5	11.0	86.4	180.0	17.3	90.0	33.8	94.1
70.0	86.0	14.2	86.2	180.0	17.1	90.0	38.3	94.4
80.0	87.0	18.4	86.1	180.0	16.9	90.0	44.4	94.6
90.0	89.5	24.6	86.1	180.0	16.7	90.0	54.2	95.0
100.0	90.3	29.2	84.6	180.0	16.8	90.0	61.1	95.5
110.0	91.1	33.2	83.2	180.0	16.8	90.0	67.1	96.0
120.0	91.4	36.3	81.9	180.0	17.0	90.0	71.6	96.7
130.0	90.7	38.1	80.8	180.0	17.0	90.0	73.6	97.4
140.0	88.9	38.5	79.9	180.0	17.1	90.0	73.1	98.1
150.0	86.0	37.4	79.2	180.0	17.2	90.0	70.3	98.9
160.0	82.5	34.8	78.7	180.0	17.4	90.0	65.4	99.6
170.0	79.0	30.8	78.4	180.0	17.7	90.0	59.0	100.3
180.0	76.0	25.6	78.3	180.0	18.0	90.0	51.9	100.9
190.0	73.5	17.8	78.4	180.0	18.0	90.0	41.3	101.7
200.0	72.8	12.5	78.7	180.0	18.0	90.0	34.6	102.7
210.0	72.9	8.5	79.2	180.0	18.1	90.0	29.8	103.8
220.0	73.3	6.4	79.9	180.0	18.3	90.0	27.3	105.1
230.0	73.4	6.3	80.6	180.0	18.4	90.0	27.6	106.6
240.0	73.1	8.2	81.3	180.0	18.6	90.0	30.6	108.3
250.0	66.6	6.5	77.8	175.4	18.6	90.0	34.3	109.4
260.0	27.0	12.1	37.4	172.5	18.6	90.0	31.1	110.0
270.0	15.8	18.2	12.2	154.7	17.2	90.0	29.8	109.3
280.0	8.0	93.6	11.9	135.4	12.1	90.0	30.6	107.2
290.0	11.4	95.4	13.0	123.4	10.2	90.0	33.4	104.2
300.0	14.4	90.6	14.8	119.8	10.0	90.0	38.0	101.4
310.0	16.9	85.0	16.7	119.8	11.7	90.0	43.6	99.0
320.0	18.4	80.9	18.6	119.8	15.1	90.0	49.7	97.3
330.0	31.0	38.5	35.7	147.6	17.1	90.0	55.8	96.1
340.0	73.1	17.8	78.5	163.6	16.6	90.0	61.4	95.3
350.0	92.1	26.6	87.2	180.0	16.3	90.0	57.7	94.8
360.0	90.1	22.5	87.3	180.0	16.2	90.0	50.8	94.5

6.31.5 Thruster loss

Case 31 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.78	0.81
10.0	0.85	0.78	0.80
20.0	0.85	0.78	0.80
30.0	0.85	0.78	0.81
40.0	0.86	0.77	0.82
50.0	0.87	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.88	0.77	0.85
80.0	0.89	0.77	0.84
90.0	0.89	0.77	0.83
100.0	0.90	0.75	0.84
110.0	0.90	0.74	0.84
120.0	0.91	0.73	0.85
130.0	0.92	0.72	0.85
140.0	0.92	0.71	0.85
150.0	0.93	0.71	0.86
160.0	0.93	0.70	0.87
170.0	0.93	0.70	0.88
180.0	0.94	0.70	0.90
190.0	0.94	0.70	0.90
200.0	0.94	0.70	0.90
210.0	0.94	0.71	0.90
220.0	0.94	0.71	0.91
230.0	0.94	0.72	0.92
240.0	0.94	0.73	0.93
250.0	0.94	0.77	0.93
260.0	0.93	0.81	0.93
270.0	0.94	0.87	0.93
280.0	0.94	0.89	0.94
290.0	0.94	0.89	0.94
300.0	0.93	0.89	0.95
310.0	0.93	0.89	0.91
320.0	0.93	0.89	0.88
330.0	0.89	0.88	0.85
340.0	0.86	0.86	0.83
350.0	0.86	0.78	0.81
360.0	0.85	0.78	0.81

Preliminary Design, @IDR5

6.32 Case 32 - Thrust Utilization: 35 knots wind @ 120 deg, 2 knots current, Sea State 5

6.32.1 Environment and thrust utilisation

Case 32 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	120.0	120.0	0.0	35.0	4.0	6.7	9.4	2.00	> 100.0
10.0	120.0	120.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	120.0	120.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	120.0	120.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	120.0	120.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	120.0	120.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	120.0	120.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	120.0	120.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	120.0	120.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	120.0	120.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	120.0	120.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	120.0	120.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	120.0	120.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	120.0	120.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	120.0	120.0	140.0	35.0	4.0	6.7	9.4	2.00	> 100.0
150.0	120.0	120.0	150.0	35.0	4.0	6.7	9.4	2.00	> 100.0
160.0	120.0	120.0	160.0	35.0	4.0	6.7	9.4	2.00	> 100.0
170.0	120.0	120.0	170.0	35.0	4.0	6.7	9.4	2.00	> 100.0
180.0	120.0	120.0	180.0	35.0	4.0	6.7	9.4	2.00	> 100.0
190.0	120.0	120.0	190.0	35.0	4.0	6.7	9.4	2.00	> 100.0
200.0	120.0	120.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	120.0	120.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	120.0	120.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	120.0	120.0	230.0	35.0	4.0	6.7	9.4	2.00	> 100.0
240.0	120.0	120.0	240.0	35.0	4.0	6.7	9.4	2.00	94.4
250.0	120.0	120.0	250.0	35.0	4.0	6.7	9.4	2.00	75.1
260.0	120.0	120.0	260.0	35.0	4.0	6.7	9.4	2.00	55.7
270.0	120.0	120.0	270.0	35.0	4.0	6.7	9.4	2.00	30.5
280.0	120.0	120.0	280.0	35.0	4.0	6.7	9.4	2.00	17.5
290.0	120.0	120.0	290.0	35.0	4.0	6.7	9.4	2.00	12.9
300.0	120.0	120.0	300.0	35.0	4.0	6.7	9.4	2.00	14.3
310.0	120.0	120.0	310.0	35.0	4.0	6.7	9.4	2.00	19.4
320.0	120.0	120.0	320.0	35.0	4.0	6.7	9.4	2.00	28.0
330.0	120.0	120.0	330.0	35.0	4.0	6.7	9.4	2.00	44.3
340.0	120.0	120.0	340.0	35.0	4.0	6.7	9.4	2.00	65.5
350.0	120.0	120.0	350.0	35.0	4.0	6.7	9.4	2.00	90.5
360.0	120.0	120.0	360.0	35.0	4.0	6.7	9.4	2.00	> 100.0

6.32.2 Relative contributions of force components

Case 32 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	49.1	30.3	-1.0	0.0	21.6	100.0
10.0	45.6	28.1	6.2	0.0	20.1	100.0
20.0	42.4	26.1	12.8	0.0	18.7	100.0
30.0	39.4	24.2	19.1	0.0	17.3	100.0
40.0	36.6	22.5	24.9	0.0	16.0	100.0
50.0	34.1	20.9	30.1	0.0	14.9	100.0
60.0	32.0	19.6	34.4	0.0	14.0	100.0
70.0	30.5	18.7	37.5	0.0	13.3	100.0
80.0	29.5	18.1	39.4	0.0	12.9	100.0
90.0	29.2	17.9	40.1	0.0	12.8	100.0
100.0	29.4	18.1	39.5	0.0	12.9	100.0
110.0	30.3	18.7	37.6	0.0	13.4	100.0
120.0	31.7	19.6	34.6	0.0	14.0	100.0
130.0	33.7	20.9	30.6	0.0	14.9	100.0
140.0	36.0	22.3	25.7	0.0	16.0	100.0
150.0	38.6	24.0	20.2	0.0	17.3	100.0
160.0	41.3	25.8	14.4	0.0	18.5	100.0
170.0	44.2	27.6	8.4	0.0	19.8	100.0
180.0	47.2	29.6	1.9	0.0	21.3	100.0
190.0	50.6	31.8	-5.3	0.0	22.9	100.0
200.0	54.7	34.5	-14.1	0.0	24.9	100.0
210.0	60.1	38.1	-25.5	0.0	27.5	100.0
220.0	67.0	42.1	-40.6	0.0	30.9	100.0
230.0	75.7	48.6	-59.6	0.0	35.3	100.0
240.0	85.7	55.5	-81.6	0.0	40.5	100.0
250.0	95.7	62.6	-104.1	0.0	45.8	100.0
260.0	104.1	68.5	-123.0	0.0	50.3	100.0
270.0	109.8	72.3	-135.2	0.0	53.1	100.0
280.0	111.1	72.6	-136.8	0.0	53.2	100.0
290.0	106.1	68.4	-124.3	0.0	49.8	100.0
300.0	95.7	60.9	-100.7	0.0	44.1	100.0
310.0	83.6	52.7	-74.4	0.0	38.0	100.0
320.0	72.9	45.6	-51.3	0.0	32.8	100.0
330.0	64.4	40.1	-33.2	0.0	28.7	100.0
340.0	58.0	35.9	-19.6	0.0	25.7	100.0
350.0	53.0	32.8	-9.3	0.0	23.5	100.0
360.0	49.1	30.3	-1.0	0.0	21.6	100.0

6.32.3 Environment forces

Case 32 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	4.8	5.3	-3.6	0.0	4.5	11.0
10.0	4.8	5.3	-3.6	0.0	4.5	11.0
20.0	4.8	5.3	-3.5	0.0	4.5	11.1
30.0	4.8	5.3	-3.2	0.0	4.5	11.4
40.0	4.8	5.3	-2.8	0.0	4.5	11.8
50.0	4.8	5.3	-2.3	0.0	4.5	12.3
60.0	4.8	5.3	-1.6	0.0	4.5	12.9
70.0	4.8	5.3	-0.9	0.0	4.5	13.7
80.0	4.8	5.3	-0.1	0.0	4.5	14.5
90.0	4.8	5.3	0.7	0.0	4.5	15.3
100.0	4.8	5.3	1.5	0.0	4.5	16.1
110.0	4.8	5.3	2.3	0.0	4.5	16.8
120.0	4.8	5.3	3.0	0.0	4.5	17.5
130.0	4.8	5.3	3.5	0.0	4.5	18.1
140.0	4.8	5.3	4.0	0.0	4.5	18.5
150.0	4.8	5.3	4.3	0.0	4.5	18.8
160.0	4.8	5.3	4.4	0.0	4.5	19.0
170.0	4.8	5.3	4.4	0.0	4.5	19.0
180.0	4.8	5.3	4.3	0.0	4.5	18.9
190.0	4.8	5.3	4.4	0.0	4.5	19.0
200.0	4.8	5.3	4.4	0.0	4.5	19.0
210.0	4.8	5.3	4.3	0.0	4.5	18.8
220.0	4.8	5.3	4.0	0.0	4.5	18.5
230.0	4.8	5.3	3.5	0.0	4.5	18.1
240.0	4.8	5.3	3.0	0.0	4.5	17.5
250.0	4.8	5.3	2.3	0.0	4.5	16.8
260.0	4.8	5.3	1.5	0.0	4.5	16.1
270.0	4.8	5.3	0.7	0.0	4.5	15.3
280.0	4.8	5.3	-0.1	0.0	4.5	14.5
290.0	4.8	5.3	-0.9	0.0	4.5	13.7
300.0	4.8	5.3	-1.6	0.0	4.5	12.9
310.0	4.8	5.3	-2.3	0.0	4.5	12.3
320.0	4.8	5.3	-2.8	0.0	4.5	11.8
330.0	4.8	5.3	-3.2	0.0	4.5	11.4
340.0	4.8	5.3	-3.5	0.0	4.5	11.1
350.0	4.8	5.3	-3.6	0.0	4.5	11.0
360.0	4.8	5.3	-3.6	0.0	4.5	11.0

Case 32 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-30.7	-18.5	0.0	0.0	-13.1	-62.3
10.0	-30.7	-18.5	-4.8	0.0	-13.1	-67.1
20.0	-30.7	-18.5	-10.0	0.0	-13.1	-72.3
30.0	-30.7	-18.5	-15.6	0.0	-13.1	-77.9
40.0	-30.7	-18.5	-21.7	0.0	-13.1	-84.0
50.0	-30.7	-18.5	-28.0	0.0	-13.1	-90.3
60.0	-30.7	-18.5	-33.8	0.0	-13.1	-96.1
70.0	-30.7	-18.5	-38.7	0.0	-13.1	-101.0
80.0	-30.7	-18.5	-41.9	0.0	-13.1	-104.2
90.0	-30.7	-18.5	-43.0	0.0	-13.1	-105.3
100.0	-30.7	-18.5	-41.9	0.0	-13.1	-104.2
110.0	-30.7	-18.5	-38.7	0.0	-13.1	-101.0
120.0	-30.7	-18.5	-33.8	0.0	-13.1	-96.1
130.0	-30.7	-18.5	-28.0	0.0	-13.1	-90.3
140.0	-30.7	-18.5	-21.7	0.0	-13.1	-84.0
150.0	-30.7	-18.5	-15.6	0.0	-13.1	-77.9
160.0	-30.7	-18.5	-10.0	0.0	-13.1	-72.3
170.0	-30.7	-18.5	-4.8	0.0	-13.1	-67.1
180.0	-30.7	-18.5	0.0	0.0	-13.1	-62.3
190.0	-30.7	-18.5	4.8	0.0	-13.1	-57.5
200.0	-30.7	-18.5	10.0	0.0	-13.1	-52.3
210.0	-30.7	-18.5	15.6	0.0	-13.1	-46.7
220.0	-30.7	-18.5	21.7	0.0	-13.1	-40.6
230.0	-30.7	-18.5	28.0	0.0	-13.1	-34.3
240.0	-30.7	-18.5	33.8	0.0	-13.1	-28.4
250.0	-30.7	-18.5	38.7	0.0	-13.1	-23.6
260.0	-30.7	-18.5	41.9	0.0	-13.1	-20.4
270.0	-30.7	-18.5	43.0	0.0	-13.1	-19.3
280.0	-30.7	-18.5	41.9	0.0	-13.1	-20.4
290.0	-30.7	-18.5	38.7	0.0	-13.1	-23.6
300.0	-30.7	-18.5	33.8	0.0	-13.1	-28.4
310.0	-30.7	-18.5	28.0	0.0	-13.1	-34.3
320.0	-30.7	-18.5	21.7	0.0	-13.1	-40.6
330.0	-30.7	-18.5	15.6	0.0	-13.1	-46.7
340.0	-30.7	-18.5	10.0	0.0	-13.1	-52.3
350.0	-30.7	-18.5	4.8	0.0	-13.1	-57.5
360.0	-30.7	-18.5	0.0	0.0	-13.1	-62.3

Case 32 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	105.7	168.9	0.0	0.0	99.8	374.4
10.0	105.7	168.9	-316.6	0.0	-99.8	-141.9
20.0	105.7	168.9	-593.0	0.0	-99.8	-418.2
30.0	105.7	168.9	-793.7	0.0	-99.8	-618.9
40.0	105.7	168.9	-892.8	0.0	-99.8	-718.0
50.0	105.7	168.9	-876.4	0.0	-99.8	-701.7
60.0	105.7	168.9	-745.2	0.0	-99.8	-570.5
70.0	105.7	168.9	-513.8	0.0	-99.8	-339.1
80.0	105.7	168.9	-209.2	0.0	99.8	165.2
90.0	105.7	168.9	132.4	0.0	99.8	506.8
100.0	105.7	168.9	470.0	0.0	99.8	844.4
110.0	105.7	168.9	762.6	0.0	99.8	1137.1
120.0	105.7	168.9	974.5	0.0	99.8	1349.0
130.0	105.7	168.9	1079.2	0.0	99.8	1457.7
140.0	105.7	168.9	1063.0	0.0	99.8	1437.4
150.0	105.7	168.9	926.1	0.0	99.8	1300.3
160.0	105.7	168.9	683.5	0.0	99.8	1058.0
170.0	105.7	168.9	362.6	0.0	99.8	737.0
180.0	105.7	168.9	0.0	0.0	99.8	374.4
190.0	105.7	168.9	-362.6	0.0	-99.8	-187.8
200.0	105.7	168.9	-683.5	0.0	-99.8	-508.8
210.0	105.7	168.9	-926.1	0.0	-99.8	-751.3
220.0	105.7	168.9	-1063.0	0.0	-99.8	-888.2
230.0	105.7	168.9	-1079.2	0.0	-99.8	-904.5
240.0	105.7	168.9	-974.5	0.0	-99.8	-799.8
250.0	105.7	168.9	-762.6	0.0	-99.8	-587.9
260.0	105.7	168.9	-470.0	0.0	-99.8	-295.2
270.0	105.7	168.9	-132.4	0.0	99.8	242.0
280.0	105.7	168.9	209.2	0.0	99.8	583.7
290.0	105.7	168.9	513.8	0.0	99.8	888.3
300.0	105.7	168.9	745.2	0.0	99.8	1119.7
310.0	105.7	168.9	876.4	0.0	99.8	1250.9
320.0	105.7	168.9	892.8	0.0	99.8	1267.2
330.0	105.7	168.9	793.7	0.0	99.8	1168.1
340.0	105.7	168.9	593.0	0.0	99.8	967.4
350.0	105.7	168.9	316.6	0.0	99.8	691.0
360.0	105.7	168.9	0.0	0.0	99.8	374.4

6.32.4 Thruster use

Case 32 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	86.1	26.1	87.0	180.0	16.2	90.0	54.9	100.1
10.0	84.2	18.7	86.9	180.0	16.0	90.0	43.5	99.4
20.0	83.8	14.7	86.8	180.0	16.0	90.0	37.7	98.9
30.0	83.5	11.8	86.7	180.0	16.2	90.0	33.6	98.4
40.0	83.4	10.4	86.5	180.0	16.4	90.0	31.8	98.1
50.0	83.3	10.8	86.3	180.0	16.8	90.0	32.7	97.9
60.0	83.3	13.0	86.1	180.0	17.3	90.0	36.3	97.8
70.0	83.7	16.2	86.0	180.0	17.1	90.0	40.8	97.8
80.0	85.7	23.3	85.9	180.0	16.9	90.0	51.2	98.0
90.0	87.5	27.9	85.8	180.0	16.7	90.0	58.2	98.4
100.0	88.2	32.7	84.3	180.0	16.8	90.0	65.1	98.9
110.0	88.9	36.9	82.9	180.0	16.8	90.0	71.2	99.6
120.0	91.3	39.5	81.7	180.0	17.0	90.0	75.9	98.5
130.0	88.0	42.3	80.6	180.0	17.0	90.0	77.8	101.5
140.0	85.9	43.0	79.7	180.0	17.1	90.0	77.5	102.6
150.0	82.6	42.2	79.0	180.0	17.2	90.0	74.8	103.8
160.0	78.5	39.8	78.4	180.0	17.4	90.0	70.0	105.0
170.0	74.5	35.8	78.1	180.0	17.7	90.0	63.7	106.1
180.0	71.2	30.5	78.0	180.0	18.0	90.0	56.2	107.1
190.0	68.4	20.9	78.1	180.0	18.0	90.0	44.7	108.6
200.0	67.6	15.2	78.4	180.0	18.0	90.0	38.1	110.3
210.0	67.5	10.9	79.0	180.0	18.1	90.0	33.4	112.3
220.0	67.3	8.6	79.7	180.0	18.3	90.0	31.2	115.0
230.0	66.2	8.5	80.6	180.0	18.4	90.0	32.0	118.2
240.0	54.7	5.7	72.1	176.5	18.6	90.0	33.4	121.6
250.0	15.2	10.3	17.9	176.0	18.6	90.0	29.0	125.5
260.0	3.9	13.9	13.4	170.0	15.5	90.0	26.0	128.2
270.0	7.7	13.8	11.5	152.2	8.2	90.0	24.6	128.3
280.0	10.1	127.4	11.3	137.2	4.7	90.0	25.0	125.3
290.0	12.6	122.0	12.3	124.5	2.8	90.0	27.3	120.1
300.0	14.8	113.6	14.1	119.8	2.6	90.0	31.2	114.4
310.0	16.7	105.1	16.0	119.8	4.3	90.0	36.4	109.7
320.0	17.7	99.6	17.7	119.8	7.7	90.0	42.2	106.2
330.0	17.5	95.5	19.3	120.2	12.6	90.0	48.0	103.7
340.0	21.8	55.7	29.3	143.0	16.6	90.0	53.5	102.0
350.0	65.1	18.5	75.5	164.2	16.3	90.0	58.5	100.8
360.0	86.1	26.1	87.0	180.0	16.2	90.0	54.9	100.1

6.32.5 Thruster loss

Case 32 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.78	0.81
10.0	0.84	0.77	0.80
20.0	0.85	0.77	0.80
30.0	0.85	0.77	0.81
40.0	0.86	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.88	0.77	0.85
80.0	0.88	0.77	0.84
90.0	0.88	0.76	0.83
100.0	0.89	0.75	0.84
110.0	0.90	0.74	0.84
120.0	0.91	0.73	0.85
130.0	0.92	0.72	0.85
140.0	0.92	0.71	0.85
150.0	0.93	0.70	0.86
160.0	0.93	0.70	0.87
170.0	0.93	0.70	0.88
180.0	0.93	0.70	0.90
190.0	0.94	0.70	0.90
200.0	0.94	0.70	0.91
210.0	0.94	0.70	0.90
220.0	0.94	0.71	0.91
230.0	0.94	0.72	0.92
240.0	0.94	0.75	0.93
250.0	0.94	0.77	0.93
260.0	0.92	0.82	0.93
270.0	0.93	0.87	0.93
280.0	0.93	0.88	0.94
290.0	0.94	0.89	0.94
300.0	0.94	0.89	0.95
310.0	0.93	0.89	0.91
320.0	0.93	0.89	0.88
330.0	0.93	0.89	0.85
340.0	0.90	0.88	0.83
350.0	0.85	0.85	0.81
360.0	0.85	0.78	0.81

Preliminary Design, @IDR5

6.33 Case 33 - Thrust Utilization: 35 knots wind @ 130 deg, 2 knots current, Sea State 5

6.33.1 Environment and thrust utilisation

Case 33 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	130.0	130.0	0.0	35.0	4.0	6.7	9.4	2.00	92.5
10.0	130.0	130.0	10.0	35.0	4.0	6.7	9.4	2.00	> 100.0
20.0	130.0	130.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	130.0	130.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	130.0	130.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	130.0	130.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	130.0	130.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	130.0	130.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	130.0	130.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	130.0	130.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	130.0	130.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	130.0	130.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	130.0	130.0	120.0	35.0	4.0	6.7	9.4	2.00	> 100.0
130.0	130.0	130.0	130.0	35.0	4.0	6.7	9.4	2.00	> 100.0
140.0	130.0	130.0	140.0	35.0	4.0	6.7	9.4	2.00	91.7
150.0	130.0	130.0	150.0	35.0	4.0	6.7	9.4	2.00	85.3
160.0	130.0	130.0	160.0	35.0	4.0	6.7	9.4	2.00	84.2
170.0	130.0	130.0	170.0	35.0	4.0	6.7	9.4	2.00	87.4
180.0	130.0	130.0	180.0	35.0	4.0	6.7	9.4	2.00	92.8
190.0	130.0	130.0	190.0	35.0	4.0	6.7	9.4	2.00	99.1
200.0	130.0	130.0	200.0	35.0	4.0	6.7	9.4	2.00	> 100.0
210.0	130.0	130.0	210.0	35.0	4.0	6.7	9.4	2.00	> 100.0
220.0	130.0	130.0	220.0	35.0	4.0	6.7	9.4	2.00	> 100.0
230.0	130.0	130.0	230.0	35.0	4.0	6.7	9.4	2.00	91.6
240.0	130.0	130.0	240.0	35.0	4.0	6.7	9.4	2.00	74.3
250.0	130.0	130.0	250.0	35.0	4.0	6.7	9.4	2.00	55.2
260.0	130.0	130.0	260.0	35.0	4.0	6.7	9.4	2.00	36.1
270.0	130.0	130.0	270.0	35.0	4.0	6.7	9.4	2.00	9.6
280.0	130.0	130.0	280.0	35.0	4.0	6.7	9.4	2.00	10.8
290.0	130.0	130.0	290.0	35.0	4.0	6.7	9.4	2.00	17.9
300.0	130.0	130.0	300.0	35.0	4.0	6.7	9.4	2.00	19.9
310.0	130.0	130.0	310.0	35.0	4.0	6.7	9.4	2.00	15.7
320.0	130.0	130.0	320.0	35.0	4.0	6.7	9.4	2.00	17.8
330.0	130.0	130.0	330.0	35.0	4.0	6.7	9.4	2.00	23.5
340.0	130.0	130.0	340.0	35.0	4.0	6.7	9.4	2.00	43.4
350.0	130.0	130.0	350.0	35.0	4.0	6.7	9.4	2.00	67.7
360.0	130.0	130.0	360.0	35.0	4.0	6.7	9.4	2.00	92.5

