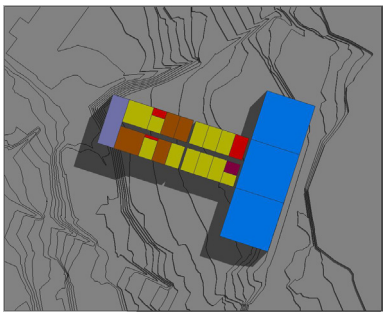

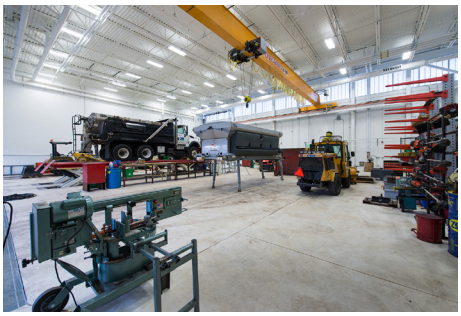

October 26, 2016

35% VEOC Basis of Design (BOD)

RNL

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SECTION 1 EXECUTIVE SUMMARY

A. General

1. This Design Analysis reflects RNL Design's interpretation of the criteria contained in the project Statement of Work, information collected from User interviews and site investigations, as well as during further development of the design process for the Vehicle & Equipment Operations Center's (VEOC) project at McMurdo Station, Antarctica.

2. Pertinent figures and facts for this project include:

   Scope As Designed:

Sub-Level 00 Floor Area (Wash)	5,984 GSF
Level 01 Floor Area (Main Level)	76,598 GSF
Level 02 (Mechanical Mezzanine)	3,576 GSF
Total Floor Area:	86,158 GSF**
**Calculations are based on Revit Model	
Project's Program	89,424 GSF
Difference	(3,266) SF
Total Conditioned Space:	42,493 SF
Total Tempered Space:	17,411 SF
Total Un-Heated Space:	23,222 SF

   Cost Limitations:

RFI Budget	$15,000,000 - $25,000,000

3. Other Site Features:

   Ramps into the facility

   Grading

   Utilities

   Exterior Vehicle & Equipment Storage improvements

   Exterior Site Stair

B. Facility Summary

1. The new Vehicle & Equipment Operations Center (VEOC) is a component of the complete rebuild of the United States Antarctic Program's McMurdo Station. The purpose of the VEOC is to serve as the maintenance and operations facility to support all equipment and vehicles at McMurdo. The primary users of the VEOC are VMF (Vehicle Maintenance), MEC (Mechanical Equipment Center), AGE (Aerospace Ground Equipment), TRAVERSE (Traverse Operations), and Fleet Operations. VMF provides support for vehicle maintenance throughout the facility, including light and heavy vehicles. TRAVERSE provides support and maintains the traverse vehicles and equipment which supply fuel and other resources to the pole. AGE provides maintenance and support for the aircraft ground equipment. MEC provides maintenance and support for equipment necessary for scientific missions in the near and far fields, this equipment includes snowmobiles, generators, augers and other small engine and battery equipment.

   This document summarizes the initial design for the VEOC, which follows on the heels of the subject programming and master planning concept design report, VEOC Charrette Design Report, dated June 21, 2016. The A/E design team consists of the following team members:

   Civil: Merrick & Company

   Structrual: Monroe & Newell

   Architect: RNL

   Equipment: Maintence Design Group

   MEP: MEP Engineering

   Lighting: RNL

   Information Technology: Michael Baker International

   Energy (Modeling / Analysis): Ambient Energy

   Cost Estimating: Johan Kemp

2. The VEOC will support approximately 68 people during the largest shifts. The operation is 24/7/365 with the bulk of the equipment and vehicle maintenance occurring currently in the winter months (April 25 - August 19). TRAVERSE's operation will ramp down, while VMF, AGE and MEC will remain relatively constant with summer levels. The summer months (October 23 - February 19) are the busiest time periods at McMurdo because of the tight window in which to complete all scientific operations and Antarctic exploration. During these months, MEC is delivering and receiving 1000s of small pieces of equipment, AGE is operating the airfield daily, TRAVERSE is either out on traverse or preparing for the next one, and VMF is working 2 shifts per day to maintain large vehicles and equipment.