6.33.2 Relative contributions of force components

Case 33 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	53.5	27.7	-1.5	0.0	20.4	100.0
10.0	49.3	25.4	6.6	0.0	18.7	100.0
20.0	45.4	23.4	14.0	0.0	17.2	100.0
30.0	41.8	21.5	20.9	0.0	15.8	100.0
40.0	38.5	19.8	27.2	0.0	14.5	100.0
50.0	35.6	18.3	32.8	0.0	13.4	100.0
60.0	33.2	17.0	37.2	0.0	12.5	100.0
70.0	31.5	16.1	40.5	0.0	11.9	100.0
80.0	30.4	15.6	42.5	0.0	11.5	100.0
90.0	30.0	15.4	43.2	0.0	11.3	100.0
100.0	30.4	15.6	42.6	0.0	11.5	100.0
110.0	31.3	16.1	40.7	0.0	11.9	100.0
120.0	32.9	17.0	37.5	0.0	12.5	100.0
130.0	35.1	18.2	33.3	0.0	13.4	100.0
140.0	37.8	19.6	28.1	0.0	14.5	100.0
150.0	40.7	21.2	22.4	0.0	15.7	100.0
160.0	43.9	23.0	16.2	0.0	16.9	100.0
170.0	47.2	24.8	9.7	0.0	18.3	100.0
180.0	50.8	26.8	2.7	0.0	19.8	100.0
190.0	54.7	29.0	-5.1	0.0	21.4	100.0
200.0	59.5	31.7	-12.7	0.0	23.5	100.0
210.0	65.6	35.2	-20.0	0.0	26.2	100.0
220.0	73.3	39.1	-27.7	0.0	29.6	100.0
230.0	82.8	45.2	-36.3	0.0	33.8	100.0
240.0	93.9	50.9	-45.0	0.0	38.2	100.0
250.0	96.7	55.4	-53.7	0.0	41.8	100.0
260.0	99.6	58.2	-62.0	0.0	44.1	100.0
270.0	103.5	60.8	-70.3	0.0	46.2	100.0
280.0	110.6	64.0	-78.6	0.0	48.4	100.0
290.0	114.6	64.5	-86.9	0.0	48.5	100.0
300.0	109.1	59.8	-95.2	0.0	44.6	100.0
310.0	96.6	51.9	-87.1	0.0	38.6	100.0
320.0	83.6	44.3	-60.6	0.0	32.8	100.0
330.0	72.8	38.2	-39.2	0.0	28.2	100.0
340.0	64.6	33.7	-23.1	0.0	24.8	100.0
350.0	58.4	30.3	-11.0	0.0	22.3	100.0
360.0	53.5	27.7	-1.5	0.0	20.4	100.0

6.33.3 Environment forces

Case 33 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	6.5	5.4	-3.6	0.0	4.4	12.8
10.0	6.5	5.4	-3.6	0.0	4.4	12.8
20.0	6.5	5.4	-3.5	0.0	4.4	12.9
30.0	6.5	5.4	-3.2	0.0	4.4	13.2
40.0	6.5	5.4	-2.8	0.0	4.4	13.6
50.0	6.5	5.4	-2.3	0.0	4.4	14.1
60.0	6.5	5.4	-1.6	0.0	4.4	14.8
70.0	6.5	5.4	-0.9	0.0	4.4	15.5
80.0	6.5	5.4	-0.1	0.0	4.4	16.3
90.0	6.5	5.4	0.7	0.0	4.4	17.1
100.0	6.5	5.4	1.5	0.0	4.4	17.9
110.0	6.5	5.4	2.3	0.0	4.4	18.7
120.0	6.5	5.4	3.0	0.0	4.4	19.3
130.0	6.5	5.4	3.5	0.0	4.4	19.9
140.0	6.5	5.4	4.0	0.0	4.4	20.4
150.0	6.5	5.4	4.3	0.0	4.4	20.7
160.0	6.5	5.4	4.4	0.0	4.4	20.8
170.0	6.5	5.4	4.4	0.0	4.4	20.8
180.0	6.5	5.4	4.3	0.0	4.4	20.7
190.0	6.5	5.4	4.4	0.0	4.4	20.8
200.0	6.5	5.4	4.4	0.0	4.4	20.8
210.0	6.5	5.4	4.3	0.0	4.4	20.7
220.0	6.5	5.4	4.0	0.0	4.4	20.4
230.0	6.5	5.4	3.5	0.0	4.4	19.9
240.0	6.5	5.4	3.0	0.0	4.4	19.3
250.0	6.5	5.4	2.3	0.0	4.4	18.7
260.0	6.5	5.4	1.5	0.0	4.4	17.9
270.0	6.5	5.4	0.7	0.0	4.4	17.1
280.0	6.5	5.4	-0.1	0.0	4.4	16.3
290.0	6.5	5.4	-0.9	0.0	4.4	15.5
300.0	6.5	5.4	-1.6	0.0	4.4	14.8
310.0	6.5	5.4	-2.3	0.0	4.4	14.1
320.0	6.5	5.4	-2.8	0.0	4.4	13.6
330.0	6.5	5.4	-3.2	0.0	4.4	13.2
340.0	6.5	5.4	-3.5	0.0	4.4	12.9
350.0	6.5	5.4	-3.6	0.0	4.4	12.8
360.0	6.5	5.4	-3.6	0.0	4.4	12.8

Case 33 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-28.8	-14.4	0.0	0.0	-10.5	-53.8
10.0	-28.8	-14.4	-4.8	0.0	-10.5	-58.6
20.0	-28.8	-14.4	-10.0	0.0	-10.5	-63.8
30.0	-28.8	-14.4	-15.6	0.0	-10.5	-69.4
40.0	-28.8	-14.4	-21.7	0.0	-10.5	-75.5
50.0	-28.8	-14.4	-28.0	0.0	-10.5	-81.8
60.0	-28.8	-14.4	-33.8	0.0	-10.5	-87.6
70.0	-28.8	-14.4	-38.7	0.0	-10.5	-92.5
80.0	-28.8	-14.4	-41.9	0.0	-10.5	-95.7
90.0	-28.8	-14.4	-43.0	0.0	-10.5	-96.8
100.0	-28.8	-14.4	-41.9	0.0	-10.5	-95.7
110.0	-28.8	-14.4	-38.7	0.0	-10.5	-92.5
120.0	-28.8	-14.4	-33.8	0.0	-10.5	-87.6
130.0	-28.8	-14.4	-28.0	0.0	-10.5	-81.8
140.0	-28.8	-14.4	-21.7	0.0	-10.5	-75.5
150.0	-28.8	-14.4	-15.6	0.0	-10.5	-69.4
160.0	-28.8	-14.4	-10.0	0.0	-10.5	-63.8
170.0	-28.8	-14.4	-4.8	0.0	-10.5	-58.6
180.0	-28.8	-14.4	0.0	0.0	-10.5	-53.8
190.0	-28.8	-14.4	4.8	0.0	-10.5	-49.0
200.0	-28.8	-14.4	10.0	0.0	-10.5	-43.8
210.0	-28.8	-14.4	15.6	0.0	-10.5	-38.2
220.0	-28.8	-14.4	21.7	0.0	-10.5	-32.1
230.0	-28.8	-14.4	28.0	0.0	-10.5	-25.8
240.0	-28.8	-14.4	33.8	0.0	-10.5	-20.0
250.0	-28.8	-14.4	38.7	0.0	-10.5	-15.1
260.0	-28.8	-14.4	41.9	0.0	-10.5	-11.9
270.0	-28.8	-14.4	43.0	0.0	-10.5	-10.8
280.0	-28.8	-14.4	41.9	0.0	-10.5	-11.9
290.0	-28.8	-14.4	38.7	0.0	-10.5	-15.1
300.0	-28.8	-14.4	33.8	0.0	-10.5	-20.0
310.0	-28.8	-14.4	28.0	0.0	-10.5	-25.8
320.0	-28.8	-14.4	21.7	0.0	-10.5	-32.1
330.0	-28.8	-14.4	15.6	0.0	-10.5	-38.2
340.0	-28.8	-14.4	10.0	0.0	-10.5	-43.8
350.0	-28.8	-14.4	4.8	0.0	-10.5	-49.0
360.0	-28.8	-14.4	0.0	0.0	-10.5	-53.8

Case 33 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	200.3	178.7	0.0	0.0	116.8	495.8
10.0	200.3	178.7	-316.6	0.0	116.8	179.2
20.0	200.3	178.7	-593.0	0.0	-116.8	-330.8
30.0	200.3	178.7	-793.7	0.0	-116.8	-531.5
40.0	200.3	178.7	-892.8	0.0	-116.8	-630.6
50.0	200.3	178.7	-876.4	0.0	-116.8	-614.2
60.0	200.3	178.7	-745.2	0.0	-116.8	-483.0
70.0	200.3	178.7	-513.8	0.0	-116.8	-251.7
80.0	200.3	178.7	-209.2	0.0	116.8	286.6
90.0	200.3	178.7	132.4	0.0	116.8	628.2
100.0	200.3	178.7	470.0	0.0	116.8	965.8
110.0	200.3	178.7	762.6	0.0	116.8	1258.5
120.0	200.3	178.7	974.5	0.0	116.8	1470.4
130.0	200.3	178.7	1079.2	0.0	116.8	1575.1
140.0	200.3	178.7	1063.0	0.0	116.8	1553.8
150.0	200.3	178.7	926.1	0.0	116.8	1421.9
160.0	200.3	178.7	683.5	0.0	116.8	1179.4
170.0	200.3	178.7	362.6	0.0	116.8	858.4
180.0	200.3	178.7	0.0	0.0	116.8	495.8
190.0	200.3	178.7	-362.6	0.0	116.8	133.2
200.0	200.3	178.7	-683.5	0.0	-116.8	-421.4
210.0	200.3	178.7	-926.1	0.0	-116.8	-663.9
220.0	200.3	178.7	-1063.0	0.0	-116.8	-800.8
230.0	200.3	178.7	-1079.2	0.0	-116.8	-817.1
240.0	200.3	178.7	-974.5	0.0	-116.8	-712.3
250.0	200.3	178.7	-762.6	0.0	-116.8	-500.5
260.0	200.3	178.7	-470.0	0.0	-116.8	-207.8
270.0	200.3	178.7	-132.4	0.0	116.8	363.4
280.0	200.3	178.7	209.2	0.0	116.8	705.1
290.0	200.3	178.7	513.8	0.0	116.8	1009.7
300.0	200.3	178.7	745.2	0.0	116.8	1241.1
310.0	200.3	178.7	876.4	0.0	116.8	1372.3
320.0	200.3	178.7	892.8	0.0	116.8	1388.6
330.0	200.3	178.7	793.7	0.0	116.8	1289.5
340.0	200.3	178.7	593.0	0.0	116.8	1088.8
350.0	200.3	178.7	316.6	0.0	116.8	812.4
360.0	200.3	178.7	0.0	0.0	116.8	495.8

6.33.4 Thruster use

Case 33 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	66.6	16.5	78.9	166.2	16.2	90.0	55.3	103.4
10.0	83.0	23.7	86.9	180.0	16.0	90.0	50.6	102.4
20.0	82.0	16.1	86.8	180.0	16.0	90.0	39.7	101.7
30.0	82.1	13.2	86.6	180.0	16.2	90.0	35.5	100.9
40.0	82.1	11.8	86.5	180.0	16.4	90.0	33.7	100.3
50.0	82.1	12.2	86.3	180.0	16.8	90.0	34.6	99.9
60.0	82.2	14.3	86.1	180.0	17.3	90.0	38.2	99.7
70.0	82.7	17.6	85.9	180.0	17.1	90.0	42.7	99.6
80.0	84.8	25.3	85.8	180.0	16.9	90.0	53.8	99.8
90.0	86.6	29.9	85.8	180.0	16.7	90.0	60.9	100.2
100.0	87.3	34.9	84.3	180.0	16.8	90.0	67.8	100.8
110.0	87.9	39.3	82.9	180.0	16.8	90.0	74.0	101.6
120.0	87.8	42.8	81.6	180.0	17.0	90.0	78.5	102.7
130.0	86.6	45.1	80.5	180.0	17.0	90.0	80.7	103.9
140.0	58.9	32.6	74.9	159.1	17.1	90.0	78.2	105.1
150.0	45.1	39.0	60.6	156.8	17.2	90.0	72.4	106.6
160.0	40.4	38.7	56.4	158.0	17.4	90.0	67.1	108.1
170.0	43.0	31.4	60.5	162.2	17.7	90.0	62.2	109.6
180.0	51.0	22.8	69.6	166.7	18.0	90.0	57.1	111.0
190.0	64.9	28.0	78.1	180.0	18.0	90.0	52.8	113.2
200.0	63.4	17.4	78.4	180.0	18.0	90.0	41.1	115.8
210.0	62.9	12.9	78.9	180.0	18.1	90.0	36.6	118.7
220.0	61.7	10.4	79.6	180.0	18.3	90.0	35.0	122.7
230.0	45.3	5.3	65.5	175.1	18.4	90.0	32.6	127.6
240.0	9.6	4.5	29.9	178.8	18.6	90.0	27.8	134.1
250.0	4.6	179.8	17.1	179.8	15.0	90.0	24.0	141.0
260.0	6.1	167.3	11.9	174.5	9.5	90.0	21.5	146.3
270.0	9.6	151.2	9.7	153.3	1.8	90.0	20.2	147.7
280.0	11.9	143.8	9.5	135.3	-1.7	90.0	20.2	143.8
290.0	13.9	136.6	10.6	120.4	-3.6	90.0	21.7	135.7
300.0	15.6	123.4	12.4	119.8	-3.8	90.0	24.8	126.5
310.0	17.1	114.3	14.2	119.8	-2.2	90.0	29.4	118.7
320.0	17.8	108.4	16.0	119.8	1.3	90.0	34.8	113.0
330.0	17.5	104.9	17.5	119.8	6.1	90.0	40.4	109.1
340.0	16.5	98.9	18.7	123.6	11.9	90.0	45.7	106.4
350.0	21.4	49.9	31.2	148.4	16.3	90.0	50.6	104.6
360.0	66.6	16.5	78.9	166.2	16.2	90.0	55.3	103.4

6.33.5 Thruster loss

Case 33 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.85	0.84	0.81
10.0	0.84	0.77	0.80
20.0	0.85	0.77	0.80
30.0	0.85	0.77	0.81
40.0	0.86	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.88	0.76	0.84
90.0	0.88	0.76	0.83
100.0	0.89	0.75	0.84
110.0	0.89	0.74	0.84
120.0	0.90	0.73	0.85
130.0	0.92	0.72	0.85
140.0	0.93	0.78	0.85
150.0	0.93	0.78	0.86
160.0	0.93	0.78	0.87
170.0	0.93	0.77	0.88
180.0	0.94	0.76	0.90
190.0	0.94	0.70	0.90
200.0	0.94	0.70	0.90
210.0	0.94	0.70	0.90
220.0	0.94	0.71	0.91
230.0	0.94	0.71	0.92
240.0	0.94	0.74	0.93
250.0	0.75	0.74	0.93
260.0	0.75	0.79	0.93
270.0	0.71	0.86	0.93
280.0	0.92	0.88	0.84
290.0	0.93	0.89	0.85
300.0	0.94	0.89	0.86
310.0	0.93	0.89	0.84
320.0	0.93	0.89	0.88
330.0	0.93	0.89	0.85
340.0	0.93	0.88	0.83
350.0	0.88	0.88	0.81
360.0	0.85	0.84	0.81

Preliminary Design, @IDR5

6.34 Case 34 - Thrust Utilization: 35 knots wind @ 140 deg, 2 knots current, Sea State 5

6.34.1 Environment and thrust utilisation

Case 34 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	140.0	140.0	0.0	35.0	4.0	6.7	9.4	2.00	67.0
10.0	140.0	140.0	10.0	35.0	4.0	6.7	9.4	2.00	92.0
20.0	140.0	140.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	140.0	140.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	140.0	140.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	140.0	140.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	140.0	140.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	140.0	140.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	140.0	140.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	140.0	140.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	140.0	140.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	140.0	140.0	110.0	35.0	4.0	6.7	9.4	2.00	> 100.0
120.0	140.0	140.0	120.0	35.0	4.0	6.7	9.4	2.00	94.3
130.0	140.0	140.0	130.0	35.0	4.0	6.7	9.4	2.00	77.2
140.0	140.0	140.0	140.0	35.0	4.0	6.7	9.4	2.00	65.2
150.0	140.0	140.0	150.0	35.0	4.0	6.7	9.4	2.00	59.5
160.0	140.0	140.0	160.0	35.0	4.0	6.7	9.4	2.00	57.5
170.0	140.0	140.0	170.0	35.0	4.0	6.7	9.4	2.00	61.1
180.0	140.0	140.0	180.0	35.0	4.0	6.7	9.4	2.00	67.6
190.0	140.0	140.0	190.0	35.0	4.0	6.7	9.4	2.00	74.0
200.0	140.0	140.0	200.0	35.0	4.0	6.7	9.4	2.00	88.9
210.0	140.0	140.0	210.0	35.0	4.0	6.7	9.4	2.00	87.7
220.0	140.0	140.0	220.0	35.0	4.0	6.7	9.4	2.00	80.7
230.0	140.0	140.0	230.0	35.0	4.0	6.7	9.4	2.00	68.0
240.0	140.0	140.0	240.0	35.0	4.0	6.7	9.4	2.00	51.0
250.0	140.0	140.0	250.0	35.0	4.0	6.7	9.4	2.00	12.1
260.0	140.0	140.0	260.0	35.0	4.0	6.7	9.4	2.00	28.4
270.0	140.0	140.0	270.0	35.0	4.0	6.7	9.4	2.00	56.8
280.0	140.0	140.0	280.0	35.0	4.0	6.7	9.4	2.00	69.3
290.0	140.0	140.0	290.0	35.0	4.0	6.7	9.4	2.00	75.5
300.0	140.0	140.0	300.0	35.0	4.0	6.7	9.4	2.00	42.4
310.0	140.0	140.0	310.0	35.0	4.0	6.7	9.4	2.00	36.6
320.0	140.0	140.0	320.0	35.0	4.0	6.7	9.4	2.00	27.6
330.0	140.0	140.0	330.0	35.0	4.0	6.7	9.4	2.00	16.4
340.0	140.0	140.0	340.0	35.0	4.0	6.7	9.4	2.00	19.3
350.0	140.0	140.0	350.0	35.0	4.0	6.7	9.4	2.00	41.5
360.0	140.0	140.0	360.0	35.0	4.0	6.7	9.4	2.00	67.0

6.34.2 Relative contributions of force components

Case 34 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	56.4	26.3	-2.5	0.0	19.8	100.0
10.0	51.2	23.7	7.2	0.0	17.9	100.0
20.0	46.5	21.4	16.0	0.0	16.1	100.0
30.0	42.2	19.4	23.9	0.0	14.6	100.0
40.0	38.3	17.5	31.0	0.0	13.2	100.0
50.0	34.9	16.0	37.1	0.0	12.0	100.0
60.0	32.3	14.7	41.9	0.0	11.1	100.0
70.0	30.4	13.9	45.3	0.0	10.4	100.0
80.0	29.2	13.3	47.4	0.0	10.0	100.0
90.0	28.8	13.2	48.1	0.0	9.9	100.0
100.0	29.2	13.4	47.4	0.0	10.0	100.0
110.0	30.2	13.9	45.4	0.0	10.4	100.0
120.0	32.0	14.8	42.1	0.0	11.1	100.0
130.0	34.4	16.0	37.6	0.0	12.0	100.0
140.0	37.3	17.4	32.1	0.0	13.1	100.0
150.0	40.7	19.1	25.8	0.0	14.1	100.0
160.0	44.2	20.9	19.1	0.0	15.3	100.0
170.0	48.0	22.9	11.9	0.0	17.2	100.0
180.0	52.1	25.0	4.1	0.0	18.8	100.0
190.0	56.4	27.3	-4.4	0.0	20.6	100.0
200.0	61.6	30.2	-14.5	0.0	22.8	100.0
210.0	67.7	33.3	-26.3	0.0	25.5	100.0
220.0	73.9	37.1	-40.3	0.0	28.5	100.0
230.0	77.6	41.2	-49.9	0.0	31.1	100.0
240.0	77.7	41.6	-46.7	0.0	31.4	100.0
250.0	-23.7	-1.9	92.3	0.0	33.3	100.0
260.0	-35.3	-8.1	109.5	0.0	33.9	100.0
270.0	-40.6	-10.7	116.8	0.0	34.5	100.0
280.0	-41.6	-10.7	115.9	0.0	36.3	100.0
290.0	-36.0	-6.6	103.4	0.0	39.2	100.0
300.0	99.7	54.5	-95.4	0.0	41.2	100.0
310.0	103.8	53.2	-97.2	0.0	40.2	100.0
320.0	93.7	46.2	-74.6	0.0	34.8	100.0
330.0	81.1	39.0	-49.6	0.0	29.4	100.0
340.0	70.7	33.5	-29.4	0.0	25.2	100.0
350.0	62.7	29.4	-14.3	0.0	22.2	100.0
360.0	56.4	26.3	-2.5	0.0	19.8	100.0

6.34.3 Environment forces

Case 34 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	7.8	5.7	-3.6	0.0	4.3	14.3
10.0	7.8	5.7	-3.6	0.0	4.3	14.3
20.0	7.8	5.7	-3.5	0.0	4.3	14.4
30.0	7.8	5.7	-3.2	0.0	4.3	14.7
40.0	7.8	5.7	-2.8	0.0	4.3	15.1
50.0	7.8	5.7	-2.3	0.0	4.3	15.6
60.0	7.8	5.7	-1.6	0.0	4.3	16.2
70.0	7.8	5.7	-0.9	0.0	4.3	17.0
80.0	7.8	5.7	-0.1	0.0	4.3	17.8
90.0	7.8	5.7	0.7	0.0	4.3	18.6
100.0	7.8	5.7	1.5	0.0	4.3	19.4
110.0	7.8	5.7	2.3	0.0	4.3	20.1
120.0	7.8	5.7	3.0	0.0	4.3	20.8
130.0	7.8	5.7	3.5	0.0	4.3	21.4
140.0	7.8	5.7	4.0	0.0	4.3	21.8
150.0	7.8	5.7	4.3	0.0	4.3	22.1
160.0	7.8	5.7	4.4	0.0	4.3	22.3
170.0	7.8	5.7	4.4	0.0	4.3	22.3
180.0	7.8	5.7	4.3	0.0	4.3	22.2
190.0	7.8	5.7	4.4	0.0	4.3	22.3
200.0	7.8	5.7	4.4	0.0	4.3	22.3
210.0	7.8	5.7	4.3	0.0	4.3	22.1
220.0	7.8	5.7	4.0	0.0	4.3	21.8
230.0	7.8	5.7	3.5	0.0	4.3	21.4
240.0	7.8	5.7	3.0	0.0	4.3	20.8
250.0	7.8	5.7	2.3	0.0	4.3	20.1
260.0	7.8	5.7	1.5	0.0	4.3	19.4
270.0	7.8	5.7	0.7	0.0	4.3	18.6
280.0	7.8	5.7	-0.1	0.0	4.3	17.8
290.0	7.8	5.7	-0.9	0.0	4.3	17.0
300.0	7.8	5.7	-1.6	0.0	4.3	16.2
310.0	7.8	5.7	-2.3	0.0	4.3	15.6
320.0	7.8	5.7	-2.8	0.0	4.3	15.1
330.0	7.8	5.7	-3.2	0.0	4.3	14.7
340.0	7.8	5.7	-3.5	0.0	4.3	14.4
350.0	7.8	5.7	-3.6	0.0	4.3	14.3
360.0	7.8	5.7	-3.6	0.0	4.3	14.3

Case 34 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-24.2	-10.6	0.0	0.0	-8.0	-42.7
10.0	-24.2	-10.6	-4.8	0.0	-8.0	-47.6
20.0	-24.2	-10.6	-10.0	0.0	-8.0	-52.7
30.0	-24.2	-10.6	-15.6	0.0	-8.0	-58.4
40.0	-24.2	-10.6	-21.7	0.0	-8.0	-64.5
50.0	-24.2	-10.6	-28.0	0.0	-8.0	-70.7
60.0	-24.2	-10.6	-33.8	0.0	-8.0	-76.6
70.0	-24.2	-10.6	-38.7	0.0	-8.0	-81.4
80.0	-24.2	-10.6	-41.9	0.0	-8.0	-84.6
90.0	-24.2	-10.6	-43.0	0.0	-8.0	-85.7
100.0	-24.2	-10.6	-41.9	0.0	-8.0	-84.6
110.0	-24.2	-10.6	-38.7	0.0	-8.0	-81.4
120.0	-24.2	-10.6	-33.8	0.0	-8.0	-76.6
130.0	-24.2	-10.6	-28.0	0.0	-8.0	-70.7
140.0	-24.2	-10.6	-21.7	0.0	-8.0	-64.5
150.0	-24.2	-10.6	-15.6	0.0	-8.0	-58.4
160.0	-24.2	-10.6	-10.0	0.0	-8.0	-52.7
170.0	-24.2	-10.6	-4.8	0.0	-8.0	-47.6
180.0	-24.2	-10.6	0.0	0.0	-8.0	-42.7
190.0	-24.2	-10.6	4.8	0.0	-8.0	-37.9
200.0	-24.2	-10.6	10.0	0.0	-8.0	-32.7
210.0	-24.2	-10.6	15.6	0.0	-8.0	-27.1
220.0	-24.2	-10.6	21.7	0.0	-8.0	-21.0
230.0	-24.2	-10.6	28.0	0.0	-8.0	-14.7
240.0	-24.2	-10.6	33.8	0.0	-8.0	-8.9
250.0	-24.2	-10.6	38.7	0.0	8.0	11.8
260.0	-24.2	-10.6	41.9	0.0	8.0	15.0
270.0	-24.2	-10.6	43.0	0.0	8.0	16.2
280.0	-24.2	-10.6	41.9	0.0	8.0	15.0
290.0	-24.2	-10.6	38.7	0.0	8.0	11.8
300.0	-24.2	-10.6	33.8	0.0	-8.0	-8.9
310.0	-24.2	-10.6	28.0	0.0	-8.0	-14.7
320.0	-24.2	-10.6	21.7	0.0	-8.0	-21.0
330.0	-24.2	-10.6	15.6	0.0	-8.0	-27.1
340.0	-24.2	-10.6	10.0	0.0	-8.0	-32.7
350.0	-24.2	-10.6	4.8	0.0	-8.0	-37.9
360.0	-24.2	-10.6	0.0	0.0	-8.0	-42.7

Case 34 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	252.6	180.3	0.0	0.0	127.5	560.4
10.0	252.6	180.3	-316.6	0.0	127.5	243.8
20.0	252.6	180.3	-593.0	0.0	-127.5	-287.6
30.0	252.6	180.3	-793.7	0.0	-127.5	-488.3
40.0	252.6	180.3	-892.8	0.0	-127.5	-587.4
50.0	252.6	180.3	-876.4	0.0	-127.5	-571.0
60.0	252.6	180.3	-745.2	0.0	-127.5	-439.8
70.0	252.6	180.3	-513.8	0.0	-127.5	-208.4
80.0	252.6	180.3	-209.2	0.0	127.5	351.2
90.0	252.6	180.3	132.4	0.0	127.5	692.8
100.0	252.6	180.3	470.0	0.0	127.5	1030.4
110.0	252.6	180.3	762.6	0.0	127.5	1323.0
120.0	252.6	180.3	974.5	0.0	127.5	1534.9
130.0	252.6	180.3	1079.2	0.0	127.5	1629.6
140.0	252.6	180.3	1063.0	0.0	127.5	1623.4
150.0	252.6	180.3	926.1	0.0	127.5	1436.3
160.0	252.6	180.3	683.5	0.0	127.5	1243.9
170.0	252.6	180.3	362.6	0.0	127.5	923.0
180.0	252.6	180.3	0.0	0.0	127.5	560.4
190.0	252.6	180.3	-362.6	0.0	127.5	197.8
200.0	252.6	180.3	-683.5	0.0	-127.5	-378.1
210.0	252.6	180.3	-926.1	0.0	-127.5	-620.7
220.0	252.6	180.3	-1063.0	0.0	-127.5	-757.6
230.0	252.6	180.3	-1079.2	0.0	-127.5	-773.9
240.0	252.6	180.3	-974.5	0.0	-127.5	-669.1
250.0	252.6	180.3	-762.6	0.0	-127.5	-457.2
260.0	252.6	180.3	-470.0	0.0	-127.5	-164.6
270.0	252.6	180.3	-132.4	0.0	127.5	428.0
280.0	252.6	180.3	209.2	0.0	127.5	769.6
290.0	252.6	180.3	513.8	0.0	127.5	1074.2
300.0	252.6	180.3	745.2	0.0	127.5	1305.6
310.0	252.6	180.3	876.4	0.0	127.5	1436.8
320.0	252.6	180.3	892.8	0.0	127.5	1453.2
330.0	252.6	180.3	793.7	0.0	127.5	1354.1
340.0	252.6	180.3	593.0	0.0	127.5	1153.4
350.0	252.6	180.3	316.6	0.0	127.5	877.0
360.0	252.6	180.3	0.0	0.0	127.5	560.4

6.34.4 Thruster use

Case 34 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	16.7	52.3	27.9	151.5	16.2	90.0	45.1	108.5
10.0	62.8	14.6	76.7	168.2	16.0	90.0	49.7	106.7
20.0	79.3	17.1	86.7	180.0	16.0	90.0	40.9	105.6
30.0	79.9	14.0	86.6	180.0	16.2	90.0	36.7	104.3
40.0	80.2	12.6	86.4	180.0	16.4	90.0	34.8	103.4
50.0	80.4	12.9	86.2	180.0	16.8	90.0	35.7	102.6
60.0	80.5	15.2	86.0	180.0	17.3	90.0	39.2	102.1
70.0	80.9	18.5	85.8	180.0	17.1	90.0	43.7	102.0
80.0	83.0	26.7	85.7	180.0	16.9	90.0	55.4	102.1
90.0	84.7	31.5	85.7	180.0	16.7	90.0	62.4	102.4
100.0	85.3	36.6	84.2	180.0	16.8	90.0	69.4	103.1
110.0	85.7	41.3	82.8	180.0	16.8	90.0	75.7	104.1
120.0	65.0	29.6	82.0	160.5	17.0	90.0	79.4	105.2
130.0	36.0	52.8	49.9	149.8	17.0	90.0	73.9	106.8
140.0	24.9	99.3	29.0	128.0	17.1	90.0	68.1	108.7
150.0	23.2	107.4	25.6	126.3	15.5	90.0	62.4	110.8
160.0	20.7	109.9	23.6	130.2	15.2	90.0	57.2	112.9
170.0	17.6	111.9	21.8	136.4	16.2	90.0	52.5	115.1
180.0	14.2	114.0	20.2	144.2	17.9	90.0	48.1	117.4
190.0	12.3	61.9	29.5	162.1	18.0	90.0	44.0	120.5
200.0	37.1	12.9	58.8	173.7	18.0	90.0	39.6	124.2
210.0	34.1	8.6	56.0	176.0	18.1	90.0	35.0	129.2
220.0	19.5	4.6	41.3	173.4	18.3	90.0	30.3	136.1
230.0	5.0	200.3	16.6	165.7	18.2	90.0	26.0	145.4
240.0	6.2	201.7	15.3	188.5	13.4	90.0	22.6	156.9
250.0	11.3	207.5	17.5	208.0	-1.3	90.0	23.4	210.5
260.0	12.5	191.0	8.7	209.5	-6.7	90.0	24.5	217.8
270.0	14.6	162.9	4.1	191.2	-14.6	90.0	24.6	221.0
280.0	14.9	178.0	7.1	8.0	-16.9	90.0	23.3	220.3
290.0	37.2	176.2	20.3	7.8	-17.1	90.0	20.7	214.9
300.0	16.3	134.6	9.7	119.8	-11.1	90.0	18.5	151.3
310.0	17.3	124.8	11.5	119.8	-9.4	90.0	21.5	136.6
320.0	17.7	118.7	13.2	119.8	-6.0	90.0	25.8	125.7
330.0	17.2	115.4	14.7	119.8	-1.1	90.0	30.8	118.4
340.0	15.7	113.7	15.9	120.7	4.8	90.0	35.8	113.7
350.0	14.1	103.7	17.1	129.8	11.1	90.0	40.5	110.6
360.0	16.7	52.3	27.9	151.5	16.2	90.0	45.1	108.5

6.34.5 Thruster loss

Case 34 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.87	0.87	0.81
10.0	0.85	0.84	0.80
20.0	0.84	0.77	0.80
30.0	0.85	0.77	0.81
40.0	0.86	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.87	0.76	0.84
90.0	0.88	0.76	0.83
100.0	0.88	0.75	0.84
110.0	0.89	0.74	0.84
120.0	0.92	0.79	0.85
130.0	0.90	0.79	0.85
140.0	0.86	0.80	0.85
150.0	0.86	0.80	0.86
160.0	0.87	0.81	0.87
170.0	0.88	0.81	0.88
180.0	0.89	0.80	0.90
190.0	0.93	0.78	0.90
200.0	0.94	0.73	0.90
210.0	0.94	0.73	0.90
220.0	0.95	0.72	0.91
230.0	0.79	0.75	0.92
240.0	0.80	0.78	0.93
250.0	0.81	0.84	0.84
260.0	0.81	0.85	0.84
270.0	0.78	0.83	0.83
280.0	0.78	0.91	0.84
290.0	0.80	0.89	0.85
300.0	0.93	0.89	0.86
310.0	0.93	0.89	0.84
320.0	0.93	0.89	0.82
330.0	0.93	0.88	0.81
340.0	0.93	0.88	0.83
350.0	0.93	0.88	0.81
360.0	0.87	0.87	0.81

Preliminary Design, @IDR5

6.35 Case 35 - Thrust Utilization: 35 knots wind @ 150 deg, 2 knots current, Sea State 5

6.35.1 Environment and thrust utilisation

Case 35 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	150.0	150.0	0.0	35.0	4.0	6.7	9.4	2.00	41.7
10.0	150.0	150.0	10.0	35.0	4.0	6.7	9.4	2.00	66.6
20.0	150.0	150.0	20.0	35.0	4.0	6.7	9.4	2.00	> 100.0
30.0	150.0	150.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	150.0	150.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	150.0	150.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	150.0	150.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	150.0	150.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	150.0	150.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	150.0	150.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	150.0	150.0	100.0	35.0	4.0	6.7	9.4	2.00	> 100.0
110.0	150.0	150.0	110.0	35.0	4.0	6.7	9.4	2.00	86.7
120.0	150.0	150.0	120.0	35.0	4.0	6.7	9.4	2.00	68.2
130.0	150.0	150.0	130.0	35.0	4.0	6.7	9.4	2.00	52.1
140.0	150.0	150.0	140.0	35.0	4.0	6.7	9.4	2.00	40.0
150.0	150.0	150.0	150.0	35.0	4.0	6.7	9.4	2.00	33.9
160.0	150.0	150.0	160.0	35.0	4.0	6.7	9.4	2.00	32.7
170.0	150.0	150.0	170.0	35.0	4.0	6.7	9.4	2.00	36.3
180.0	150.0	150.0	180.0	35.0	4.0	6.7	9.4	2.00	42.8
190.0	150.0	150.0	190.0	35.0	4.0	6.7	9.4	2.00	49.1
200.0	150.0	150.0	200.0	35.0	4.0	6.7	9.4	2.00	64.1
210.0	150.0	150.0	210.0	35.0	4.0	6.7	9.4	2.00	62.9
220.0	150.0	150.0	220.0	35.0	4.0	6.7	9.4	2.00	56.0
230.0	150.0	150.0	230.0	35.0	4.0	6.7	9.4	2.00	21.1
240.0	150.0	150.0	240.0	35.0	4.0	6.7	9.4	2.00	14.2
250.0	150.0	150.0	250.0	35.0	4.0	6.7	9.4	2.00	23.9
260.0	150.0	150.0	260.0	35.0	4.0	6.7	9.4	2.00	43.9
270.0	150.0	150.0	270.0	35.0	4.0	6.7	9.4	2.00	72.1
280.0	150.0	150.0	280.0	35.0	4.0	6.7	9.4	2.00	84.5
290.0	150.0	150.0	290.0	35.0	4.0	6.7	9.4	2.00	90.7
300.0	150.0	150.0	300.0	35.0	4.0	6.7	9.4	2.00	90.2
310.0	150.0	150.0	310.0	35.0	4.0	6.7	9.4	2.00	85.1
320.0	150.0	150.0	320.0	35.0	4.0	6.7	9.4	2.00	49.9
330.0	150.0	150.0	330.0	35.0	4.0	6.7	9.4	2.00	33.0
340.0	150.0	150.0	340.0	35.0	4.0	6.7	9.4	2.00	13.8
350.0	150.0	150.0	350.0	35.0	4.0	6.7	9.4	2.00	16.9
360.0	150.0	150.0	360.0	35.0	4.0	6.7	9.4	2.00	41.6

6.35.2 Relative contributions of force components

Case 35 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	57.9	26.6	-4.8	0.0	20.3	100.0
10.0	51.3	23.1	7.9	0.0	17.7	100.0
20.0	45.4	20.2	18.9	0.0	15.5	100.0
30.0	40.2	17.7	28.5	0.0	13.6	100.0
40.0	35.7	15.6	36.8	0.0	12.0	100.0
50.0	31.9	13.8	43.5	0.0	10.7	100.0
60.0	29.0	12.5	48.7	0.0	9.7	100.0
70.0	27.0	11.6	52.3	0.0	9.0	100.0
80.0	25.8	11.1	54.5	0.0	8.6	100.0
90.0	25.4	11.0	55.1	0.0	8.5	100.0
100.0	25.8	11.2	54.4	0.0	8.6	100.0
110.0	26.9	11.7	52.3	0.0	9.1	100.0
120.0	28.7	12.7	48.8	0.0	9.8	100.0
130.0	31.3	14.0	44.0	0.0	10.7	100.0
140.0	34.5	15.6	38.0	0.0	11.9	100.0
150.0	38.1	17.5	31.0	0.0	13.4	100.0
160.0	42.0	19.6	23.4	0.0	14.9	100.0
170.0	46.1	21.9	15.4	0.0	16.6	100.0
180.0	50.3	24.3	6.9	0.0	18.4	100.0
190.0	54.4	27.0	-1.7	0.0	20.3	100.0
200.0	58.3	29.9	-10.5	0.0	22.4	100.0
210.0	60.6	32.0	-17.4	0.0	24.2	100.0
220.0	57.6	33.1	-15.9	0.0	24.7	100.0
230.0	53.0	32.9	-12.9	0.0	25.3	100.0
240.0	49.0	32.9	-11.7	0.0	25.5	100.0
250.0	45.7	32.9	-10.8	0.0	25.6	100.0
260.0	43.0	32.9	-10.0	0.0	25.7	100.0
270.0	40.7	32.9	-9.2	0.0	25.7	100.0
280.0	38.9	32.9	-8.5	0.0	25.7	100.0
290.0	37.5	32.9	-7.9	0.0	25.6	100.0
300.0	36.4	32.9	-7.4	0.0	25.5	100.0
310.0	35.6	32.9	-6.9	0.0	25.4	100.0
320.0	35.0	32.9	-6.5	0.0	25.3	100.0
330.0	34.6	32.9	-6.1	0.0	25.2	100.0
340.0	34.3	32.9	-5.8	0.0	25.1	100.0
350.0	34.1	32.9	-5.5	0.0	25.0	100.0
360.0	57.9	26.6	-4.8	0.0	20.3	100.0

6.35.3 Environment forces

Case 35 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.3	6.1	-3.6	0.0	4.3	15.1
10.0	8.3	6.1	-3.6	0.0	4.3	15.1
20.0	8.3	6.1	-3.5	0.0	4.3	15.2
30.0	8.3	6.1	-3.2	0.0	4.3	15.5
40.0	8.3	6.1	-2.8	0.0	4.3	15.9
50.0	8.3	6.1	-2.3	0.0	4.3	16.4
60.0	8.3	6.1	-1.6	0.0	4.3	17.1
70.0	8.3	6.1	-0.9	0.0	4.3	17.8
80.0	8.3	6.1	-0.1	0.0	4.3	18.6
90.0	8.3	6.1	0.7	0.0	4.3	19.4
100.0	8.3	6.1	1.5	0.0	4.3	20.2
110.0	8.3	6.1	2.3	0.0	4.3	21.0
120.0	8.3	6.1	3.0	0.0	4.3	21.7
130.0	8.3	6.1	3.5	0.0	4.3	22.2
140.0	8.3	6.1	4.0	0.0	4.3	22.7
150.0	8.3	6.1	4.3	0.0	4.3	23.0
160.0	8.3	6.1	4.4	0.0	4.3	23.1
170.0	8.3	6.1	4.4	0.0	4.3	23.1
180.0	8.3	6.1	4.3	0.0	4.3	23.0
190.0	8.3	6.1	4.4	0.0	4.3	23.1
200.0	8.3	6.1	4.4	0.0	4.3	23.1
210.0	8.3	6.1	4.3	0.0	4.3	23.0
220.0	8.3	6.1	4.0	0.0	4.3	22.7
230.0	8.3	6.1	3.5	0.0	4.3	22.2
240.0	8.3	6.1	3.0	0.0	4.3	21.7
250.0	8.3	6.1	2.3	0.0	4.3	21.0
260.0	8.3	6.1	1.5	0.0	4.3	20.2
270.0	8.3	6.1	0.7	0.0	4.3	19.4
280.0	8.3	6.1	-0.1	0.0	4.3	18.6
290.0	8.3	6.1	-0.9	0.0	4.3	17.8
300.0	8.3	6.1	-1.6	0.0	4.3	17.1
310.0	8.3	6.1	-2.3	0.0	4.3	16.4
320.0	8.3	6.1	-2.8	0.0	4.3	15.9
330.0	8.3	6.1	-3.2	0.0	4.3	15.5
340.0	8.3	6.1	-3.5	0.0	4.3	15.2
350.0	8.3	6.1	-3.6	0.0	4.3	15.1
360.0	8.3	6.1	-3.6	0.0	4.3	15.1

Case 35 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-17.7	-7.0	0.0	0.0	-5.5	-30.2
10.0	-17.7	-7.0	-4.8	0.0	-5.5	-35.0
20.0	-17.7	-7.0	-10.0	0.0	-5.5	-40.2
30.0	-17.7	-7.0	-15.6	0.0	-5.5	-45.8
40.0	-17.7	-7.0	-21.7	0.0	-5.5	-51.9
50.0	-17.7	-7.0	-28.0	0.0	-5.5	-58.2
60.0	-17.7	-7.0	-33.8	0.0	-5.5	-64.0
70.0	-17.7	-7.0	-38.7	0.0	-5.5	-68.8
80.0	-17.7	-7.0	-41.9	0.0	-5.5	-72.0
90.0	-17.7	-7.0	-43.0	0.0	-5.5	-73.2
100.0	-17.7	-7.0	-41.9	0.0	-5.5	-72.0
110.0	-17.7	-7.0	-38.7	0.0	-5.5	-68.8
120.0	-17.7	-7.0	-33.8	0.0	-5.5	-64.0
130.0	-17.7	-7.0	-28.0	0.0	-5.5	-58.2
140.0	-17.7	-7.0	-21.7	0.0	-5.5	-51.9
150.0	-17.7	-7.0	-15.6	0.0	-5.5	-45.8
160.0	-17.7	-7.0	-10.0	0.0	-5.5	-40.2
170.0	-17.7	-7.0	-4.8	0.0	-5.5	-35.0
180.0	-17.7	-7.0	0.0	0.0	-5.5	-30.2
190.0	-17.7	-7.0	4.8	0.0	-5.5	-25.3
200.0	-17.7	-7.0	10.0	0.0	-5.5	-20.2
210.0	-17.7	-7.0	15.6	0.0	-5.5	-14.5
220.0	-17.7	-7.0	21.7	0.0	-5.5	-8.4
230.0	-17.7	-7.0	28.0	0.0	5.5	8.8
240.0	-17.7	-7.0	33.8	0.0	5.5	14.7
250.0	-17.7	-7.0	38.7	0.0	5.5	19.5
260.0	-17.7	-7.0	41.9	0.0	5.5	22.7
270.0	-17.7	-7.0	43.0	0.0	5.5	23.8
280.0	-17.7	-7.0	41.9	0.0	5.5	22.7
290.0	-17.7	-7.0	38.7	0.0	5.5	19.5
300.0	-17.7	-7.0	33.8	0.0	5.5	14.7
310.0	-17.7	-7.0	28.0	0.0	5.5	8.8
320.0	-17.7	-7.0	21.7	0.0	-5.5	-8.4
330.0	-17.7	-7.0	15.6	0.0	-5.5	-14.5
340.0	-17.7	-7.0	10.0	0.0	-5.5	-20.2
350.0	-17.7	-7.0	4.8	0.0	-5.5	-25.3
360.0	-17.7	-7.0	0.0	0.0	-5.5	-30.2

Case 35 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	246.7	173.4	0.0	0.0	126.3	546.4
10.0	246.7	173.4	-316.6	0.0	126.3	229.8
20.0	246.7	173.4	-593.0	0.0	-126.3	-299.1
30.0	246.7	173.4	-793.7	0.0	-126.3	-499.9
40.0	246.7	173.4	-892.8	0.0	-126.3	-599.0
50.0	246.7	173.4	-876.4	0.0	-126.3	-582.6
60.0	246.7	173.4	-745.2	0.0	-126.3	-451.4
70.0	246.7	173.4	-513.8	0.0	-126.3	-220.0
80.0	246.7	173.4	-209.2	0.0	126.3	337.2
90.0	246.7	173.4	132.4	0.0	126.3	678.8
100.0	246.7	173.4	470.0	0.0	126.3	1016.4
110.0	246.7	173.4	762.6	0.0	126.3	1309.0
120.0	246.7	173.4	974.5	0.0	126.3	1520.9
130.0	246.7	173.4	1079.2	0.0	126.3	1635.7
140.0	246.7	173.4	1063.0	0.0	126.3	1602.4
150.0	246.7	173.4	926.1	0.0	126.3	1472.3
160.0	246.7	173.4	683.5	0.0	126.3	1229.9
170.0	246.7	173.4	362.6	0.0	126.3	909.0
180.0	246.7	173.4	0.0	0.0	126.3	546.4
190.0	246.7	173.4	-362.6	0.0	126.3	183.8
200.0	246.7	173.4	-683.5	0.0	-126.3	-389.7
210.0	246.7	173.4	-926.1	0.0	-126.3	-632.3
220.0	246.7	173.4	-1063.0	0.0	-126.3	-769.1
230.0	246.7	173.4	-1079.2	0.0	-126.3	-785.4
240.0	246.7	173.4	-974.5	0.0	-126.3	-680.7
250.0	246.7	173.4	-762.6	0.0	-126.3	-468.8
260.0	246.7	173.4	-470.0	0.0	-126.3	-176.2
270.0	246.7	173.4	-132.4	0.0	126.3	414.0
280.0	246.7	173.4	209.2	0.0	126.3	755.6
290.0	246.7	173.4	513.8	0.0	126.3	1060.2
300.0	246.7	173.4	745.2	0.0	126.3	1291.6
310.0	246.7	173.4	876.4	0.0	126.3	1422.8
320.0	246.7	173.4	892.8	0.0	126.3	1439.2
330.0	246.7	173.4	793.7	0.0	126.3	1340.1
340.0	246.7	173.4	593.0	0.0	126.3	1139.4
350.0	246.7	173.4	316.6	0.0	126.3	863.0
360.0	246.7	173.4	0.0	0.0	126.3	546.4