3. The VEOC is a new 2 story facility. The overall structure is robust with a structural steel frame, durable heated precast concrete flooring, SIP panel walls, and standing seam metal roofing.

C. Discipline Narratives

1. Included in this document are the following discipline narratives:

   Civil and Sitework (By others under separate contract. Will be included in 35% Report)

   Architectural

   Interiors

   Structural

   Mechanical and Plumbing

   Fire Protection

   Electrical, Lighting, and Communications

   Environmental Compliance

   Contracting Strategy

   Sustainable Design

   This document defines User needs and presents discipline specific design analyses. A Construction Cost Estimate (under separate cover) will be provided with this submittal.

SECTION 2 PROGRAMMING NOTES

A. Funding - TBD

B. Scope Summary

The following major elements and their associated scope are from the Statement of Work and are contained within this project:

1. VEOC Building
2. Ramps into the facility
3. Site grading and site improvements (by others)
4. Utilities (by others)
5. Site power and lighting (by others)

C. Design Schedule

Master Plan Charrette	4 & 5 April 2016
Master Plan Charrette Report	21 June 2016
Partial 15% Design Submittal	8 July 2016
Final 15% Design Submittal	5 August 2016
Partial 35% Design Submittal	29 August 2016
Final 35% Design Submittal	9 September 2016
Integrated Review Meeting 35% Submittal	29 September 2016

D. Bid Options

1. Per direction from ASC, this project shall not exceed the Construction Cost Limitation (CCL) or scope identified in the Statement of Work. Bid options have been identified to ensure an awardable project. These bid options are (subject to modifications as design progresses):
   a. Bid Option 1: TBD
   b. Bid Option 2: TBD

E. Stakeholder Interviews and Results

1. Reference Appendix to this document, entitled “Design Charrette Meeting Minutes.”

SECTION 3 ACTION ITEMS

1. Complete 35% BOD Final
2. Complete 35% Cost Estimate

SECTION 4 CIVIL AND SITE WORK

Preliminary design for the site, roadway, grading, and utilities for the VEOC was originally created in the master planning process. The final results of the master planning were documented on October 30, 2015 in Master Plan 2.1 (MP 2.1). This McMurdo VEOC Bridging Document has further developed all of the MP 2.1 concepts associated with the VEOC. The intent of this section of the report is to explain the important civil-related items that resulted in the current McMurdo Station VEOC design.

A. Existing Site

The VEOC site lies north of Scott Base Road in the northern portion of McMurdo Station, Antarctica. Several other existing buildings and utilities that service the current McMurdo Station are located at this proposed site. Since many of these existing buildings and utilities will be used by McMurdo Station throughout the construction of the VEOC, this site was selected for the VEOC in the master planning process to keep McMurdo Station consolidated throughout construction. Throughout the VEOC design process there have been key restraints defined that have finalized the VEOC location.

Beneath the proposed footprint of the VEOC, several existing buildings are present in the current location: Buildings 340, 341, 342, and 140. Buildings 340, 341, and 342 will be demolished prior to the construction of VEOC under a separate contract (not a part of this project). Building 140 can remain during the construction and intial operation of the VEOC but neither facility will operate optimally. Access to Building 140 will be restricted by the new VEOC site improvements and the existing cargo yard associated with Building 140 will be occupied by the VEOC building itself. The VEOC wash bay will have restricted access until Building 140 is ultimately removed and functions are replicated elsewhere with other new construction. Removal of Building 140 is not a part of this project.

The anticipated area encompassed by the VEOC site is approximately 6.9 acres. The site consists of native volcanic rock materials amongst the existing buildings listed above. Existing aboveground utilities are interspersed across the site, servicing the various existing facilities. These utilities include: overhead power lines with poles, communication lines, and fuel.
There is an existing fuel distribution pipe rack within the proposed VEOC site. This fuel pipe rack will be rerouted as part of the separate, overall site utilities project.