6.35.4 Thruster use

Case 35 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	10.6	110.2	14.9	140.2	10.7	90.0	33.7	116.6
10.0	12.6	48.8	25.3	157.8	16.0	90.0	38.1	113.3
20.0	75.4	17.5	86.8	180.0	16.0	90.0	41.5	111.0
30.0	76.9	14.1	86.6	180.0	16.2	90.0	36.9	109.0
40.0	77.9	12.6	86.4	180.0	16.4	90.0	34.9	107.3
50.0	78.3	12.9	86.2	180.0	16.8	90.0	35.7	106.1
60.0	78.5	15.2	86.0	180.0	17.3	90.0	39.2	105.2
70.0	78.9	18.7	85.9	180.0	17.1	90.0	43.7	104.7
80.0	80.5	27.1	85.8	180.0	16.9	90.0	55.4	104.8
90.0	82.1	32.1	85.7	180.0	16.7	90.0	62.5	105.1
100.0	82.2	37.6	84.2	180.0	16.7	90.0	69.6	105.9
110.0	52.9	31.5	70.4	159.7	16.8	90.0	72.0	107.0
120.0	24.7	80.6	34.3	138.5	17.0	90.0	67.6	108.7
130.0	24.1	108.7	26.0	123.9	13.7	90.0	62.3	110.9
140.0	23.3	113.2	24.3	123.8	10.3	90.0	56.6	113.6
150.0	21.6	117.3	22.4	125.8	8.4	90.0	51.2	116.6
160.0	19.2	121.1	20.4	130.4	8.2	90.0	46.3	120.0
170.0	16.4	125.2	18.6	137.6	9.1	90.0	42.0	123.5
180.0	13.3	130.7	17.1	147.1	10.8	90.0	37.9	127.3
190.0	10.4	139.9	16.4	158.0	12.5	90.0	34.3	132.4
200.0	6.8	164.1	16.6	174.1	16.6	90.0	30.7	138.9
210.0	6.4	188.1	16.7	183.0	16.3	90.0	27.2	147.7
220.0	6.9	205.6	16.7	190.2	14.4	90.0	24.2	159.6
230.0	11.0	216.5	15.0	205.9	4.5	90.0	23.9	201.6
240.0	12.4	215.0	12.7	212.7	-0.1	90.0	26.2	214.1
250.0	13.8	209.3	7.5	218.3	-5.5	90.0	28.6	222.9
260.0	15.0	207.5	8.7	223.2	-11.0	90.0	30.4	228.3
270.0	11.7	186.0	12.7	342.7	-16.7	90.0	30.7	230.8
280.0	16.0	182.7	37.9	355.3	-16.9	90.0	29.3	230.6
290.0	68.7	180.9	50.9	358.5	-17.1	90.0	26.4	227.6
300.0	67.3	179.0	50.2	1.6	-17.3	90.0	22.5	220.6
310.0	57.6	176.2	41.3	5.8	-16.8	90.0	18.7	208.2
320.0	17.3	130.1	9.6	119.8	-13.1	90.0	18.0	152.1
330.0	16.6	127.2	11.1	119.8	-8.3	90.0	21.3	136.9
340.0	15.0	127.6	12.3	119.8	-2.3	90.0	25.3	127.1
350.0	12.8	121.6	13.4	129.0	4.0	90.0	29.5	120.8
360.0	10.6	110.2	14.9	140.2	10.7	90.0	33.7	116.6

@IDR5

Preliminary Design

6.35.5 Thruster loss

Case 35 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.92	0.88	0.81
10.0	0.86	0.86	0.80
20.0	0.84	0.77	0.80
30.0	0.85	0.77	0.81
40.0	0.85	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.87	0.76	0.84
90.0	0.88	0.76	0.83
100.0	0.88	0.75	0.84
110.0	0.91	0.80	0.84
120.0	0.86	0.80	0.85
130.0	0.84	0.80	0.85
140.0	0.85	0.80	0.85
150.0	0.85	0.80	0.86
160.0	0.86	0.81	0.87
170.0	0.86	0.81	0.88
180.0	0.86	0.80	0.90
190.0	0.86	0.79	0.90
200.0	0.81	0.73	0.90
210.0	0.74	0.72	0.90
220.0	0.79	0.78	0.91
230.0	0.80	0.83	0.92
240.0	0.80	0.83	0.85
250.0	0.81	0.84	0.84
260.0	0.81	0.85	0.84
270.0	0.79	0.90	0.83
280.0	0.78	0.91	0.84
290.0	0.77	0.90	0.85
300.0	0.78	0.89	0.86
310.0	0.80	0.87	0.84
320.0	0.93	0.89	0.82
330.0	0.93	0.89	0.81
340.0	0.93	0.88	0.80
350.0	0.93	0.88	0.81
360.0	0.92	0.88	0.81

Preliminary Design, @IDR5

6.36 Case 36 - Thrust Utilization: 35 knots wind @ 160 deg, 2 knots current, Sea State 5

6.36.1 Environment and thrust utilisation

Case 36 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	160.0	160.0	0.0	35.0	4.0	6.7	9.4	2.00	22.9
10.0	160.0	160.0	10.0	35.0	4.0	6.7	9.4	2.00	48.3
20.0	160.0	160.0	20.0	35.0	4.0	6.7	9.4	2.00	80.6
30.0	160.0	160.0	30.0	35.0	4.0	6.7	9.4	2.00	> 100.0
40.0	160.0	160.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	160.0	160.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	160.0	160.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	160.0	160.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	160.0	160.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	160.0	160.0	90.0	35.0	4.0	6.7	9.4	2.00	> 100.0
100.0	160.0	160.0	100.0	35.0	4.0	6.7	9.4	2.00	90.5
110.0	160.0	160.0	110.0	35.0	4.0	6.7	9.4	2.00	70.9
120.0	160.0	160.0	120.0	35.0	4.0	6.7	9.4	2.00	50.8
130.0	160.0	160.0	130.0	35.0	4.0	6.7	9.4	2.00	34.4
140.0	160.0	160.0	140.0	35.0	4.0	6.7	9.4	2.00	24.9
150.0	160.0	160.0	150.0	35.0	4.0	6.7	9.4	2.00	21.3
160.0	160.0	160.0	160.0	35.0	4.0	6.7	9.4	2.00	18.6
170.0	160.0	160.0	170.0	35.0	4.0	6.7	9.4	2.00	18.6
180.0	160.0	160.0	180.0	35.0	4.0	6.7	9.4	2.00	24.6
190.0	160.0	160.0	190.0	35.0	4.0	6.7	9.4	2.00	39.9
200.0	160.0	160.0	200.0	35.0	4.0	6.7	9.4	2.00	43.6
210.0	160.0	160.0	210.0	35.0	4.0	6.7	9.4	2.00	28.8
220.0	160.0	160.0	220.0	35.0	4.0	6.7	9.4	2.00	21.4
230.0	160.0	160.0	230.0	35.0	4.0	6.7	9.4	2.00	15.5
240.0	160.0	160.0	240.0	35.0	4.0	6.7	9.4	2.00	17.2
250.0	160.0	160.0	250.0	35.0	4.0	6.7	9.4	2.00	36.6
260.0	160.0	160.0	260.0	35.0	4.0	6.7	9.4	2.00	56.3
270.0	160.0	160.0	270.0	35.0	4.0	6.7	9.4	2.00	81.8
280.0	160.0	160.0	280.0	35.0	4.0	6.7	9.4	2.00	94.1
290.0	160.0	160.0	290.0	35.0	4.0	6.7	9.4	2.00	99.6
300.0	160.0	160.0	300.0	35.0	4.0	6.7	9.4	2.00	99.7
310.0	160.0	160.0	310.0	35.0	4.0	6.7	9.4	2.00	95.1
320.0	160.0	160.0	320.0	35.0	4.0	6.7	9.4	2.00	84.0
330.0	160.0	160.0	330.0	35.0	4.0	6.7	9.4	2.00	66.8
340.0	160.0	160.0	340.0	35.0	4.0	6.7	9.4	2.00	30.5
350.0	160.0	160.0	350.0	35.0	4.0	6.7	9.4	2.00	11.1
360.0	160.0	160.0	360.0	35.0	4.0	6.7	9.4	2.00	23.4

6.36.2 Relative contributions of force components

Case 36 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	56.9	30.0	-9.4	0.0	22.5	100.0
10.0	49.0	24.8	7.4	0.0	18.8	100.0
20.0	41.9	20.6	21.8	0.0	15.7	100.0
30.0	35.8	17.1	34.0	0.0	13.1	100.0
40.0	30.7	14.4	43.9	0.0	11.1	100.0
50.0	26.7	12.3	51.5	0.0	9.5	100.0
60.0	23.7	10.8	57.1	0.0	8.4	100.0
70.0	21.7	9.8	60.8	0.0	7.7	100.0
80.0	20.6	9.3	62.9	0.0	7.2	100.0
90.0	20.2	9.2	63.5	0.0	7.1	100.0
100.0	20.6	9.4	62.7	0.0	7.3	100.0
110.0	21.7	10.0	60.5	0.0	7.8	100.0
120.0	23.6	11.1	56.8	0.0	8.6	100.0
130.0	26.2	12.6	51.5	0.0	9.7	100.0
140.0	29.5	14.6	44.8	0.0	11.1	100.0
150.0	33.3	17.0	36.9	0.0	12.8	100.0
160.0	37.3	19.6	28.4	0.0	14.7	100.0
170.0	41.1	22.4	19.7	0.0	16.7	100.0
180.0	44.7	25.4	11.2	0.0	18.7	100.0
190.0	46.8	27.9	5.0	0.0	20.3	100.0
200.0	46.4	29.7	2.7	0.0	21.3	100.0
210.0	26.9	23.5	28.5	0.0	20.8	100.0
220.0	12.8	6.1	48.9	0.0	21.6	100.0
230.0	3.9	9.9	69.0	0.0	20.2	100.0
240.0	-1.5	5.0	83.7	0.0	17.9	100.0
250.0	-10.4	2.0	92.5	0.0	15.9	100.0
260.0	-12.4	0.4	97.3	0.0	14.7	100.0
270.0	-13.4	-0.3	99.5	0.0	14.3	100.0
280.0	-14.0	-0.4	99.6	0.0	14.8	100.0
290.0	-14.1	0.3	97.4	0.0	16.4	100.0
300.0	-12.8	2.4	91.0	0.0	19.4	100.0
310.0	-7.5	7.2	76.4	0.0	23.9	100.0
320.0	6.7	17.2	46.9	0.0	29.2	100.0
330.0	33.4	32.1	3.2	0.0	31.3	100.0
340.0	70.7	42.6	-44.3	0.0	31.0	100.0
350.0	65.3	36.3	-28.4	0.0	26.9	100.0
360.0	56.9	30.0	-9.4	0.0	22.5	100.0

6.36.3 Environment forces

Case 36 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.2	6.4	-3.6	0.0	4.4	15.4
10.0	8.2	6.4	-3.6	0.0	4.4	15.4
20.0	8.2	6.4	-3.5	0.0	4.4	15.6
30.0	8.2	6.4	-3.2	0.0	4.4	15.8
40.0	8.2	6.4	-2.8	0.0	4.4	16.2
50.0	8.2	6.4	-2.3	0.0	4.4	16.8
60.0	8.2	6.4	-1.6	0.0	4.4	17.4
70.0	8.2	6.4	-0.9	0.0	4.4	18.1
80.0	8.2	6.4	-0.1	0.0	4.4	18.9
90.0	8.2	6.4	0.7	0.0	4.4	19.7
100.0	8.2	6.4	1.5	0.0	4.4	20.6
110.0	8.2	6.4	2.3	0.0	4.4	21.3
120.0	8.2	6.4	3.0	0.0	4.4	22.0
130.0	8.2	6.4	3.5	0.0	4.4	22.6
140.0	8.2	6.4	4.0	0.0	4.4	23.0
150.0	8.2	6.4	4.3	0.0	4.4	23.3
160.0	8.2	6.4	4.4	0.0	4.4	23.5
170.0	8.2	6.4	4.4	0.0	4.4	23.5
180.0	8.2	6.4	4.3	0.0	4.4	23.3
190.0	8.2	6.4	4.4	0.0	4.4	23.5
200.0	8.2	6.4	4.4	0.0	4.4	23.5
210.0	8.2	6.4	4.3	0.0	4.4	23.3
220.0	8.2	6.4	4.0	0.0	4.4	23.0
230.0	8.2	6.4	3.5	0.0	4.4	22.6
240.0	8.2	6.4	3.0	0.0	4.4	22.0
250.0	8.2	6.4	2.3	0.0	4.4	21.3
260.0	8.2	6.4	1.5	0.0	4.4	20.6
270.0	8.2	6.4	0.7	0.0	4.4	19.7
280.0	8.2	6.4	-0.1	0.0	4.4	18.9
290.0	8.2	6.4	-0.9	0.0	4.4	18.1
300.0	8.2	6.4	-1.6	0.0	4.4	17.4
310.0	8.2	6.4	-2.3	0.0	4.4	16.8
320.0	8.2	6.4	-2.8	0.0	4.4	16.2
330.0	8.2	6.4	-3.2	0.0	4.4	15.8
340.0	8.2	6.4	-3.5	0.0	4.4	15.6
350.0	8.2	6.4	-3.6	0.0	4.4	15.4
360.0	8.2	6.4	-3.6	0.0	4.4	15.4

Case 36 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-11.1	-4.2	0.0	0.0	-3.4	-18.7
10.0	-11.1	-4.2	-4.8	0.0	-3.4	-23.6
20.0	-11.1	-4.2	-10.0	0.0	-3.4	-28.7
30.0	-11.1	-4.2	-15.6	0.0	-3.4	-34.4
40.0	-11.1	-4.2	-21.7	0.0	-3.4	-40.5
50.0	-11.1	-4.2	-28.0	0.0	-3.4	-46.7
60.0	-11.1	-4.2	-33.8	0.0	-3.4	-52.6
70.0	-11.1	-4.2	-38.7	0.0	-3.4	-57.4
80.0	-11.1	-4.2	-41.9	0.0	-3.4	-60.6
90.0	-11.1	-4.2	-43.0	0.0	-3.4	-61.7
100.0	-11.1	-4.2	-41.9	0.0	-3.4	-60.6
110.0	-11.1	-4.2	-38.7	0.0	-3.4	-57.4
120.0	-11.1	-4.2	-33.8	0.0	-3.4	-52.6
130.0	-11.1	-4.2	-28.0	0.0	-3.4	-46.7
140.0	-11.1	-4.2	-21.7	0.0	-3.4	-40.5
150.0	-11.1	-4.2	-15.6	0.0	-3.4	-34.4
160.0	-11.1	-4.2	-10.0	0.0	-3.4	-28.7
170.0	-11.1	-4.2	-4.8	0.0	-3.4	-23.6
180.0	-11.1	-4.2	0.0	0.0	-3.4	-18.7
190.0	-11.1	-4.2	4.8	0.0	-3.4	-13.9
200.0	-11.1	-4.2	10.0	0.0	-3.4	-8.7
210.0	-11.1	-4.2	15.6	0.0	3.4	3.8
220.0	-11.1	-4.2	21.7	0.0	3.4	9.9
230.0	-11.1	-4.2	28.0	0.0	3.4	16.1
240.0	-11.1	-4.2	33.8	0.0	3.4	22.0
250.0	-11.1	-4.2	38.7	0.0	3.4	26.8
260.0	-11.1	-4.2	41.9	0.0	3.4	30.0
270.0	-11.1	-4.2	43.0	0.0	3.4	31.1
280.0	-11.1	-4.2	41.9	0.0	3.4	30.0
290.0	-11.1	-4.2	38.7	0.0	3.4	26.8
300.0	-11.1	-4.2	33.8	0.0	3.4	22.0
310.0	-11.1	-4.2	28.0	0.0	3.4	16.1
320.0	-11.1	-4.2	21.7	0.0	3.4	9.9
330.0	-11.1	-4.2	15.6	0.0	3.4	3.8
340.0	-11.1	-4.2	10.0	0.0	-3.4	-8.7
350.0	-11.1	-4.2	4.8	0.0	-3.4	-13.9
360.0	-11.1	-4.2	0.0	0.0	-3.4	-18.7

Case 36 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	193.5	133.0	0.0	0.0	95.6	422.1
10.0	193.5	133.0	-316.6	0.0	95.6	105.5
20.0	193.5	133.0	-593.0	0.0	-95.6	-362.1
30.0	193.5	133.0	-793.7	0.0	-95.6	-562.8
40.0	193.5	133.0	-892.8	0.0	-95.6	-661.9
50.0	193.5	133.0	-876.4	0.0	-95.6	-645.6
60.0	193.5	133.0	-745.2	0.0	-95.6	-514.4
70.0	193.5	133.0	-513.8	0.0	-95.6	-283.0
80.0	193.5	133.0	-209.2	0.0	95.6	212.9
90.0	193.5	133.0	132.4	0.0	95.6	554.5
100.0	193.5	133.0	470.0	0.0	95.6	892.1
110.0	193.5	133.0	762.6	0.0	95.6	1184.7
120.0	193.5	133.0	974.5	0.0	95.6	1396.6
130.0	193.5	133.0	1079.2	0.0	95.6	1591.3
140.0	193.5	133.0	1063.0	0.0	95.6	1485.1
150.0	193.5	133.0	926.1	0.0	95.6	1318.2
160.0	193.5	133.0	683.5	0.0	95.6	1105.6
170.0	193.5	133.0	362.6	0.0	95.6	784.7
180.0	193.5	133.0	0.0	0.0	95.6	422.1
190.0	193.5	133.0	-362.6	0.0	-95.6	-131.7
200.0	193.5	133.0	-683.5	0.0	-95.6	-452.7
210.0	193.5	133.0	-926.1	0.0	-95.6	-695.2
220.0	193.5	133.0	-1063.0	0.0	-95.6	-832.1
230.0	193.5	133.0	-1079.2	0.0	-95.6	-848.4
240.0	193.5	133.0	-974.5	0.0	-95.6	-743.7
250.0	193.5	133.0	-762.6	0.0	-95.6	-531.8
260.0	193.5	133.0	-470.0	0.0	-95.6	-239.1
270.0	193.5	133.0	-132.4	0.0	95.6	289.7
280.0	193.5	133.0	209.2	0.0	95.6	631.3
290.0	193.5	133.0	513.8	0.0	95.6	935.9
300.0	193.5	133.0	745.2	0.0	95.6	1167.3
310.0	193.5	133.0	876.4	0.0	95.6	1298.5
320.0	193.5	133.0	892.8	0.0	95.6	1314.9
330.0	193.5	133.0	793.7	0.0	95.6	1215.8
340.0	193.5	133.0	593.0	0.0	95.6	1015.1
350.0	193.5	133.0	316.6	0.0	95.6	738.7
360.0	193.5	133.0	0.0	0.0	95.6	422.1

6.36.4 Thruster use

Case 36 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	8.9	131.1	11.5	146.3	5.6	90.0	24.3	129.5
10.0	6.5	116.3	13.7	156.4	12.2	90.0	28.2	123.2
20.0	35.5	10.5	50.8	173.0	16.0	90.0	32.7	118.5
30.0	73.0	13.4	86.6	180.0	16.2	90.0	36.6	115.2
40.0	75.1	11.7	86.4	180.0	16.4	90.0	34.2	112.2
50.0	75.9	12.1	86.2	180.0	16.8	90.0	34.9	110.1
60.0	76.2	14.4	86.0	180.0	17.3	90.0	38.3	108.6
70.0	76.5	18.0	85.9	180.0	17.1	90.0	42.8	107.8
80.0	77.4	25.9	85.8	180.0	16.9	90.0	53.1	107.7
90.0	78.5	31.2	85.8	180.0	16.7	90.0	60.4	108.0
100.0	54.0	25.4	72.4	163.4	16.7	90.0	64.0	108.7
110.0	22.3	69.8	35.0	145.9	16.8	90.0	61.2	110.4
120.0	21.5	110.5	24.0	127.0	13.3	90.0	57.0	112.7
130.0	21.8	116.2	22.6	124.9	8.6	90.0	51.9	115.8
140.0	21.2	121.4	20.9	124.8	5.2	90.0	46.5	119.6
150.0	19.8	126.5	19.0	127.4	3.4	90.0	41.5	124.1
160.0	17.7	131.9	17.1	133.1	3.1	90.0	37.1	129.3
170.0	15.1	138.3	15.5	142.2	4.0	90.0	33.3	134.9
180.0	12.4	147.2	14.4	154.0	5.7	90.0	29.1	141.3
190.0	9.2	166.6	14.7	172.1	9.8	90.0	27.3	149.4
200.0	8.3	186.8	15.2	183.7	10.7	90.0	25.0	159.6
210.0	10.3	209.3	15.2	199.6	6.4	90.0	23.6	189.2
220.0	11.6	217.5	15.6	207.9	4.5	90.0	25.0	203.3
230.0	13.1	219.9	15.3	215.1	1.1	90.0	27.7	215.6
240.0	14.6	218.0	14.1	221.8	-3.6	90.0	31.1	225.0
250.0	15.9	213.2	12.1	228.8	-9.0	90.0	34.3	231.5
260.0	17.1	203.7	9.5	236.4	-14.4	90.0	36.4	235.6
270.0	18.0	187.5	32.7	346.5	-16.7	90.0	36.9	237.6
280.0	16.3	184.6	57.9	353.0	-16.9	90.0	35.5	237.8
290.0	87.9	182.9	70.0	355.8	-17.1	90.0	32.1	235.9
300.0	86.3	180.0	69.0	356.3	-17.3	90.0	27.9	231.3
310.0	77.5	179.8	60.8	0.3	-16.8	90.0	23.3	223.9
320.0	54.9	176.7	38.8	5.0	-16.4	90.0	19.0	211.3
330.0	22.3	163.6	8.3	47.6	-16.2	90.0	16.3	193.5
340.0	14.2	142.5	8.7	119.8	-7.4	90.0	17.9	150.7
350.0	11.7	139.4	9.8	132.0	-1.0	90.0	20.8	138.0
360.0	8.9	131.1	11.5	146.3	5.6	90.0	24.3	129.5

6.36.5 Thruster loss

Case 36 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.93	0.88	0.81
10.0	0.92	0.87	0.80
20.0	0.85	0.81	0.80
30.0	0.85	0.77	0.81
40.0	0.85	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.87	0.76	0.84
90.0	0.88	0.76	0.83
100.0	0.90	0.80	0.84
110.0	0.86	0.80	0.84
120.0	0.84	0.80	0.85
130.0	0.84	0.80	0.85
140.0	0.84	0.80	0.85
150.0	0.84	0.80	0.86
160.0	0.85	0.80	0.87
170.0	0.85	0.80	0.88
180.0	0.84	0.79	0.90
190.0	0.79	0.74	0.90
200.0	0.73	0.72	0.90
210.0	0.79	0.80	0.90
220.0	0.80	0.82	0.91
230.0	0.80	0.83	0.92
240.0	0.80	0.84	0.85
250.0	0.81	0.84	0.84
260.0	0.82	0.84	0.84
270.0	0.80	0.91	0.83
280.0	0.79	0.90	0.84
290.0	0.78	0.90	0.85
300.0	0.77	0.88	0.86
310.0	0.77	0.88	0.84
320.0	0.80	0.86	0.82
330.0	0.88	0.86	0.81
340.0	0.93	0.88	0.80
350.0	0.93	0.88	0.80
360.0	0.93	0.88	0.81

Preliminary Design, @IDR5

6.37 Case 37 - Thrust Utilization: 35 knots wind @ 170 deg, 2 knots current, Sea State 5

6.37.1 Environment and thrust utilisation

Case 37 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	170.0	170.0	0.0	35.0	4.0	6.7	9.4	2.00	11.1
10.0	170.0	170.0	10.0	35.0	4.0	6.7	9.4	2.00	40.8
20.0	170.0	170.0	20.0	35.0	4.0	6.7	9.4	2.00	64.2
30.0	170.0	170.0	30.0	35.0	4.0	6.7	9.4	2.00	84.9
40.0	170.0	170.0	40.0	35.0	4.0	6.7	9.4	2.00	> 100.0
50.0	170.0	170.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	170.0	170.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	170.0	170.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	170.0	170.0	80.0	35.0	4.0	6.7	9.4	2.00	> 100.0
90.0	170.0	170.0	90.0	35.0	4.0	6.7	9.4	2.00	94.4
100.0	170.0	170.0	100.0	35.0	4.0	6.7	9.4	2.00	77.7
110.0	170.0	170.0	110.0	35.0	4.0	6.7	9.4	2.00	58.3
120.0	170.0	170.0	120.0	35.0	4.0	6.7	9.4	2.00	38.3
130.0	170.0	170.0	130.0	35.0	4.0	6.7	9.4	2.00	23.1
140.0	170.0	170.0	140.0	35.0	4.0	6.7	9.4	2.00	19.8
150.0	170.0	170.0	150.0	35.0	4.0	6.7	9.4	2.00	18.3
160.0	170.0	170.0	160.0	35.0	4.0	6.7	9.4	2.00	16.4
170.0	170.0	170.0	170.0	35.0	4.0	6.7	9.4	2.00	14.8
180.0	170.0	170.0	180.0	35.0	4.0	6.7	9.4	2.00	13.8
190.0	170.0	170.0	190.0	35.0	4.0	6.7	9.4	2.00	24.0
200.0	170.0	170.0	200.0	35.0	4.0	6.7	9.4	2.00	20.4
210.0	170.0	170.0	210.0	35.0	4.0	6.7	9.4	2.00	19.2
220.0	170.0	170.0	220.0	35.0	4.0	6.7	9.4	2.00	15.9
230.0	170.0	170.0	230.0	35.0	4.0	6.7	9.4	2.00	16.5
240.0	170.0	170.0	240.0	35.0	4.0	6.7	9.4	2.00	25.5
250.0	170.0	170.0	250.0	35.0	4.0	6.7	9.4	2.00	45.5
260.0	170.0	170.0	260.0	35.0	4.0	6.7	9.4	2.00	65.0
270.0	170.0	170.0	270.0	35.0	4.0	6.7	9.4	2.00	86.6
280.0	170.0	170.0	280.0	35.0	4.0	6.7	9.4	2.00	99.0
290.0	170.0	170.0	290.0	35.0	4.0	6.7	9.4	2.00	> 100.0
300.0	170.0	170.0	300.0	35.0	4.0	6.7	9.4	2.00	> 100.0
310.0	170.0	170.0	310.0	35.0	4.0	6.7	9.4	2.00	99.8
320.0	170.0	170.0	320.0	35.0	4.0	6.7	9.4	2.00	88.8
330.0	170.0	170.0	330.0	35.0	4.0	6.7	9.4	2.00	71.9
340.0	170.0	170.0	340.0	35.0	4.0	6.7	9.4	2.00	51.2
350.0	170.0	170.0	350.0	35.0	4.0	6.7	9.4	2.00	20.4
360.0	170.0	170.0	360.0	35.0	4.0	6.7	9.4	2.00	11.2

6.37.2 Relative contributions of force components

Case 37 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	54.0	37.2	-17.6	0.0	26.4	100.0
10.0	46.2	29.9	2.4	0.0	21.5	100.0
20.0	37.7	23.1	22.4	0.0	16.9	100.0
30.0	30.2	17.6	39.1	0.0	13.1	100.0
40.0	24.4	13.7	51.7	0.0	10.2	100.0
50.0	20.1	10.9	60.7	0.0	8.3	100.0
60.0	17.2	9.1	66.7	0.0	7.0	100.0
70.0	15.3	8.0	70.5	0.0	6.1	100.0
80.0	14.3	7.5	72.5	0.0	5.7	100.0
90.0	14.0	7.4	73.0	0.0	5.6	100.0
100.0	14.5	7.7	72.0	0.0	5.8	100.0
110.0	15.6	8.4	69.6	0.0	6.4	100.0
120.0	17.4	9.7	65.5	0.0	7.3	100.0
130.0	20.2	11.6	59.6	0.0	8.6	100.0
140.0	23.7	14.2	51.7	0.0	10.4	100.0
150.0	27.7	17.4	42.2	0.0	12.5	100.0
160.0	31.9	20.9	32.2	0.0	15.0	100.0
170.0	35.4	24.3	23.1	0.0	17.2	100.0
180.0	37.6	27.2	16.2	0.0	19.0	100.0
190.0	37.0	28.4	15.1	0.0	19.6	100.0
200.0	28.9	25.4	20.0	0.0	19.6	100.0
210.0	20.8	20.0	39.3	0.0	18.6	100.0
220.0	12.6	5.0	56.0	0.0	16.3	100.0
230.0	3.3	10.4	69.8	0.0	13.5	100.0
240.0	-2.2	7.1	79.5	0.0	11.2	100.0
250.0	-0.2	5.0	85.6	0.0	9.6	100.0
260.0	-1.4	3.8	89.0	0.0	8.6	100.0
270.0	-2.1	3.3	90.5	0.0	8.3	100.0
280.0	-2.3	3.3	90.4	0.0	8.5	100.0
290.0	-1.9	4.0	88.5	0.0	9.4	100.0
300.0	-0.8	5.5	84.1	0.0	11.2	100.0
310.0	2.2	8.6	75.1	0.0	14.2	100.0
320.0	8.6	14.4	58.2	0.0	18.7	100.0
330.0	21.0	23.9	30.5	0.0	24.6	100.0
340.0	38.7	35.5	-3.5	0.0	29.2	100.0
350.0	57.0	42.6	-29.3	0.0	29.6	100.0
360.0	54.0	37.2	-17.6	0.0	26.4	100.0

6.37.3 Environment forces

Case 37 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.1	6.5	-3.6	0.0	4.5	15.5
10.0	8.1	6.5	-3.6	0.0	4.5	15.5
20.0	8.1	6.5	-3.5	0.0	4.5	15.6
30.0	8.1	6.5	-3.2	0.0	4.5	15.9
40.0	8.1	6.5	-2.8	0.0	4.5	16.3
50.0	8.1	6.5	-2.3	0.0	4.5	16.8
60.0	8.1	6.5	-1.6	0.0	4.5	17.4
70.0	8.1	6.5	-0.9	0.0	4.5	18.2
80.0	8.1	6.5	-0.1	0.0	4.5	19.0
90.0	8.1	6.5	0.7	0.0	4.5	19.8
100.0	8.1	6.5	1.5	0.0	4.5	20.6
110.0	8.1	6.5	2.3	0.0	4.5	21.3
120.0	8.1	6.5	3.0	0.0	4.5	22.0
130.0	8.1	6.5	3.5	0.0	4.5	22.6
140.0	8.1	6.5	4.0	0.0	4.5	23.0
150.0	8.1	6.5	4.3	0.0	4.5	23.3
160.0	8.1	6.5	4.4	0.0	4.5	23.5
170.0	8.1	6.5	4.4	0.0	4.5	23.5
180.0	8.1	6.5	4.3	0.0	4.5	23.4
190.0	8.1	6.5	4.4	0.0	4.5	23.5
200.0	8.1	6.5	4.4	0.0	4.5	23.5
210.0	8.1	6.5	4.3	0.0	4.5	23.3
220.0	8.1	6.5	4.0	0.0	4.5	23.0
230.0	8.1	6.5	3.5	0.0	4.5	22.6
240.0	8.1	6.5	3.0	0.0	4.5	22.0
250.0	8.1	6.5	2.3	0.0	4.5	21.3
260.0	8.1	6.5	1.5	0.0	4.5	20.6
270.0	8.1	6.5	0.7	0.0	4.5	19.8
280.0	8.1	6.5	-0.1	0.0	4.5	19.0
290.0	8.1	6.5	-0.9	0.0	4.5	18.2
300.0	8.1	6.5	-1.6	0.0	4.5	17.4
310.0	8.1	6.5	-2.3	0.0	4.5	16.8
320.0	8.1	6.5	-2.8	0.0	4.5	16.3
330.0	8.1	6.5	-3.2	0.0	4.5	15.9
340.0	8.1	6.5	-3.5	0.0	4.5	15.6
350.0	8.1	6.5	-3.6	0.0	4.5	15.5
360.0	8.1	6.5	-3.6	0.0	4.5	15.5

Case 37 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-5.2	-1.9	0.0	0.0	-1.6	-8.7
10.0	-5.2	-1.9	-4.8	0.0	-1.6	-13.6
20.0	-5.2	-1.9	-10.0	0.0	-1.6	-18.7
30.0	-5.2	-1.9	-15.6	0.0	-1.6	-24.4
40.0	-5.2	-1.9	-21.7	0.0	-1.6	-30.5
50.0	-5.2	-1.9	-28.0	0.0	-1.6	-36.7
60.0	-5.2	-1.9	-33.8	0.0	-1.6	-42.6
70.0	-5.2	-1.9	-38.7	0.0	-1.6	-47.4
80.0	-5.2	-1.9	-41.9	0.0	-1.6	-50.6
90.0	-5.2	-1.9	-43.0	0.0	-1.6	-51.7
100.0	-5.2	-1.9	-41.9	0.0	-1.6	-50.6
110.0	-5.2	-1.9	-38.7	0.0	-1.6	-47.4
120.0	-5.2	-1.9	-33.8	0.0	-1.6	-42.6
130.0	-5.2	-1.9	-28.0	0.0	-1.6	-36.7
140.0	-5.2	-1.9	-21.7	0.0	-1.6	-30.5
150.0	-5.2	-1.9	-15.6	0.0	-1.6	-24.4
160.0	-5.2	-1.9	-10.0	0.0	-1.6	-18.7
170.0	-5.2	-1.9	-4.8	0.0	-1.6	-13.6
180.0	-5.2	-1.9	0.0	0.0	-1.6	-8.7
190.0	-5.2	-1.9	4.8	0.0	-1.6	-3.9
200.0	-5.2	-1.9	10.0	0.0	1.6	4.5
210.0	-5.2	-1.9	15.6	0.0	1.6	10.1
220.0	-5.2	-1.9	21.7	0.0	1.6	16.3
230.0	-5.2	-1.9	28.0	0.0	1.6	22.5
240.0	-5.2	-1.9	33.8	0.0	1.6	28.4
250.0	-5.2	-1.9	38.7	0.0	1.6	33.2
260.0	-5.2	-1.9	41.9	0.0	1.6	36.4
270.0	-5.2	-1.9	43.0	0.0	1.6	37.5
280.0	-5.2	-1.9	41.9	0.0	1.6	36.4
290.0	-5.2	-1.9	38.7	0.0	1.6	33.2
300.0	-5.2	-1.9	33.8	0.0	1.6	28.4
310.0	-5.2	-1.9	28.0	0.0	1.6	22.5
320.0	-5.2	-1.9	21.7	0.0	1.6	16.3
330.0	-5.2	-1.9	15.6	0.0	1.6	10.1
340.0	-5.2	-1.9	10.0	0.0	1.6	4.5
350.0	-5.2	-1.9	4.8	0.0	-1.6	-3.9
360.0	-5.2	-1.9	0.0	0.0	-1.6	-8.7

Case 37 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	109.9	75.2	0.0	0.0	53.6	238.7
10.0	109.9	75.2	-316.6	0.0	-53.6	-185.2
20.0	109.9	75.2	-593.0	0.0	-53.6	-461.5
30.0	109.9	75.2	-793.7	0.0	-53.6	-662.2
40.0	109.9	75.2	-892.8	0.0	-53.6	-761.3
50.0	109.9	75.2	-876.4	0.0	-53.6	-745.0
60.0	109.9	75.2	-745.2	0.0	-53.6	-613.8
70.0	109.9	75.2	-513.8	0.0	-53.6	-382.4
80.0	109.9	75.2	-209.2	0.0	-53.6	-77.8
90.0	109.9	75.2	132.4	0.0	53.6	371.1
100.0	109.9	75.2	470.0	0.0	53.6	708.7
110.0	109.9	75.2	762.6	0.0	53.6	1001.4
120.0	109.9	75.2	974.5	0.0	53.6	1213.2
130.0	109.9	75.2	1079.2	0.0	53.6	1315.0
140.0	109.9	75.2	1063.0	0.0	53.6	1300.7
150.0	109.9	75.2	926.1	0.0	53.6	1154.8
160.0	109.9	75.2	683.5	0.0	53.6	922.2
170.0	109.9	75.2	362.6	0.0	53.6	601.3
180.0	109.9	75.2	0.0	0.0	53.6	238.7
190.0	109.9	75.2	-362.6	0.0	-53.6	-231.2
200.0	109.9	75.2	-683.5	0.0	-53.6	-552.1
210.0	109.9	75.2	-926.1	0.0	-53.6	-794.6
220.0	109.9	75.2	-1063.0	0.0	-53.6	-931.5
230.0	109.9	75.2	-1079.2	0.0	-53.6	-947.8
240.0	109.9	75.2	-974.5	0.0	-53.6	-843.1
250.0	109.9	75.2	-762.6	0.0	-53.6	-631.2
260.0	109.9	75.2	-470.0	0.0	-53.6	-338.5
270.0	109.9	75.2	-132.4	0.0	53.6	106.3
280.0	109.9	75.2	209.2	0.0	53.6	447.9
290.0	109.9	75.2	513.8	0.0	53.6	752.6
300.0	109.9	75.2	745.2	0.0	53.6	983.9
310.0	109.9	75.2	876.4	0.0	53.6	1115.1
320.0	109.9	75.2	892.8	0.0	53.6	1131.5
330.0	109.9	75.2	793.7	0.0	53.6	1032.4
340.0	109.9	75.2	593.0	0.0	53.6	831.7
350.0	109.9	75.2	316.6	0.0	53.6	555.3
360.0	109.9	75.2	0.0	0.0	53.6	238.7

6.37.4 Thruster use

Case 37 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	8.0	154.9	8.9	158.6	2.1	90.0	17.8	150.5
10.0	4.3	154.8	11.7	171.9	10.1	90.0	20.6	138.7
20.0	2.1	41.9	17.2	175.6	16.0	90.0	24.4	129.8
30.0	42.9	5.7	58.7	176.1	16.2	90.0	29.1	123.0
40.0	71.8	10.3	86.5	180.0	16.4	90.0	33.3	118.5
50.0	73.5	10.6	86.3	180.0	16.8	90.0	33.5	114.8
60.0	73.8	13.0	86.1	180.0	17.3	90.0	36.8	112.7
70.0	74.2	16.7	85.9	180.0	17.1	90.0	41.2	111.2
80.0	74.2	21.7	85.8	180.0	16.9	90.0	47.4	110.9
90.0	62.0	17.3	80.7	168.1	16.7	90.0	55.4	110.9
100.0	29.1	37.3	46.6	159.6	16.7	90.0	54.6	112.1
110.0	17.6	110.4	21.9	133.9	15.1	90.0	52.0	114.2
120.0	18.9	117.3	20.8	129.8	9.8	90.0	47.9	117.3
130.0	19.4	123.5	19.5	127.5	5.1	90.0	43.1	121.6
140.0	19.1	129.5	17.8	127.7	1.7	90.0	38.2	127.1
150.0	18.0	135.7	15.9	131.1	-0.2	90.0	33.7	133.7
160.0	16.2	142.7	14.2	138.6	-0.5	90.0	30.0	141.4
170.0	14.0	151.5	12.9	150.3	0.5	90.0	27.1	150.0
180.0	11.9	163.6	12.4	164.9	2.2	90.0	25.7	159.5
190.0	10.1	183.5	13.4	182.6	5.1	90.0	23.8	170.5
200.0	10.7	203.6	14.3	197.8	4.2	90.0	23.9	190.8
210.0	11.8	215.7	15.5	207.4	3.9	90.0	25.4	203.5
220.0	13.4	222.1	16.1	215.4	2.0	90.0	28.2	215.2
230.0	15.0	223.6	16.0	222.5	-1.4	90.0	31.9	224.9
240.0	16.4	221.5	15.9	229.6	-6.1	90.0	35.9	232.2
250.0	17.7	217.0	16.2	237.1	-11.4	90.0	39.5	237.3
260.0	19.5	207.8	10.6	250.0	-16.7	90.0	41.8	240.5
270.0	12.7	189.0	43.6	345.4	-16.7	90.0	42.4	242.2
280.0	16.0	180.0	69.7	343.9	-16.9	90.0	40.9	242.3
290.0	86.1	180.0	70.4	349.2	-17.1	90.0	34.7	240.8
300.0	86.2	180.0	70.7	353.1	-17.3	90.0	30.4	238.1
310.0	86.4	180.0	69.8	355.6	-16.8	90.0	27.8	232.8
320.0	65.2	179.9	49.0	0.1	-16.4	90.0	23.0	225.0
330.0	31.9	174.7	16.2	10.9	-16.2	90.0	18.8	212.6
340.0	14.1	161.9	4.5	119.8	-12.7	90.0	16.2	196.1
350.0	11.0	157.2	6.7	142.0	-4.5	90.0	15.9	165.8
360.0	8.0	154.9	8.9	158.6	2.1	90.0	17.8	150.5

6.37.5 Thruster loss

Case 37 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.91	0.86	0.81
10.0	0.91	0.82	0.80
20.0	0.84	0.80	0.80
30.0	0.86	0.79	0.81
40.0	0.86	0.77	0.82
50.0	0.86	0.77	0.84
60.0	0.87	0.77	0.86
70.0	0.87	0.77	0.85
80.0	0.88	0.77	0.84
90.0	0.90	0.81	0.83
100.0	0.88	0.81	0.84
110.0	0.84	0.80	0.84
120.0	0.84	0.80	0.85
130.0	0.84	0.80	0.85
140.0	0.84	0.80	0.85
150.0	0.84	0.80	0.90
160.0	0.83	0.80	0.90
170.0	0.83	0.79	0.88
180.0	0.80	0.76	0.90
190.0	0.72	0.71	0.90
200.0	0.78	0.80	0.90
210.0	0.79	0.82	0.90
220.0	0.80	0.83	0.91
230.0	0.80	0.83	0.85
240.0	0.80	0.84	0.85
250.0	0.81	0.84	0.84
260.0	0.82	0.84	0.84
270.0	0.80	0.90	0.83
280.0	0.77	0.89	0.84
290.0	0.77	0.88	0.85
300.0	0.77	0.88	0.86
310.0	0.77	0.87	0.84
320.0	0.77	0.87	0.82
330.0	0.82	0.84	0.81
340.0	0.89	0.88	0.80
350.0	0.90	0.88	0.80
360.0	0.91	0.86	0.81

Preliminary Design, @IDR5

6.38 Case 38 - Thrust Utilization: 35 knots wind @ 180 deg, 2 knots current, Sea State 5

6.38.1 Environment and thrust utilisation

Case 38 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	180.0	180.0	0.0	35.0	4.0	6.7	9.4	2.00	8.7
10.0	180.0	180.0	10.0	35.0	4.0	6.7	9.4	2.00	28.5
20.0	180.0	180.0	20.0	35.0	4.0	6.7	9.4	2.00	52.0
30.0	180.0	180.0	30.0	35.0	4.0	6.7	9.4	2.00	72.8
40.0	180.0	180.0	40.0	35.0	4.0	6.7	9.4	2.00	89.6
50.0	180.0	180.0	50.0	35.0	4.0	6.7	9.4	2.00	> 100.0
60.0	180.0	180.0	60.0	35.0	4.0	6.7	9.4	2.00	> 100.0
70.0	180.0	180.0	70.0	35.0	4.0	6.7	9.4	2.00	> 100.0
80.0	180.0	180.0	80.0	35.0	4.0	6.7	9.4	2.00	99.7
90.0	180.0	180.0	90.0	35.0	4.0	6.7	9.4	2.00	87.4
100.0	180.0	180.0	100.0	35.0	4.0	6.7	9.4	2.00	70.6
110.0	180.0	180.0	110.0	35.0	4.0	6.7	9.4	2.00	50.7
120.0	180.0	180.0	120.0	35.0	4.0	6.7	9.4	2.00	31.3
130.0	180.0	180.0	130.0	35.0	4.0	6.7	9.4	2.00	18.2
140.0	180.0	180.0	140.0	35.0	4.0	6.7	9.4	2.00	17.4
150.0	180.0	180.0	150.0	35.0	4.0	6.7	9.4	2.00	15.9
160.0	180.0	180.0	160.0	35.0	4.0	6.7	9.4	2.00	15.2
170.0	180.0	180.0	170.0	35.0	4.0	6.7	9.4	2.00	14.2
180.0	180.0	180.0	180.0	35.0	4.0	6.7	9.4	2.00	14.7
190.0	180.0	180.0	190.0	35.0	4.0	6.7	9.4	2.00	14.2
200.0	180.0	180.0	200.0	35.0	4.0	6.7	9.4	2.00	15.2
210.0	180.0	180.0	210.0	35.0	4.0	6.7	9.4	2.00	15.9
220.0	180.0	180.0	220.0	35.0	4.0	6.7	9.4	2.00	17.4
230.0	180.0	180.0	230.0	35.0	4.0	6.7	9.4	2.00	18.4
240.0	180.0	180.0	240.0	35.0	4.0	6.7	9.4	2.00	31.3
250.0	180.0	180.0	250.0	35.0	4.0	6.7	9.4	2.00	51.0
260.0	180.0	180.0	260.0	35.0	4.0	6.7	9.4	2.00	70.6
270.0	180.0	180.0	270.0	35.0	4.0	6.7	9.4	2.00	87.4
280.0	180.0	180.0	280.0	35.0	4.0	6.7	9.4	2.00	99.7
290.0	180.0	180.0	290.0	35.0	4.0	6.7	9.4	2.00	> 100.0
300.0	180.0	180.0	300.0	35.0	4.0	6.7	9.4	2.00	> 100.0
310.0	180.0	180.0	310.0	35.0	4.0	6.7	9.4	2.00	> 100.0
320.0	180.0	180.0	320.0	35.0	4.0	6.7	9.4	2.00	89.6
330.0	180.0	180.0	330.0	35.0	4.0	6.7	9.4	2.00	72.8
340.0	180.0	180.0	340.0	35.0	4.0	6.7	9.4	2.00	52.0
350.0	180.0	180.0	350.0	35.0	4.0	6.7	9.4	2.00	28.5
360.0	180.0	180.0	360.0	35.0	4.0	6.7	9.4	2.00	8.7