B. Roadways

Vehicles will access the upper level of VEOC via Scott Base Road (to the south of VEOC) and a roadway connection (to the north of VEOC – near existing Building 143 VMF). This will provide circulation and drive-through capability for the vehicle service bays within VEOC. Vehicles will access the lower vehicle wash bay element in the same manner, but grade will be separated from the upper level.

C. Grading

The upper level of the VEOC will have a finished floor elevation all at the same level to facilitate material distribution within the facility by forklift as well as to provide drive-through capability for the vehicle service bays. The lowest level vehicle wash bay will have a finish floor elevation to support at-grade vehicle drive-through. All grading improvements as shown in these documents and drawings will be performed by a separate project. Contractor is to assume receipt of the site with grading and walls as shown on the proposed grading plan. Contractor will be responsible for fine grading on the site during construction and can assume the overall site grading (as shown herein) will be +/- 2” from the concept shown.

D. Utilities

Utilities to support the VEOC are assumed to be: domestic and fire suppression water, sanitary sewer, fuel, heat loop supply and return, power, and communications. All of the utilities are assumed to be fed to the VEOC from the exterior McMurdo utility distribution system, which is being upgraded by a separate project.

In MP 2.1, the VEOC was serviced from a utility main distribution looped branch within the northern portion of McMurdo Station. To reduce the scope of the utilities project and to cut cost, the utility loop within the northern part of McMurdo Station was removed. VEOC will now be serviced by dead-end utility services. The sanitary sewer will be gravity fed from the southwest side of VEOC. All other utilities will be fed from a utility vault also located at the southwest corner of the VEOC.

E. Landscape Design

1. There will be no landscape or irrigation improvements as part of this project.

F. Exterior Electrical Distribution and Lighting

1. Exterior lighting will be building mounted only.

G. Site Communication

1. Site Communication will be building mounted.
2. Telecommunications System
   a. High pair copper and single mode fiber optic (SM FO) cabling will be provided to the facility through the new combined site utility corridor.
   b. The communications outside plant cabling will enter the facility at the telecommunication entrance room (TER) which contains protective entrance terminals, 110 termination blocks, main grounding busbar and rack mounted fiber optic termination patch panels. The TER shall be 10’x12’ and contain three 2’x3’ racks/cabinets. A plywood backboard will be installed on two walls to accommodate any copper cabling connections and any miscellaneous wall mounted equipment. All over head cabling will be contained in a ladder rack wire management system.

SECTION 5 ARCHITECTURE

A. General Description

1. New construction after demolition of existing structures and preparation of existing subgrade to bedrock.
2. Existing site slopes significantly (16 ft. +/-) from east to west and will require substantial fill material. Currently the design utilizes Structural Fill and GeoFoam as the fill materials under the facility.
3. Facility is designed to accommodate the harsh climate and wind loading criteria of McMurdo Station, and have an intended life span of 50 years or more.
4. Energy efficiency and facility functionality are critical elements to the facility's design.
5. **PROJECT GOALS** **VALUES**

Maintain Place:	The new VEOC at McMurdo Station will be a global example how to design, build, operate, and maintain a vital equipment and vehicle maintenance and operations facility in one of the most remote places on Earth.
Foster National Pride:	By creating a streamlined vehicle and maintenance operations facility at McMurdo, the VEOC will create efficiencies and colocations at McMurdo Station, thus making a great impact to the success of the United States' Antarctic Program as a whole.
Be Reliable:	Meeting rigid schedule demands, but also being flexible to respond to the unforeseen - by enabling both, true reliability is ensured to the NSF's globally supported grantees.
Be Innovative:	VEOC will be one of the premier facilities of the entire continent, and must enable staff to meet tighter deadlines and quicker turnarounds from one project to the next.

Conserve Resources: The new VEOC is an opportunity to contribute to the new McMurdo Station's goal of significantly reducing its annual carbon footprint compared to the existing station.