6.38.2 Relative contributions of force components

Case 38 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	51.6	42.7	-23.3	0.0	29.1	100.0
10.0	47.0	38.9	-12.3	0.0	26.5	100.0
20.0	36.2	30.0	13.4	0.0	20.4	100.0
30.0	25.5	21.1	39.1	0.0	14.3	100.0
40.0	17.6	14.5	58.0	0.0	9.9	100.0
50.0	12.5	10.4	70.0	0.0	7.1	100.0
60.0	9.6	7.9	77.1	0.0	5.4	100.0
70.0	7.9	6.6	81.1	0.0	4.5	100.0
80.0	7.1	5.9	82.9	0.0	4.0	100.0
90.0	7.0	5.8	83.2	0.0	4.0	100.0
100.0	7.5	6.2	82.0	0.0	4.2	100.0
110.0	8.7	7.2	79.2	0.0	4.9	100.0
120.0	10.7	8.9	74.3	0.0	6.1	100.0
130.0	13.9	11.5	66.8	0.0	7.8	100.0
140.0	18.3	15.1	56.3	0.0	10.3	100.0
150.0	23.6	19.5	43.7	0.0	13.3	100.0
160.0	28.7	23.8	31.3	0.0	16.2	100.0
170.0	32.5	26.9	22.2	0.0	18.3	100.0
180.0	34.1	28.2	18.5	0.0	19.2	100.0
190.0	32.5	26.9	22.2	0.0	18.3	100.0
200.0	28.7	23.8	31.3	0.0	16.2	100.0
210.0	23.6	19.5	43.7	0.0	13.3	100.0
220.0	18.3	15.1	56.3	0.0	10.3	100.0
230.0	13.9	11.5	66.8	0.0	7.8	100.0
240.0	10.7	8.9	74.3	0.0	6.1	100.0
250.0	8.7	7.2	79.2	0.0	4.9	100.0
260.0	7.5	6.2	82.0	0.0	4.2	100.0
270.0	7.0	5.8	83.2	0.0	4.0	100.0
280.0	7.1	5.9	82.9	0.0	4.0	100.0
290.0	7.9	6.6	81.1	0.0	4.5	100.0
300.0	9.6	7.9	77.1	0.0	5.4	100.0
310.0	12.5	10.4	70.0	0.0	7.1	100.0
320.0	17.6	14.5	58.0	0.0	9.9	100.0
330.0	25.5	21.1	39.1	0.0	14.3	100.0
340.0	36.2	30.0	13.4	0.0	20.4	100.0
350.0	47.0	38.9	-12.3	0.0	26.5	100.0
360.0	51.6	42.7	-23.3	0.0	29.1	100.0

6.38.3 Environment forces

Case 38 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	8.0	6.6	-3.6	0.0	4.5	15.4
10.0	8.0	6.6	-3.6	0.0	4.5	15.4
20.0	8.0	6.6	-3.5	0.0	4.5	15.6
30.0	8.0	6.6	-3.2	0.0	4.5	15.8
40.0	8.0	6.6	-2.8	0.0	4.5	16.2
50.0	8.0	6.6	-2.3	0.0	4.5	16.8
60.0	8.0	6.6	-1.6	0.0	4.5	17.4
70.0	8.0	6.6	-0.9	0.0	4.5	18.2
80.0	8.0	6.6	-0.1	0.0	4.5	18.9
90.0	8.0	6.6	0.7	0.0	4.5	19.8
100.0	8.0	6.6	1.5	0.0	4.5	20.6
110.0	8.0	6.6	2.3	0.0	4.5	21.3
120.0	8.0	6.6	3.0	0.0	4.5	22.0
130.0	8.0	6.6	3.5	0.0	4.5	22.6
140.0	8.0	6.6	4.0	0.0	4.5	23.0
150.0	8.0	6.6	4.3	0.0	4.5	23.3
160.0	8.0	6.6	4.4	0.0	4.5	23.5
170.0	8.0	6.6	4.4	0.0	4.5	23.5
180.0	8.0	6.6	4.3	0.0	4.5	23.4
190.0	8.0	6.6	4.4	0.0	4.5	23.5
200.0	8.0	6.6	4.4	0.0	4.5	23.5
210.0	8.0	6.6	4.3	0.0	4.5	23.3
220.0	8.0	6.6	4.0	0.0	4.5	23.0
230.0	8.0	6.6	3.5	0.0	4.5	22.6
240.0	8.0	6.6	3.0	0.0	4.5	22.0
250.0	8.0	6.6	2.3	0.0	4.5	21.3
260.0	8.0	6.6	1.5	0.0	4.5	20.6
270.0	8.0	6.6	0.7	0.0	4.5	19.8
280.0	8.0	6.6	-0.1	0.0	4.5	18.9
290.0	8.0	6.6	-0.9	0.0	4.5	18.2
300.0	8.0	6.6	-1.6	0.0	4.5	17.4
310.0	8.0	6.6	-2.3	0.0	4.5	16.8
320.0	8.0	6.6	-2.8	0.0	4.5	16.2
330.0	8.0	6.6	-3.2	0.0	4.5	15.8
340.0	8.0	6.6	-3.5	0.0	4.5	15.6
350.0	8.0	6.6	-3.6	0.0	4.5	15.4
360.0	8.0	6.6	-3.6	0.0	4.5	15.4

Case 38 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-4.8	0.0	0.0	-4.8
20.0	0.0	0.0	-10.0	0.0	0.0	-10.0
30.0	0.0	0.0	-15.6	0.0	0.0	-15.6
40.0	0.0	0.0	-21.7	0.0	0.0	-21.7
50.0	0.0	0.0	-28.0	0.0	0.0	-28.0
60.0	0.0	0.0	-33.8	0.0	0.0	-33.8
70.0	0.0	0.0	-38.7	0.0	0.0	-38.7
80.0	0.0	0.0	-41.9	0.0	0.0	-41.9
90.0	0.0	0.0	-43.0	0.0	0.0	-43.0
100.0	0.0	0.0	-41.9	0.0	0.0	-41.9
110.0	0.0	0.0	-38.7	0.0	0.0	-38.7
120.0	0.0	0.0	-33.8	0.0	0.0	-33.8
130.0	0.0	0.0	-28.0	0.0	0.0	-28.0
140.0	0.0	0.0	-21.7	0.0	0.0	-21.7
150.0	0.0	0.0	-15.6	0.0	0.0	-15.6
160.0	0.0	0.0	-10.0	0.0	0.0	-10.0
170.0	0.0	0.0	-4.8	0.0	0.0	-4.8
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	4.8	0.0	0.0	4.8
200.0	0.0	0.0	10.0	0.0	0.0	10.0
210.0	0.0	0.0	15.6	0.0	0.0	15.6
220.0	0.0	0.0	21.7	0.0	0.0	21.7
230.0	0.0	0.0	28.0	0.0	0.0	28.0
240.0	0.0	0.0	33.8	0.0	0.0	33.8
250.0	0.0	0.0	38.7	0.0	0.0	38.7
260.0	0.0	0.0	41.9	0.0	0.0	41.9
270.0	0.0	0.0	43.0	0.0	0.0	43.0
280.0	0.0	0.0	41.9	0.0	0.0	41.9
290.0	0.0	0.0	38.7	0.0	0.0	38.7
300.0	0.0	0.0	33.8	0.0	0.0	33.8
310.0	0.0	0.0	28.0	0.0	0.0	28.0
320.0	0.0	0.0	21.7	0.0	0.0	21.7
330.0	0.0	0.0	15.6	0.0	0.0	15.6
340.0	0.0	0.0	10.0	0.0	0.0	10.0
350.0	0.0	0.0	4.8	0.0	0.0	4.8
360.0	0.0	0.0	0.0	0.0	0.0	0.0

Case 38 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	0.0	0.0	-316.6	0.0	0.0	-316.6
20.0	0.0	0.0	-593.0	0.0	0.0	-593.0
30.0	0.0	0.0	-793.7	0.0	0.0	-793.7
40.0	0.0	0.0	-892.8	0.0	0.0	-892.8
50.0	0.0	0.0	-876.4	0.0	0.0	-876.4
60.0	0.0	0.0	-745.2	0.0	0.0	-745.2
70.0	0.0	0.0	-513.8	0.0	0.0	-513.8
80.0	0.0	0.0	-209.2	0.0	0.0	-209.2
90.0	0.0	0.0	132.4	0.0	0.0	132.4
100.0	0.0	0.0	470.0	0.0	0.0	470.0
110.0	0.0	0.0	762.6	0.0	0.0	762.6
120.0	0.0	0.0	974.5	0.0	0.0	974.5
130.0	0.0	0.0	1079.2	0.0	0.0	1079.2
140.0	0.0	0.0	1063.0	0.0	0.0	1063.0
150.0	0.0	0.0	926.1	0.0	0.0	926.1
160.0	0.0	0.0	683.5	0.0	0.0	683.5
170.0	0.0	0.0	362.6	0.0	0.0	362.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	0.0	0.0	-362.6	0.0	0.0	-362.6
200.0	0.0	0.0	-683.5	0.0	0.0	-683.5
210.0	0.0	0.0	-926.1	0.0	0.0	-926.1
220.0	0.0	0.0	-1063.0	0.0	0.0	-1063.0
230.0	0.0	0.0	-1079.2	0.0	0.0	-1079.2
240.0	0.0	0.0	-974.5	0.0	0.0	-974.5
250.0	0.0	0.0	-762.6	0.0	0.0	-762.6
260.0	0.0	0.0	-470.0	0.0	0.0	-470.0
270.0	0.0	0.0	-132.4	0.0	0.0	-132.4
280.0	0.0	0.0	209.2	0.0	0.0	209.2
290.0	0.0	0.0	513.8	0.0	0.0	513.8
300.0	0.0	0.0	745.2	0.0	0.0	745.2
310.0	0.0	0.0	876.4	0.0	0.0	876.4
320.0	0.0	0.0	892.8	0.0	0.0	892.8
330.0	0.0	0.0	793.7	0.0	0.0	793.7
340.0	0.0	0.0	593.0	0.0	0.0	593.0
350.0	0.0	0.0	316.6	0.0	0.0	316.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.38.4 Thruster use

Case 38 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	7.7	180.0	7.7	180.0	0.0	90.0	15.4	180.0
10.0	5.1	190.5	10.5	184.9	6.7	90.0	16.2	162.6
20.0	2.8	213.3	13.3	186.3	13.0	90.0	18.5	147.3
30.0	18.0	359.2	33.8	180.4	16.1	90.0	22.3	135.4
40.0	51.1	3.2	67.3	177.8	16.3	90.0	27.1	126.8
50.0	70.6	8.5	86.3	180.0	16.7	90.0	31.8	121.3
60.0	71.4	11.0	86.1	180.0	17.2	90.0	34.7	117.5
70.0	71.6	14.8	86.0	180.0	17.0	90.0	39.0	115.4
80.0	71.2	20.0	85.9	180.0	16.8	90.0	45.3	114.7
90.0	46.4	17.4	65.2	169.0	16.6	90.0	47.3	114.7
100.0	15.3	57.6	31.3	156.9	16.7	90.0	46.6	116.2
110.0	14.7	117.0	19.3	139.3	13.0	90.0	44.2	118.9
120.0	16.3	124.5	18.1	134.9	7.6	90.0	40.4	123.0
130.0	17.1	131.4	16.6	132.7	3.0	90.0	36.0	128.9
140.0	17.0	138.3	15.0	133.5	-0.4	90.0	31.7	136.6
150.0	16.2	145.6	13.3	138.5	-2.3	90.0	28.1	146.2
160.0	14.8	154.3	11.9	148.6	-2.6	90.0	25.5	157.0
170.0	13.1	165.5	11.3	163.5	-1.6	90.0	24.0	168.4
180.0	11.7	180.0	11.7	180.0	0.0	90.0	23.4	180.0
190.0	11.3	196.5	13.1	194.5	1.6	90.0	24.0	191.6
200.0	11.9	211.4	14.8	205.7	2.6	90.0	25.5	203.0
210.0	13.3	221.5	16.2	214.4	2.3	90.0	28.1	213.8
220.0	15.0	226.5	17.0	221.7	0.4	90.0	31.7	223.4
230.0	16.6	227.3	17.0	225.6	-3.0	90.0	36.0	231.1
240.0	18.1	225.1	19.3	235.5	-7.6	90.0	40.4	237.0
250.0	19.3	226.7	17.7	243.0	-13.0	90.0	44.2	241.1
260.0	31.3	207.1	15.3	302.4	-16.7	90.0	46.6	243.8
270.0	65.2	191.0	46.4	342.6	-16.6	90.0	47.3	245.3
280.0	85.0	180.0	71.2	340.0	-16.8	90.0	45.3	245.3
290.0	86.0	180.0	71.6	345.2	-17.0	90.0	39.0	244.6
300.0	86.1	180.0	71.4	349.0	-17.2	90.0	34.7	242.5
310.0	86.3	180.0	70.6	351.5	-16.7	90.0	31.8	238.7
320.0	67.3	182.2	51.1	356.8	-16.3	90.0	27.1	233.2
330.0	33.8	179.6	18.0	0.8	-16.1	90.0	22.3	224.6
340.0	13.3	173.7	2.8	146.7	-13.0	90.0	18.5	212.7
350.0	10.5	175.1	5.1	169.5	-6.7	90.0	16.2	197.4
360.0	7.7	180.0	7.7	180.0	0.0	90.0	15.4	180.0

6.38.5 Thruster loss

Case 38 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.78	0.78	1.00
10.0	0.83	0.81	0.79
20.0	0.88	0.82	0.80
30.0	0.86	0.78	0.80
40.0	0.87	0.78	0.82
50.0	0.87	0.77	0.83
60.0	0.87	0.77	0.86
70.0	0.88	0.77	0.85
80.0	0.88	0.77	0.84
90.0	0.90	0.81	0.83
100.0	0.86	0.81	0.83
110.0	0.84	0.80	0.84
120.0	0.84	0.80	0.84
130.0	0.84	0.80	0.84
140.0	0.83	0.80	0.91
150.0	0.83	0.80	0.90
160.0	0.82	0.79	0.90
170.0	0.78	0.77	0.90
180.0	0.70	0.70	1.00
190.0	0.77	0.78	0.90
200.0	0.79	0.82	0.90
210.0	0.80	0.83	0.90
220.0	0.80	0.83	0.91
230.0	0.80	0.84	0.84
240.0	0.80	0.84	0.84
250.0	0.80	0.84	0.84
260.0	0.81	0.86	0.83
270.0	0.81	0.90	0.83
280.0	0.77	0.88	0.84
290.0	0.77	0.88	0.85
300.0	0.77	0.87	0.86
310.0	0.77	0.87	0.83
320.0	0.78	0.87	0.82
330.0	0.78	0.86	0.80
340.0	0.82	0.88	0.80
350.0	0.81	0.83	0.79
360.0	0.78	0.78	1.00

Preliminary Design, @IDR5

6.39 Case 39 - Thrust Utilization: 35 knots wind, 0 current, 0 waves

6.39.1 Environment and thrust utilisation

Case 39 environment and thrust utilisation									
Dir [deg]	WindDir [deg]	WaveDir [deg]	CurrentDir [deg]	WindSpeed [kts]	WaveHs [m]	WaveTz [s]	WaveTp [s]	CurrentSpeed [kts]	ThrustUtil [%]
0.0	0.0	0.0	360.0	35.0	0.0	0.0	0.0	0.00	3.2
10.0	10.0	10.0	360.0	35.0	0.0	0.0	0.0	0.00	18.2
20.0	20.0	20.0	360.0	35.0	0.0	0.0	0.0	0.00	35.5
30.0	30.0	30.0	360.0	35.0	0.0	0.0	0.0	0.00	55.1
40.0	40.0	40.0	360.0	35.0	0.0	0.0	0.0	0.00	72.6
50.0	50.0	50.0	360.0	35.0	0.0	0.0	0.0	0.00	82.8
60.0	60.0	60.0	360.0	35.0	0.0	0.0	0.0	0.00	83.4
70.0	70.0	70.0	360.0	35.0	0.0	0.0	0.0	0.00	78.2
80.0	80.0	80.0	360.0	35.0	0.0	0.0	0.0	0.00	71.9
90.0	90.0	90.0	360.0	35.0	0.0	0.0	0.0	0.00	66.9
100.0	100.0	100.0	180.0	35.0	0.0	0.0	0.0	0.00	63.4
110.0	110.0	110.0	180.0	35.0	0.0	0.0	0.0	0.00	60.8
120.0	120.0	120.0	180.0	35.0	0.0	0.0	0.0	0.00	56.9
130.0	130.0	130.0	180.0	35.0	0.0	0.0	0.0	0.00	49.7
140.0	140.0	140.0	180.0	35.0	0.0	0.0	0.0	0.00	38.6
150.0	150.0	150.0	180.0	35.0	0.0	0.0	0.0	0.00	26.2
160.0	160.0	160.0	180.0	35.0	0.0	0.0	0.0	0.00	15.5
170.0	170.0	170.0	180.0	35.0	0.0	0.0	0.0	0.00	7.5
180.0	180.0	180.0	180.0	35.0	0.0	0.0	0.0	0.00	4.6
190.0	190.0	190.0	180.0	35.0	0.0	0.0	0.0	0.00	7.5
200.0	200.0	200.0	180.0	35.0	0.0	0.0	0.0	0.00	15.5
210.0	210.0	210.0	180.0	35.0	0.0	0.0	0.0	0.00	26.2
220.0	220.0	220.0	180.0	35.0	0.0	0.0	0.0	0.00	38.6
230.0	230.0	230.0	180.0	35.0	0.0	0.0	0.0	0.00	49.7
240.0	240.0	240.0	180.0	35.0	0.0	0.0	0.0	0.00	56.9
250.0	250.0	250.0	180.0	35.0	0.0	0.0	0.0	0.00	60.8
260.0	260.0	260.0	180.0	35.0	0.0	0.0	0.0	0.00	63.4
270.0	270.0	270.0	0.0	35.0	0.0	0.0	0.0	0.00	66.9
280.0	280.0	280.0	0.0	35.0	0.0	0.0	0.0	0.00	71.9
290.0	290.0	290.0	0.0	35.0	0.0	0.0	0.0	0.00	78.2
300.0	300.0	300.0	0.0	35.0	0.0	0.0	0.0	0.00	83.4
310.0	310.0	310.0	0.0	35.0	0.0	0.0	0.0	0.00	82.8
320.0	320.0	320.0	0.0	35.0	0.0	0.0	0.0	0.00	72.6
330.0	330.0	330.0	0.0	35.0	0.0	0.0	0.0	0.00	55.1
340.0	340.0	340.0	0.0	35.0	0.0	0.0	0.0	0.00	35.5
350.0	350.0	350.0	0.0	35.0	0.0	0.0	0.0	0.00	18.2
360.0	360.0	360.0	0.0	35.0	0.0	0.0	0.0	0.00	3.2

6.39.2 Relative contributions of force components

Case 39 relative contributions of force						
Dir [deg]	Wind [%]	Waves [%]	Current [%]	Additional [%]	Dynamics [%]	Sum [%]
0.0	93.4	0.0	0.0	0.0	6.6	100.0
10.0	93.5	0.0	0.0	0.0	6.5	100.0
20.0	93.5	0.0	0.0	0.0	6.5	100.0
30.0	93.5	0.0	0.0	0.0	6.5	100.0
40.0	93.5	0.0	0.0	0.0	6.5	100.0
50.0	93.5	0.0	0.0	0.0	6.5	100.0
60.0	93.5	0.0	0.0	0.0	6.5	100.0
70.0	93.5	0.0	0.0	0.0	6.5	100.0
80.0	93.5	0.0	0.0	0.0	6.5	100.0
90.0	93.5	0.0	0.0	0.0	6.5	100.0
100.0	93.5	0.0	0.0	0.0	6.5	100.0
110.0	93.5	0.0	0.0	0.0	6.5	100.0
120.0	93.5	0.0	0.0	0.0	6.5	100.0
130.0	93.5	0.0	0.0	0.0	6.5	100.0
140.0	93.5	0.0	0.0	0.0	6.5	100.0
150.0	93.5	0.0	0.0	0.0	6.5	100.0
160.0	93.5	0.0	0.0	0.0	6.5	100.0
170.0	93.5	0.0	0.0	0.0	6.5	100.0
180.0	93.4	0.0	0.0	0.0	6.6	100.0
190.0	93.5	0.0	0.0	0.0	6.5	100.0
200.0	93.5	0.0	0.0	0.0	6.5	100.0
210.0	93.5	0.0	0.0	0.0	6.5	100.0
220.0	93.5	0.0	0.0	0.0	6.5	100.0
230.0	93.5	0.0	0.0	0.0	6.5	100.0
240.0	93.5	0.0	0.0	0.0	6.5	100.0
250.0	93.5	0.0	0.0	0.0	6.5	100.0
260.0	93.5	0.0	0.0	0.0	6.5	100.0
270.0	93.5	0.0	0.0	0.0	6.5	100.0
280.0	93.5	0.0	0.0	0.0	6.5	100.0
290.0	93.5	0.0	0.0	0.0	6.5	100.0
300.0	93.5	0.0	0.0	0.0	6.5	100.0
310.0	93.5	0.0	0.0	0.0	6.5	100.0
320.0	93.5	0.0	0.0	0.0	6.5	100.0
330.0	93.5	0.0	0.0	0.0	6.5	100.0
340.0	93.5	0.0	0.0	0.0	6.5	100.0
350.0	93.5	0.0	0.0	0.0	6.5	100.0
360.0	93.4	0.0	0.0	0.0	6.6	100.0

6.39.3 Environment forces

Case 39 Environmental SURGE forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	-6.7	0.0	0.0	0.0	-0.5	-7.2
10.0	-6.8	0.0	0.0	0.0	-0.5	-7.3
20.0	-7.0	0.0	0.0	0.0	-0.5	-7.5
30.0	-7.1	0.0	0.0	0.0	-0.5	-7.6
40.0	-6.7	0.0	0.0	0.0	-0.5	-7.2
50.0	-5.6	0.0	0.0	0.0	-0.4	-6.0
60.0	-4.1	0.0	0.0	0.0	-0.3	-4.4
70.0	-2.6	0.0	0.0	0.0	-0.2	-2.7
80.0	-1.2	0.0	0.0	0.0	-0.1	-1.3
90.0	0.0	0.0	0.0	0.0	0.0	0.0
100.0	1.4	0.0	0.0	0.0	0.1	1.5
110.0	3.0	0.0	0.0	0.0	0.2	3.2
120.0	4.8	0.0	0.0	0.0	0.3	5.1
130.0	6.5	0.0	0.0	0.0	0.5	7.0
140.0	7.8	0.0	0.0	0.0	0.5	8.3
150.0	8.3	0.0	0.0	0.0	0.6	8.9
160.0	8.2	0.0	0.0	0.0	0.6	8.8
170.0	8.1	0.0	0.0	0.0	0.6	8.6
180.0	8.0	0.0	0.0	0.0	0.6	8.5
190.0	8.1	0.0	0.0	0.0	0.6	8.6
200.0	8.2	0.0	0.0	0.0	0.6	8.8
210.0	8.3	0.0	0.0	0.0	0.6	8.9
220.0	7.8	0.0	0.0	0.0	0.5	8.3
230.0	6.5	0.0	0.0	0.0	0.5	7.0
240.0	4.8	0.0	0.0	0.0	0.3	5.1
250.0	3.0	0.0	0.0	0.0	0.2	3.2
260.0	1.4	0.0	0.0	0.0	0.1	1.5
270.0	0.0	0.0	0.0	0.0	0.0	0.0
280.0	-1.2	0.0	0.0	0.0	-0.1	-1.3
290.0	-2.6	0.0	0.0	0.0	-0.2	-2.7
300.0	-4.1	0.0	0.0	0.0	-0.3	-4.4
310.0	-5.6	0.0	0.0	0.0	-0.4	-6.0
320.0	-6.7	0.0	0.0	0.0	-0.5	-7.2
330.0	-7.1	0.0	0.0	0.0	-0.5	-7.6
340.0	-7.0	0.0	0.0	0.0	-0.5	-7.5
350.0	-6.8	0.0	0.0	0.0	-0.5	-7.3
360.0	-6.7	0.0	0.0	0.0	-0.5	-7.2

Case 39 Environmental SWAY forces						
Dir [deg]	Wind [tf]	Wave [tf]	Current [tf]	Additional [tf]	Dynamics [tf]	Sum [tf]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	-5.3	0.0	0.0	0.0	-0.4	-5.6
20.0	-11.2	0.0	0.0	0.0	-0.8	-11.9
30.0	-17.9	0.0	0.0	0.0	-1.3	-19.1
40.0	-24.5	0.0	0.0	0.0	-1.7	-26.3
50.0	-29.3	0.0	0.0	0.0	-2.0	-31.3
60.0	-31.0	0.0	0.0	0.0	-2.2	-33.1
70.0	-30.7	0.0	0.0	0.0	-2.1	-32.8
80.0	-29.8	0.0	0.0	0.0	-2.1	-31.9
90.0	-29.4	0.0	0.0	0.0	-2.1	-31.5
100.0	-29.8	0.0	0.0	0.0	-2.1	-31.8
110.0	-30.5	0.0	0.0	0.0	-2.1	-32.6
120.0	-30.7	0.0	0.0	0.0	-2.1	-32.8
130.0	-28.8	0.0	0.0	0.0	-2.0	-30.9
140.0	-24.2	0.0	0.0	0.0	-1.7	-25.9
150.0	-17.7	0.0	0.0	0.0	-1.2	-18.9
160.0	-11.1	0.0	0.0	0.0	-0.8	-11.9
170.0	-5.2	0.0	0.0	0.0	-0.4	-5.6
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	5.2	0.0	0.0	0.0	0.4	5.6
200.0	11.1	0.0	0.0	0.0	0.8	11.9
210.0	17.7	0.0	0.0	0.0	1.2	18.9
220.0	24.2	0.0	0.0	0.0	1.7	25.9
230.0	28.8	0.0	0.0	0.0	2.0	30.9
240.0	30.7	0.0	0.0	0.0	2.1	32.8
250.0	30.5	0.0	0.0	0.0	2.1	32.6
260.0	29.8	0.0	0.0	0.0	2.1	31.8
270.0	29.4	0.0	0.0	0.0	2.1	31.5
280.0	29.8	0.0	0.0	0.0	2.1	31.9
290.0	30.7	0.0	0.0	0.0	2.1	32.8
300.0	31.0	0.0	0.0	0.0	2.2	33.1
310.0	29.3	0.0	0.0	0.0	2.0	31.3
320.0	24.5	0.0	0.0	0.0	1.7	26.3
330.0	17.9	0.0	0.0	0.0	1.3	19.1
340.0	11.2	0.0	0.0	0.0	0.8	11.9
350.0	5.3	0.0	0.0	0.0	0.4	5.6
360.0	0.0	0.0	0.0	0.0	0.0	0.0

Case 39 Environmental YAW forces						
Dir [deg]	Wind [tf.m]	Wave [tf.m]	Current [tf.m]	Additional [tf.m]	Dynamics [tf.m]	Sum [tf.m]
0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.0	-184.0	0.0	0.0	0.0	-12.7	-196.7
20.0	-351.6	0.0	0.0	0.0	-24.3	-375.8
30.0	-501.2	0.0	0.0	0.0	-34.6	-535.8
40.0	-601.9	0.0	0.0	0.0	-41.5	-643.5
50.0	-615.1	0.0	0.0	0.0	-42.5	-657.5
60.0	-543.1	0.0	0.0	0.0	-37.5	-580.6
70.0	-430.1	0.0	0.0	0.0	-29.7	-459.8
80.0	-314.1	0.0	0.0	0.0	-21.7	-335.8
90.0	-207.2	0.0	0.0	0.0	-14.3	-221.5
100.0	-105.5	0.0	0.0	0.0	-7.3	-112.8
110.0	-1.5	0.0	0.0	0.0	-0.1	-1.6
120.0	105.7	0.0	0.0	0.0	7.3	113.0
130.0	200.3	0.0	0.0	0.0	13.8	214.1
140.0	252.6	0.0	0.0	0.0	17.4	270.1
150.0	246.7	0.0	0.0	0.0	17.0	263.7
160.0	193.5	0.0	0.0	0.0	13.4	206.8
170.0	109.9	0.0	0.0	0.0	7.6	117.4
180.0	0.0	0.0	0.0	0.0	0.0	0.0
190.0	-109.9	0.0	0.0	0.0	-7.6	-117.4
200.0	-193.5	0.0	0.0	0.0	-13.4	-206.8
210.0	-246.7	0.0	0.0	0.0	-17.0	-263.7
220.0	-252.6	0.0	0.0	0.0	-17.4	-270.1
230.0	-200.3	0.0	0.0	0.0	-13.8	-214.1
240.0	-105.7	0.0	0.0	0.0	-7.3	-113.0
250.0	1.5	0.0	0.0	0.0	0.1	1.6
260.0	105.5	0.0	0.0	0.0	7.3	112.8
270.0	207.2	0.0	0.0	0.0	14.3	221.5
280.0	314.1	0.0	0.0	0.0	21.7	335.8
290.0	430.1	0.0	0.0	0.0	29.7	459.8
300.0	543.1	0.0	0.0	0.0	37.5	580.6
310.0	615.1	0.0	0.0	0.0	42.5	657.5
320.0	601.9	0.0	0.0	0.0	41.5	643.5
330.0	501.2	0.0	0.0	0.0	34.6	535.8
340.0	351.6	0.0	0.0	0.0	24.3	375.8
350.0	184.0	0.0	0.0	0.0	12.7	196.7
360.0	0.0	0.0	0.0	0.0	0.0	0.0

6.39.4 Thruster use

Case 39 thruster use: Thrusters 1 to 3								
Dir	Thruster 1		Thruster 2		Thruster 3		Total	
[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]	[tf]	[deg]
0.0	3.6	0.0	3.6	0.0	0.0	90.0	7.2	360.0
10.0	6.0	359.9	1.3	359.6	5.6	90.0	9.2	37.6
20.0	8.4	1.7	0.9	166.1	11.5	90.0	14.1	57.8
30.0	10.8	4.3	3.2	167.0	17.6	90.0	20.6	68.4
40.0	38.4	5.6	31.2	174.1	19.4	90.0	27.2	74.7
50.0	60.6	6.1	54.5	174.2	19.4	90.0	31.9	79.1
60.0	60.8	7.0	56.3	173.5	19.4	90.0	33.4	82.5
70.0	47.6	8.7	44.7	172.0	19.4	90.0	32.9	85.2
80.0	31.9	12.0	30.5	168.8	19.4	90.0	31.9	87.7
90.0	19.5	19.0	19.3	162.6	19.4	90.0	31.5	90.0
100.0	11.3	34.6	12.4	150.8	19.4	90.0	31.9	92.7
110.0	8.8	53.4	10.8	141.6	18.8	90.0	32.8	95.6
120.0	8.7	64.6	11.6	140.0	17.6	90.0	33.2	98.9
130.0	8.2	77.3	11.7	139.1	15.2	90.0	31.6	102.8
140.0	7.3	91.7	10.7	139.5	11.6	90.0	27.2	107.9
150.0	6.1	108.5	8.8	141.8	7.7	90.0	20.9	115.1
160.0	5.0	128.8	6.8	147.3	4.3	90.0	14.8	126.6
170.0	4.3	153.2	5.1	158.8	1.8	90.0	10.3	146.9
180.0	4.3	180.0	4.3	180.0	0.0	90.0	8.7	180.0
190.0	5.1	201.2	4.3	206.8	-1.8	90.0	10.3	213.1
200.0	6.8	212.7	5.0	231.2	-4.3	90.0	14.8	233.4
210.0	8.8	218.2	6.1	251.5	-7.7	90.0	20.9	244.9
220.0	10.7	220.5	7.3	263.3	-11.6	90.0	27.2	252.1
230.0	11.7	220.9	8.2	269.7	-15.2	90.0	31.6	257.2
240.0	11.6	220.0	9.7	295.4	-17.6	90.0	33.2	261.1
250.0	10.8	218.4	9.8	306.6	-18.8	90.0	32.8	264.4
260.0	12.4	207.2	11.3	325.4	-19.4	90.0	31.9	267.3
270.0	9.3	197.4	19.5	341.0	-19.4	90.0	31.5	270.0
280.0	8.0	191.2	31.9	348.0	-19.4	90.0	31.9	272.3
290.0	44.7	188.0	47.6	351.3	-19.4	90.0	32.9	274.8
300.0	56.3	186.5	60.8	353.0	-19.4	90.0	33.4	277.5
310.0	54.5	185.8	60.6	353.9	-19.4	90.0	31.9	280.9
320.0	31.2	185.9	38.4	354.4	-19.4	90.0	27.2	285.3
330.0	3.2	193.0	10.8	355.7	-17.6	90.0	20.6	291.6
340.0	0.9	193.9	8.4	358.3	-11.5	90.0	14.1	302.2
350.0	1.3	0.4	6.0	0.1	-5.6	90.0	9.2	322.4
360.0	3.6	0.0	3.6	0.0	0.0	90.0	7.2	360.0

6.39.5 Thruster loss

Case 39 thruster loss: Thrusters 1 to 3			
Dir	Thruster 1	Thruster 2	Thruster 3
[deg]	[-]	[-]	[-]
0.0	0.99	0.99	1.00
10.0	0.99	0.99	0.97
20.0	0.99	0.88	0.97
30.0	0.99	0.88	0.97
40.0	0.99	0.84	0.97
50.0	0.99	0.84	0.97
60.0	0.98	0.85	0.97
70.0	0.98	0.86	0.97
80.0	0.98	0.87	0.97
90.0	0.98	0.89	0.97
100.0	0.97	0.92	0.97
110.0	0.97	0.92	0.97
120.0	0.97	0.92	0.97
130.0	0.97	0.92	0.97
140.0	0.97	0.92	0.97
150.0	0.97	0.92	0.97
160.0	0.97	0.92	0.97
170.0	0.95	0.90	0.97
180.0	0.81	0.81	1.00
190.0	0.90	0.95	0.97
200.0	0.92	0.97	0.97
210.0	0.92	0.97	0.97
220.0	0.92	0.97	0.97
230.0	0.92	0.97	0.97
240.0	0.92	0.97	0.97
250.0	0.92	0.97	0.97
260.0	0.92	0.97	0.97
270.0	0.89	0.98	0.97
280.0	0.87	0.98	0.97
290.0	0.86	0.98	0.97
300.0	0.85	0.98	0.97
310.0	0.84	0.99	0.97
320.0	0.84	0.99	0.97
330.0	0.88	0.99	0.97
340.0	0.88	0.99	0.97
350.0	0.99	0.99	0.97
360.0	0.99	0.99	1.00

Preliminary Design, @IDR5

7 Load coefficients

7.1 Wind load coefficients

Wind load coefficients			
Dir [deg]	Surge [tf s ² /m ²]	Sway [tf s ² /m ²]	Yaw [tf s ² /m]
0.0	-2.078E-002	0.000E+000	0.000E+000
5.0	-2.085E-002	-7.969E-003	-2.929E-001
10.0	-2.105E-002	-1.621E-002	-5.676E-001
15.0	-2.133E-002	-2.497E-002	-8.306E-001
20.0	-2.164E-002	-3.441E-002	-1.084E+000
25.0	-2.187E-002	-4.455E-002	-1.326E+000
30.0	-2.188E-002	-5.518E-002	-1.546E+000
35.0	-2.152E-002	-6.581E-002	-1.729E+000
40.0	-2.066E-002	-7.572E-002	-1.857E+000
45.0	-1.925E-002	-8.407E-002	-1.915E+000
50.0	-1.733E-002	-9.024E-002	-1.897E+000
55.0	-1.507E-002	-9.399E-002	-1.812E+000
60.0	-1.263E-002	-9.557E-002	-1.675E+000
65.0	-1.020E-002	-9.553E-002	-1.508E+000
70.0	-7.877E-003	-9.454E-002	-1.327E+000
75.0	-5.716E-003	-9.320E-002	-1.147E+000
80.0	-3.711E-003	-9.194E-002	-9.088E-001
85.0	-1.824E-003	-9.108E-002	-8.005E-001
90.0	1.074E-009	-9.078E-002	-6.391E-001
95.0	2.155E-003	-9.105E-002	-4.819E-001
100.0	4.380E-003	-9.182E-002	-3.254E-001
105.0	6.733E-003	-9.291E-002	-1.669E-001
110.0	9.261E-003	-9.404E-002	-4.501E-003
115.0	1.196E-002	-9.478E-002	1.612E-001
120.0	1.477E-002	-9.457E-002	3.261E-001
125.0	1.758E-002	-9.279E-002	4.822E-001
130.0	2.019E-002	-8.894E-002	6.177E-001
135.0	2.241E-002	-8.282E-002	7.199E-001
140.0	2.406E-002	-7.463E-002	7.792E-001
145.0	2.510E-002	-6.497E-002	7.920E-001
150.0	2.559E-002	-5.460E-002	7.610E-001
155.0	2.564E-002	-4.420E-002	6.933E-001
160.0	2.544E-002	-3.423E-002	5.967E-001
165.0	2.514E-002	-2.490E-002	4.775E-001
170.0	2.484E-002	-1.619E-002	3.389E-001
175.0	2.463E-002	-7.966E-003	1.807E-001
180.0	2.456E-002	7.936E-009	-1.939E-007

7.2 Current load coefficients

Current load coefficients			
Dir [deg]	Surge [tf s ² /m ²]	Sway [tf s ² /m ²]	Yaw [tf s ² /m]
0.0	-3.397E+000	3.139E-006	1.531E-004
5.0	-3.412E+000	-2.262E+000	-1.520E+002
10.0	-3.397E+000	-4.565E+000	-2.991E+002
15.0	-3.351E+000	-6.945E+000	-4.366E+002
20.0	-3.273E+000	-9.429E+000	-5.601E+002
25.0	-3.163E+000	-1.204E+001	-6.656E+002
30.0	-3.020E+000	-1.477E+001	-7.497E+002
35.0	-2.845E+000	-1.761E+001	-8.096E+002
40.0	-2.639E+000	-2.053E+001	-8.433E+002
45.0	-2.402E+000	-2.349E+001	-8.495E+002
50.0	-2.136E+000	-2.643E+001	-8.279E+002
55.0	-1.844E+000	-2.929E+001	-7.789E+002
60.0	-1.528E+000	-3.197E+001	-7.040E+002
65.0	-1.192E+000	-3.441E+001	-6.052E+002
70.0	-8.373E-001	-3.654E+001	-4.854E+002
75.0	-4.691E-001	-3.827E+001	-3.482E+002
80.0	-9.080E-002	-3.955E+001	-1.976E+002
85.0	2.934E-001	-4.034E+001	-3.879E+001
90.0	6.793E-001	-4.061E+001	1.251E+002
95.0	1.063E+000	-4.034E+001	2.875E+002
100.0	1.439E+000	-3.955E+001	4.440E+002
105.0	1.805E+000	-3.827E+001	5.898E+002
110.0	2.155E+000	-3.654E+001	7.204E+002
115.0	2.487E+000	-3.441E+001	8.318E+002
120.0	2.796E+000	-3.197E+001	9.206E+002
125.0	3.080E+000	-2.929E+001	9.838E+002
130.0	3.336E+000	-2.643E+001	1.019E+003
135.0	3.561E+000	-2.349E+001	1.026E+003
140.0	3.755E+000	-2.053E+001	1.004E+003
145.0	3.914E+000	-1.761E+001	9.531E+002
150.0	4.039E+000	-1.477E+001	8.748E+002
155.0	4.129E+000	-1.204E+001	7.714E+002
160.0	4.185E+000	-9.429E+000	6.457E+002
165.0	4.206E+000	-6.945E+000	5.013E+002
170.0	4.194E+000	-4.565E+000	3.425E+002
175.0	4.150E+000	-2.262E+000	1.738E+002
180.0	4.076E+000	0.000E+000	0.000E+000

7.3 Wave-drift load coefficients

Wave drift angle of attack: 0.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-3.587E-004	2.821E-011	-1.311E-008
1.776e-001	-4.640E-004	3.649E-011	-2.346E-008
2.072e-001	-6.216E-004	4.893E-011	-4.770E-008
2.487e-001	-8.829E-004	6.979E-011	-1.107E-007
2.764e-001	-1.061E-003	7.700E-011	-1.748E-007
3.110e-001	-1.318E-003	1.125E-010	-2.700E-007
3.455e-001	-1.604E-003	1.783E-010	-3.304E-007
3.658e-001	-1.800E-003	2.090E-010	-2.938E-007
3.886e-001	-2.037E-003	3.561E-010	-8.462E-008
4.146e-001	-2.344E-003	9.672E-011	7.367E-007
4.288e-001	-2.507E-003	1.847E-010	1.639E-006
4.442e-001	-2.666E-003	7.145E-010	7.383E-007
4.606e-001	-2.952E-003	-4.259E-010	-2.253E-006
4.783e-001	-3.173E-003	6.782E-010	-2.478E-006
4.975e-001	-3.477E-003	9.926E-010	-1.944E-006
5.182e-001	-4.049E-003	7.668E-010	-1.161E-006
5.408e-001	-6.106E-003	-5.721E-010	-4.531E-006
5.653e-001	-1.319E-002	-3.211E-009	-1.909E-006
5.922e-001	-3.610E-002	-2.641E-009	4.005E-006
6.218e-001	-1.034E-001	-1.790E-009	7.310E-006
6.546e-001	-2.822E-001	2.312E-008	1.073E-005
6.909e-001	-7.005E-001	4.468E-008	1.714E-005
7.316e-001	-1.526E+000	7.599E-008	2.229E-005
7.773e-001	-2.873E+000	7.850E-008	2.641E-005
8.291e-001	-4.232E+000	4.833E-007	2.524E-005
8.883e-001	-5.407E+000	6.865E-007	2.626E-005
9.576e-001	-5.737E+000	1.223E-006	2.074E-005
1.036e+000	-5.344E+000	1.849E-006	-7.625E-006
1.131e+000	-4.375E+000	7.442E-007	7.383E-006
1.244e+000	-2.594E+000	8.402E-007	-5.438E-007
1.382e+000	-2.365E+000	1.145E-006	-1.962E-005
1.555e+000	-1.964E+000	7.527E-007	-6.586E-006
1.777e+000	-1.861E+000	8.684E-007	-1.595E-005
2.073e+000	-1.928E+000	1.170E-006	-1.034E-006

Wave drift angle of attack: 15.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-3.349E-004	-8.072E-005	3.549E-002
1.776e-001	-4.383E-004	-1.056E-004	6.422E-002
2.072e-001	-5.924E-004	-1.428E-004	1.329E-001
2.487e-001	-8.335E-004	-2.009E-004	3.184E-001
2.764e-001	-1.029E-003	-2.480E-004	5.173E-001
3.110e-001	-1.332E-003	-3.207E-004	8.468E-001
3.455e-001	-1.783E-003	-4.288E-004	1.194E+000
3.658e-001	-2.273E-003	-5.463E-004	1.320E+000
3.886e-001	-3.508E-003	-8.438E-004	1.235E+000
4.146e-001	-8.680E-003	-2.100E-003	5.005E-001
4.288e-001	-1.936E-002	-4.702E-003	5.517E-002
4.442e-001	-3.892E-002	-9.482E-003	3.162E+000
4.606e-001	-2.687E-002	-6.541E-003	6.738E+000
4.783e-001	-1.477E-002	-3.575E-003	5.849E+000
4.975e-001	-1.020E-002	-2.431E-003	4.228E+000
5.182e-001	-8.616E-003	-1.959E-003	2.125E+000
5.408e-001	-9.354E-003	-1.891E-003	-8.377E-001
5.653e-001	-1.481E-002	-2.525E-003	-5.117E+000
5.922e-001	-3.439E-002	-5.467E-003	1.138E+001
6.218e-001	-9.358E-002	-1.551E-002	-2.018E+001
6.546e-001	-2.540E-001	-4.599E-002	-3.216E+001
6.909e-001	-6.384E-001	-1.288E-001	-4.765E+001
7.316e-001	-1.423E+000	-3.117E-001	-6.589E+001
7.773e-001	-2.698E+000	-7.775E-001	-8.352E+001
8.291e-001	-5.220E+000	-1.650E+000	-9.243E+001
8.883e-001	-5.529E+000	-3.113E+000	-8.076E+001
9.566e-001	-5.861E+000	-4.905E+000	-3.748E+001
1.036e+000	-5.281E+000	-5.992E+000	1.548E+001
1.131e+000	-4.707E+000	-5.415E+000	-5.300E+000
1.244e+000	-3.148E+000	-5.423E+000	-4.814E+001
1.382e+000	-2.799E+000	-6.128E+000	-2.412E+001
1.555e+000	-2.624E+000	-6.613E+000	-5.275E+001
1.777e+000	-2.612E+000	-7.030E+000	-7.296E+001
2.073e+000	-2.700E+000	-7.331E+000	-9.064E+001

Wave drift angle of attack: 30.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-2.728E-004	-1.417E-004	5.473E-002
1.776e-001	-3.504E-004	-1.820E-004	9.703E-002
2.072e-001	-4.759E-004	-2.472E-004	1.969E-001
2.487e-001	-7.017E-004	-3.644E-004	4.661E-001
2.764e-001	-9.049E-004	-4.699E-004	7.562E-001
3.110e-001	-1.291E-003	-6.702E-004	1.244E+000
3.455e-001	-2.169E-003	-1.125E-003	1.780E+000
3.658e-001	-3.345E-003	-1.735E-003	2.006E+000
3.886e-001	-6.727E-003	-3.490E-003	1.983E+000
4.146e-001	-2.273E-002	-1.181E-002	1.265E+000
4.288e-001	-5.647E-002	-2.938E-002	1.327E+000
4.442e-001	-1.183E-001	-6.160E-002	7.485E+000
4.606e-001	-7.901E-002	-4.123E-002	1.251E+001
4.783e-001	-3.991E-002	-2.088E-002	1.072E+001
4.975e-001	-2.472E-002	-1.299E-002	8.399E+000
5.182e-001	-1.845E-002	-9.709E-003	5.682E+000
5.408e-001	-1.635E-002	-8.427E-003	1.935E+000
5.653e-001	-1.859E-002	-8.825E-003	-3.534E+000
5.922e-001	-3.065E-002	-1.264E-002	1.177E+001
6.218e-001	-7.013E-002	-2.630E-002	-2.371E+001
6.546e-001	-1.831E-001	-6.912E-002	-4.071E+001
6.909e-001	-4.721E-001	-1.904E-001	-6.411E+001
7.316e-001	-1.117E+000	-5.154E-001	-9.480E+001
7.773e-001	-2.311E+000	-1.248E+000	-1.314E+002
8.291e-001	-5.021E+000	-2.822E+000	-1.668E+002
8.883e-001	-5.747E+000	-5.730E+000	-1.833E+002
9.566e-001	-6.414E+000	-9.991E+000	-1.451E+002
1.036e+000	-5.515E+000	-1.410E+001	-1.841E+001
1.131e+000	-5.100E+000	-1.543E+001	5.988E+001
1.244e+000	-4.733E+000	-1.546E+001	-3.745E+001
1.382e+000	-3.873E+000	-1.731E+001	-5.911E+001
1.555e+000	-4.043E+000	-1.819E+001	-1.150E+002
1.777e+000	-4.231E+000	-1.891E+001	-1.723E+002
2.073e+000	-3.931E+000	-1.852E+001	-1.992E+002

Wave drift angle of attack: 45.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-1.806E-004	-1.624E-004	5.257E-002
1.776e-001	-2.367E-004	-2.129E-004	8.937E-002
2.072e-001	-3.258E-004	-2.931E-004	1.746E-001
2.487e-001	-5.040E-004	-4.534E-004	4.019E-001
2.764e-001	-6.922E-004	-6.226E-004	6.485E-001
3.110e-001	-1.137E-003	-1.023E-003	1.072E+000
3.455e-001	-2.279E-003	-2.048E-003	1.573E+000
3.658e-001	-4.016E-003	-3.609E-003	1.836E+000
3.886e-001	-9.115E-003	-8.193E-003	2.012E+000
4.146e-001	-3.332E-002	-2.996E-002	2.222E+000
4.288e-001	-8.428E-002	-7.583E-002	3.995E+000
4.442e-001	-1.766E-001	-1.590E-001	1.277E+001
4.606e-001	-1.162E-001	-1.049E-001	1.579E+001
4.783e-001	-5.718E-002	-5.190E-002	1.266E+001
4.975e-001	-3.443E-002	-3.162E-002	1.034E+001
5.182e-001	-2.494E-002	-2.340E-002	8.297E+000
5.408e-001	-2.101E-002	-2.030E-002	5.774E+000
5.653e-001	-2.087E-002	-2.057E-002	2.030E+000
5.922e-001	-2.645E-002	-2.517E-002	3.530E+000
6.218e-001	-4.659E-002	-3.950E-002	-1.224E+001
6.546e-001	-1.068E-001	-8.017E-002	-2.535E+001
6.909e-001	-2.732E-001	-1.940E-001	-4.501E+001
7.316e-001	-6.907E-001	-5.134E-001	-7.444E+001
7.773e-001	-1.610E+000	-1.303E+000	-1.184E+002
8.291e-001	3.280E+000	-3.223E+000	-1.815E+002
8.883e-001	5.568E+000	-7.303E+000	-2.569E+002
9.566e-001	-7.354E+000	-1.428E+001	-2.988E+002
1.036e+000	-7.307E+000	-2.249E+001	-2.197E+002
1.137e+000	-5.499E+000	-2.776E+001	-3.670E+001
1.244e+000	-5.075E+000	-2.928E+001	3.074E+001
1.382e+000	-5.088E+000	-2.942E+001	-1.352E+002
1.555e+000	-4.848E+000	-3.056E+001	-1.982E+002
1.777e+000	-4.870E+000	-3.022E+001	-2.470E+002
2.073e+000	-4.765E+000	-3.097E+001	-2.690E+002

Wave drift angle of attack: 60.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-9.146E-005	-1.425E-004	3.619E-002
1.776e-001	-1.215E-004	-1.893E-004	5.769E-002
2.072e-001	-1.712E-004	-2.667E-004	1.054E-001
2.487e-001	-2.861E-004	-4.458E-004	2.292E-001
2.764e-001	-4.292E-004	-6.686E-004	3.643E-001
3.110e-001	-8.220E-004	-1.280E-003	6.064E-001
3.455e-001	-1.920E-003	-2.990E-003	9.339E-001
3.658e-001	-3.609E-003	-5.620E-003	1.176E+000
3.886e-001	-8.617E-003	-1.342E-002	1.574E+000
4.146e-001	-3.214E-002	-5.002E-002	3.137E+000
4.288e-001	-8.112E-002	-1.263E-001	7.195E+000
4.442e-001	-1.681E-001	-2.619E-001	1.783E+001
4.606e-001	-1.087E-001	-1.698E-001	1.621E+001
4.783e-001	-5.226E-002	-8.224E-002	1.107E+001
4.975e-001	-3.076E-002	-4.925E-002	8.602E+000
5.182e-001	-2.189E-002	-3.636E-002	7.168E+000
5.408e-001	-1.829E-002	-3.240E-002	5.890E+000
5.653e-001	-1.789E-002	-3.473E-002	4.237E+000
5.922e-001	-2.104E-002	-4.481E-002	1.634E+000
6.218e-001	-3.092E-002	-6.861E-002	-2.421E+000
6.546e-001	-5.805E-002	-1.232E-001	-9.153E+000
6.909e-001	-1.330E-001	-2.550E-001	-2.034E+001
7.316e-001	-3.383E-001	-5.142E-001	-3.961E+001
7.773e-001	-8.748E-001	-1.512E+000	-7.430E+001
8.291e-001	-1.411E+000	-4.022E+000	-1.362E+002
8.883e-001	-1.569E+000	-1.013E+001	-2.175E+002
9.566e-001	-7.222E+000	-2.012E+001	-2.386E+002
1.036e+000	-8.527E+000	-2.987E+001	-2.228E+002
1.131e+000	-7.917E+000	-3.431E+001	-2.392E+002
1.244e+000	-6.292E+000	-3.749E+001	-2.246E+002
1.382e+000	-5.140E+000	-3.994E+001	-1.357E+002
1.555e+000	-5.190E+000	-4.115E+001	-1.186E+002
1.777e+000	-5.377E+000	-4.179E+001	-2.411E+002
2.073e+000	-5.179E+000	-4.245E+001	-2.262E+002

Wave drift angle of attack: 75.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-2.531E-005	-8.498E-005	1.703E-002
1.776e-001	-3.425E-005	-1.150E-004	2.513E-002
2.072e-001	-5.167E-005	-1.735E-004	4.186E-002
2.487e-001	-1.010E-004	-3.392E-004	8.423E-002
2.764e-001	-1.744E-004	-5.854E-004	1.323E-001
3.110e-001	-3.950E-004	-1.326E-003	2.300E-001
3.455e-001	-1.055E-003	-3.542E-003	4.152E-001
3.658e-001	-2.081E-003	-6.980E-003	6.312E-001
3.886e-001	-5.104E-003	-1.711E-002	1.198E+000
4.146e-001	-1.913E-002	-6.408E-002	3.847E+000
4.288e-001	-4.798E-002	-1.606E-001	9.709E+000
4.442e-001	-9.817E-002	-3.287E-001	2.139E+001
4.606e-001	-6.226E-002	-2.090E-001	1.544E+001
4.783e-001	-2.920E-002	-9.881E-002	8.472E+000
4.975e-001	-1.674E-002	-5.791E-002	5.604E+000
5.182e-001	-1.170E-002	-4.253E-002	4.232E+000
5.408e-001	-9.800E-003	-3.908E-002	3.347E+000
5.653e-001	-9.874E-003	-4.516E-002	2.504E+000
5.922e-001	-1.204E-002	-6.438E-002	1.334E+000
6.218e-001	-1.765E-002	-1.082E-001	-4.132E-001
6.546e-001	-3.065E-002	-2.054E-001	-3.529E+000
6.909e-001	-6.243E-002	-4.295E-001	-9.170E+000
7.316e-001	-1.478E-001	-9.154E-001	-1.988E+001
7.773e-001	-3.945E-001	-2.483E+000	-4.124E+001
8.291e-001	-1.20E+000	-6.764E+000	-8.271E+001
8.883e-001	2.996E+000	-1.764E+001	-1.306E+002
9.566e-001	-5.350E+000	-3.236E+001	-6.315E+001
1.036e+000	-5.741E+000	-4.032E+001	8.476E+001
1.137e+000	-5.556E+000	-4.205E+001	1.445E+002
1.244e+000	-5.906E+000	-4.282E+001	1.008E+002
1.382e+000	-5.916E+000	-4.361E+001	-7.948E-001
1.555e+000	-5.894E+000	-4.580E+001	-1.309E+002
1.777e+000	-5.660E+000	-4.838E+001	-1.901E+002
2.073e+000	-5.069E+000	-4.979E+001	-1.294E+002

Preliminary Design, @IDR5

Wave drift angle of attack: 90.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	2.946E-029	-3.705E-006	1.903E-004
1.776e-001	7.989E-029	-1.071E-005	5.291E-004
2.072e-001	-2.782E-011	-3.427E-005	1.729E-003
2.487e-001	-4.571E-010	-1.546E-004	7.621E-003
2.764e-001	-3.491E-009	-3.761E-004	1.913E-002
3.110e-001	-3.520E-008	-1.126E-003	5.893E-002
3.455e-001	-3.050E-007	-3.473E-003	1.891E-001
3.658e-001	-1.119E-006	-7.143E-003	3.993E-001
3.886e-001	-5.191E-006	-1.804E-002	1.040E+000
4.146e-001	-3.768E-005	-6.837E-002	4.100E+000
4.288e-001	-1.327E-004	-1.714E-001	1.051E+001
4.442e-001	-3.827E-004	-3.492E-001	2.192E+001
4.606e-001	-3.426E-004	-2.199E-001	1.410E+001
4.783e-001	-2.258E-004	-1.027E-001	6.641E+000
4.975e-001	-1.787E-004	-5.942E-002	3.748E+000
5.182e-001	-1.660E-004	-4.336E-002	2.485E+000
5.408e-001	-1.724E-004	-4.029E-002	1.858E+000
5.653e-001	-1.973E-004	-4.831E-002	1.510E+000
5.922e-001	-2.541E-004	-7.219E-002	1.414E+000
6.218e-001	-4.034E-004	-1.272E-001	1.453E+000
6.546e-001	-8.763E-004	-2.505E-001	1.667E+000
6.909e-001	-2.578E-003	-5.370E-001	2.060E+000
7.316e-001	-8.971E-003	-1.249E+000	2.410E+000
7.773e-001	-3.381E-002	-3.164E+000	1.285E+000
8.291e-001	-1.385E-001	-8.635E+000	-8.641E+000
8.883e-001	6.226E-001	-2.247E+001	-5.297E+001
9.566e-001	-2.252E+000	-3.969E+001	-1.127E+002
1.036e+000	-4.303E+000	-4.546E+001	-1.112E+001
1.137e+000	-4.303E+000	-4.638E+001	9.253E+001
1.244e+000	-3.506E+000	-4.609E+001	8.939E+001
1.382e+000	-3.273E+000	-4.730E+001	3.341E+001
1.555e+000	-3.171E+000	-4.976E+001	-1.719E+001
1.777e+000	-3.432E+000	-5.117E+001	-3.617E+001
2.073e+000	-3.835E+000	-5.196E+001	-1.289E+001

Wave drift angle of attack: 105.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-2.304E-005	7.736E-005	-1.670E-002
1.776e-001	-2.819E-005	9.463E-005	-2.419E-002
2.072e-001	-3.231E-005	1.085E-004	-3.876E-002
2.487e-001	-1.793E-005	6.022E-005	-7.047E-002
2.764e-001	2.998E-005	-1.006E-004	-9.761E-002
3.110e-001	2.130E-004	-7.150E-004	-1.239E-001
3.455e-001	8.267E-004	-2.776E-003	-7.467E-002
3.658e-001	1.815E-003	-6.093E-003	8.706E-002
3.886e-001	4.779E-003	-1.605E-002	6.721E-001
4.146e-001	1.865E-002	-6.266E-002	3.523E+000
4.288e-001	4.725E-002	-1.589E-001	9.183E+000
4.442e-001	9.710E-002	-3.272E-001	1.800E+001
4.606e-001	6.150E-002	-2.082E-001	9.882E+000
4.783e-001	2.867E-002	-9.817E-002	3.451E+000
4.975e-001	1.627E-002	-5.721E-002	1.118E+000
5.182e-001	1.120E-002	-4.166E-002	2.145E-001
5.408e-001	9.281E-003	-3.813E-002	-3.982E-002
5.653e-001	9.302E-003	-4.407E-002	2.107E-001
5.922e-001	1.138E-002	-6.305E-002	1.037E+000
6.218e-001	1.683E-002	-1.065E-001	2.777E+000
6.546e-001	2.942E-002	-2.025E-001	5.997E+000
6.909e-001	6.032E-002	-4.235E-001	1.173E+001
7.316e-001	1.441E-001	-9.177E-001	2.173E+001
7.773e-001	3.926E-001	-2.419E+000	3.827E+001
8.291e-001	1.150E+000	-6.502E+000	5.737E+001
8.883e-001	3.038E+000	-1.668E+001	2.952E+001
9.566e-001	4.758E+000	-3.054E+001	-8.325E+001
1.036e+000	3.658E+000	-3.953E+001	5.726E+001
1.131e+000	2.436E+000	-4.299E+001	2.560E+002
1.244e+000	1.949E+000	-4.521E+001	2.998E+002
1.382e+000	1.264E+000	-4.562E+001	2.233E+002
1.555e+000	-3.432E-002	-4.445E+001	1.476E+002
1.777e+000	-9.993E-001	-4.558E+001	1.371E+002
2.073e+000	-1.209E+000	-4.650E+001	1.090E+002

Wave drift angle of attack: 120.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-8.813E-005	1.373E-004	-3.591E-002
1.776e-001	-1.121E-004	1.747E-004	-5.693E-002
2.072e-001	-1.418E-004	2.210E-004	-1.030E-001
2.487e-001	-1.572E-004	2.449E-004	-2.194E-001
2.764e-001	-1.088E-004	1.695E-004	-3.396E-001
3.110e-001	1.384E-004	-2.153E-004	-5.300E-001
3.455e-001	1.085E-003	-1.690E-003	-6.896E-001
3.658e-001	2.655E-003	-4.135E-003	-6.605E-001
3.886e-001	7.487E-003	-1.166E-002	-2.335E-001
4.146e-001	3.066E-002	-4.776E-002	2.140E+000
4.288e-001	7.928E-002	-1.235E-001	6.326E+000
4.442e-001	1.663E-001	-2.594E-001	1.035E+001
4.606e-001	1.076E-001	-1.683E-001	1.893E+000
4.783e-001	5.130E-002	-8.091E-002	-2.560E+000
4.975e-001	2.977E-002	-4.782E-002	-3.819E+000
5.182e-001	2.083E-002	-3.478E-002	-4.027E+000
5.408e-001	1.717E-002	-3.069E-002	-3.593E+000
5.653e-001	1.673E-002	-3.290E-002	-2.436E+000
5.922e-001	1.982E-002	-4.268E-002	-2.130E-001
6.218e-001	2.986E-002	-6.612E-002	3.630E+000
6.546e-001	5.784E-002	-1.196E-001	9.949E+000
6.909e-001	1.364E-001	-2.476E-001	2.019E+001
7.316e-001	3.587E-001	-5.128E-001	3.687E+001
7.773e-001	9.711E-001	-1.437E+000	6.387E+001
8.291e-001	2.551E+000	-3.736E+000	1.017E+002
8.883e-001	5.967E+000	-9.176E+000	1.201E+002
9.566e-001	9.955E+000	-1.820E+001	1.073E+002
1.036e+000	9.984E+000	-2.809E+001	2.144E+002
1.131e+000	6.121E+000	-3.310E+001	2.682E+002
1.244e+000	3.065E+000	-3.324E+001	2.129E+002
1.382e+000	2.084E+000	-3.289E+001	2.175E+002
1.555e+000	2.458E+000	-3.426E+001	2.251E+002
1.777e+000	2.503E+000	-3.493E+001	2.245E+002
2.073e+000	2.333E+000	-3.541E+001	2.184E+002

Wave drift angle of attack: 135.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-1.775E-004	1.597E-004	-5.242E-002
1.776e-001	-2.281E-004	2.052E-004	-8.888E-002
2.072e-001	-2.969E-004	2.671E-004	-1.731E-001
2.487e-001	-3.805E-004	3.423E-004	-3.966E-001
2.764e-001	-3.828E-004	3.445E-004	-6.349E-001
3.110e-001	-2.134E-004	1.925E-004	-1.031E+000
3.455e-001	6.564E-004	-5.886E-004	-1.440E+000
3.658e-001	2.173E-003	-1.951E-003	-1.557E+000
3.886e-001	7.002E-003	-6.289E-003	-1.286E+000
4.146e-001	3.073E-002	-2.761E-002	6.336E-001
4.288e-001	8.129E-002	-7.306E-002	3.316E+000
4.442e-001	1.737E-001	-1.563E-001	2.457E+000
4.606e-001	1.143E-001	-1.030E-001	-6.022E+000
4.783e-001	5.527E-002	-5.007E-002	-8.080E+000
4.975e-001	3.241E-002	-2.971E-002	-7.782E+000
5.182e-001	2.277E-002	-2.136E-002	-6.645E+000
5.408e-001	1.874E-002	-1.818E-002	-4.606E+000
5.653e-001	1.862E-002	-1.843E-002	-1.238E+000
5.922e-001	2.434E-002	-2.302E-002	4.158E+000
6.218e-001	4.488E-002	-3.727E-002	1.249E+001
6.546e-001	1.066E-001	-7.732E-002	2.505E+001
6.909e-001	2.780E-001	-1.882E-001	4.366E+001
7.316e-001	7.145E-001	-4.154E-001	7.081E+001
7.773e-001	1.701E+000	-1.236E+000	1.089E+002
8.291e-001	3.591E+000	-2.964E+000	1.544E+002
8.883e-001	5.350E+000	-6.431E+000	1.825E+002
9.566e-001	8.356E+000	-1.206E+001	1.712E+002
1.036e+000	6.856E+000	-1.832E+001	1.388E+002
1.131e+000	4.635E+000	-2.160E+001	8.956E+001
1.244e+000	5.433E+000	-2.253E+001	1.404E+002
1.382e+000	5.036E+000	-2.224E+001	1.862E+002
1.555e+000	4.717E+000	-2.215E+001	2.021E+002
1.777e+000	4.982E+000	-2.151E+001	2.516E+002
2.073e+000	5.239E+000	-2.194E+001	2.507E+002

Wave drift angle of attack: 150.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-2.717E-004	1.411E-004	-5.465E-002
1.776e-001	-3.467E-004	1.801E-004	-9.678E-002
2.072e-001	-4.631E-004	2.405E-004	-1.964E-001
2.487e-001	-6.207E-004	3.224E-004	-4.642E-001
2.764e-001	-7.085E-004	3.681E-004	-7.515E-001
3.110e-001	-6.981E-004	3.630E-004	-1.229E+000
3.455e-001	-2.679E-004	1.410E-004	-1.733E+000
3.658e-001	6.671E-004	-3.426E-004	-1.907E+000
3.886e-001	3.735E-003	-1.931E-003	-1.725E+000
4.146e-001	1.926E-002	-9.974E-003	-2.499E-001
4.288e-001	5.268E-002	-2.729E-002	1.267E+000
4.442e-001	1.145E-001	-5.936E-002	-2.094E+000
4.606e-001	7.580E-002	-3.932E-002	-9.072E+000
4.783e-001	3.660E-002	-1.903E-002	-9.129E+000
4.975e-001	2.128E-002	-1.112E-002	-7.528E+000
5.182e-001	1.491E-002	-7.816E-003	-5.144E+000
5.408e-001	1.272E-002	-6.515E-003	-1.592E+000
5.653e-001	1.487E-002	-6.884E-003	3.725E+000
5.922e-001	2.710E-002	-1.077E-002	1.179E+001
6.218e-001	6.698E-002	-2.455E-002	2.351E+001
6.546e-001	1.809E-001	-6.704E-002	4.017E+001
6.909e-001	4.718E-001	-1.862E-001	6.308E+001
7.316e-001	1.119E+000	-4.108E-001	9.296E+001
7.773e-001	2.309E+000	-1.188E+000	1.276E+002
8.291e-001	3.951E+000	-2.584E+000	1.558E+002
8.883e-001	5.423E+000	-4.955E+000	1.529E+002
9.566e-001	5.962E+000	-8.104E+000	1.118E+002
1.036e+000	6.412E+000	-1.071E+001	9.107E+001
1.131e+000	8.128E+000	-1.055E+001	1.308E+002
1.244e+000	7.920E+000	-9.376E+000	1.544E+002
1.382e+000	6.864E+000	-9.788E+000	1.145E+002
1.555e+000	6.958E+000	-9.987E+000	1.124E+002
1.777e+000	6.982E+000	-1.055E+001	1.256E+002
2.073e+000	7.205E+000	-1.104E+001	1.472E+002

Wave drift angle of attack: 165.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-3.396E-004	8.186E-005	-3.544E-002
1.776e-001	-4.346E-004	1.048E-004	-6.420E-002
2.072e-001	-5.912E-004	1.425E-004	-1.329E-001
2.487e-001	-8.089E-004	1.950E-004	-3.181E-001
2.764e-001	-9.776E-004	2.357E-004	-5.165E-001
3.110e-001	-1.135E-003	2.739E-004	-8.448E-001
3.455e-001	-1.166E-003	2.824E-004	-1.187E+000
3.658e-001	-9.615E-004	2.342E-004	-1.305E+000
3.886e-001	-8.988E-005	2.675E-005	-1.197E+000
4.146e-001	4.709E-003	-1.120E-003	-3.496E-001
4.288e-001	1.516E-002	-3.619E-003	3.279E-001
4.442e-001	3.459E-002	-8.252E-003	-2.378E+000
4.606e-001	2.253E-002	-5.355E-003	-6.252E+000
4.783e-001	1.028E-002	-2.421E-003	-5.638E+000
4.975e-001	5.470E-003	-1.254E-003	-4.128E+000
5.182e-001	3.792E-003	-7.834E-004	-2.084E+000
5.408e-001	4.432E-003	-7.150E-004	8.336E+000
5.653e-001	9.961E-003	-1.392E-003	5.093E+000
5.922e-001	2.964E-002	-4.381E-003	1.126E+001
6.218e-001	8.904E-002	-1.451E-002	1.996E+001
6.546e-001	2.494E-001	-4.480E-002	3.183E+001
6.909e-001	6.312E-001	-1.263E-001	4.723E+001
7.316e-001	1.400E+000	-3.128E-001	6.550E+001
7.773e-001	2.609E+000	-7.397E-001	8.314E+001
8.291e-001	5.901E+000	-1.504E+000	9.101E+001
8.883e-001	1.714E+000	-2.671E+000	7.741E+001
9.566e-001	5.508E+000	-3.981E+000	5.426E+001
1.036e+000	8.094E+000	-4.563E+000	7.273E+001
1.131e+000	9.361E+000	-3.449E+000	1.142E+002
1.244e+000	7.788E+000	-2.607E+000	9.452E+001
1.382e+000	8.017E+000	-2.623E+000	8.787E+001
1.555e+000	8.176E+000	-2.232E+000	6.916E+001
1.777e+000	8.502E+000	-2.099E+000	6.198E+001
2.073e+000	8.517E+000	-2.309E+000	6.151E+001

Preliminary Design, @IDR5

Wave drift angle of attack: 180.0 deg			
Frequency [rad/s]	Surge [tf/m ²]	Sway [tf/m ²]	Yaw [tf/m]
1.555e-001	-3.585E-004	-3.055E-031	-3.465E-029
1.776e-001	-4.653E-004	-2.770E-031	-1.086E-028
2.072e-001	-6.244E-004	-8.618E-030	-7.551E-012
2.487e-001	-8.801E-004	-1.475E-029	8.379E-012
2.764e-001	-1.055E-003	-7.651E-012	-1.585E-010
3.110e-001	-1.307E-003	-1.074E-011	1.383E-009
3.455e-001	-1.556E-003	-3.598E-011	1.776E-009
3.658e-001	-1.678E-003	1.146E-010	-9.151E-009
3.886e-001	-1.782E-003	4.554E-011	-5.592E-009
4.146e-001	-1.891E-003	-4.151E-010	-2.721E-008
4.288e-001	-1.923E-003	-2.533E-010	3.598E-009
4.442e-001	-1.931E-003	3.976E-011	1.838E-008
4.606e-001	-1.891E-003	1.010E-011	-4.468E-008
4.783e-001	-1.883E-003	-4.829E-010	-2.242E-008
4.975e-001	-1.759E-003	2.529E-010	2.387E-008
5.182e-001	-1.288E-003	-7.090E-010	-5.349E-008
5.408e-001	6.427E-004	5.586E-010	2.958E-008
5.653e-001	7.748E-003	2.856E-009	-1.350E-008
5.922e-001	3.071E-002	5.013E-009	-5.351E-008
6.218e-001	9.820E-002	-6.695E-009	-2.996E-007
6.546e-001	2.764E-001	-7.136E-009	2.812E-007
6.909e-001	6.903E-001	-3.335E-008	-3.188E-007
7.316e-001	1.493E+000	9.122E-009	-4.997E-007
7.773e-001	2.682E+000	1.325E-008	-3.126E-006
8.291e-001	3.831E+000	-1.061E-008	6.908E-007
8.883e-001	4.506E+000	-1.012E-008	-6.842E-007
9.566e-001	5.607E+000	-2.524E-007	-2.267E-006
1.036e+000	8.749E+000	6.161E-007	-8.715E-006
1.131e+000	9.249E+000	6.173E-008	-6.793E-006
1.244e+000	7.681E+000	4.398E-008	7.865E-006
1.382e+000	8.000E+000	-4.487E-007	1.504E-005
1.555e+000	8.208E+000	3.338E-008	3.782E-006
1.777e+000	8.623E+000	-1.776E-007	-3.720E-006
2.073e+000	8.566E+000	-1.444E-007	3.543E-007

Preliminary Design, @IDR5