Design Safety: Creating a facility that increases operational safety for the staff that will occupy the VEOC is paramount to its long term success and significant initial financial investment.

B. Building Code and Life Safety Analysis

1. The current design is based on the most current adopted International Codes. It is not anticipated that these codes will change during the timeframe of this project, and as such, they will remain the basis of our design.

   INTERNATIONAL BUILDING CODE – 2015 EDITION

   INTERNATIONAL PLUMBING CODE - 2015 EDITION

   INTERNATIONAL MECHANICAL CODE - 2015 EDITION

   INTERNATIONAL /NATIONAL ELECTRICAL CODE - 2014 (NEC) EDITION

   INTERNATIONAL ENERGY CONSERVATION CODE - 2015 EDITION

   INTERNATIONAL FIRE CODE - 2015 EDITION

   INTERNATIONAL FUEL GAS CODE - 2015 EDITION

   NFPA - 2015 EDITION (Only Sections as referenced in the International Codes)

   ASHRAE STANDARD 55-2013

   ASHRAE STANDARD 62.2-2013

   ASHRAE STANDARD 90.1-2013

   ICC/ANSI A117.1-2009 AMERICAN NATIONAL STANDARD

2. Initial Code Analysis

   <u>Area</u>

Allowable Area:	Unlimited *
Gross Area:	86,158 SF
Net Area:	83,126 SF

Use and Occupancy

Space	**VMF**	**MEC**	**AGE**	**TRAVERSE**	**Fleet Ops**	**Supply**	**Total**
Occupancy	S-1	S-1	S-1	S-1	B	S-2	
Construction Type	V-B*						
Large Bay	7	1	0	3	0	0	30x50 ea.
Small Bay	1	1	1	0	0	0	25x25 ea.

*** IBC 506.1.1 & IBC 507.5**

The area of group B,F,M or S builiding no more that two stories above grade grade plane shall not be limited where the building is equipped througout with an automatic sprinkler system in accordance with section 903.1.1 and is surrounded and adjoined by public way or yards not less than 60 feet in width.

3. Accessibility Requirements:

   Accessibility to all the design of this facility is not required to meet the Americans with Disabilities Act (ADA).

C. Construction Description – Roof

Ultimate wind speed: 150 mph

Layers – exterior to interior:

Prefinished standing seam sheet metal panel roofing system

Self-adhering air and water barrier sheet membrane

3/4” Plywood cover board

Continuous Polyisocyanurate board insulation (R-Value = 100) (with staggered joints)

Vapor retarder

Glass-mat water-resistant substrate board

1 ½" Metal deck

Bar joist sub structure

Roof framing steel super structure

D. Construction Description – Exterior Vertical Surfaces

1. Walls: Layers – Exterior to Interior

Prefinished standing seam sheet metal panel (Concealed fasterners)

Self-adhering sheet vapor permeable air and water barrier

3" foam control nailstrip with furring strips

12 ¼" SIPS Panels

Vapor retarder

4" Furring wall (metal or wood studs, metal preferred) or mechanically fastened sheet metal wall covering at shop areas

Steel super structure

2. Large Vehicle Operable Walls/Doors: Layers – Exterior to Interior

Insulated fiberglass translucent glazing (high windows) or spf 73 with argon insulating clear glass vision glazing units (low, vision windows)

12 ¼" SIPS Panels

Steel frame structure

Hydraulic single panel door with operators

SECTION 6 INTERIORS

A. General

1. This project includes the selection and coordination of interior and exterior materials and finishes. Functional excellence and durability in interior design is a primary goal for this project. Careful attention to durability function and budgetary concerns was exercised to assure the best possible product. Materials and finishes were selected for long-term appearance retention and low maintenance.

B. Finishes

1. Wall Finishes:
   a. **Interior Partition 1:** 5/8” Gypsum Board with smooth finish
      4” nominal metal studs (acoustic batt)
      5/8” Gypsum Board with smooth finish
   b. **Interior Partition 2**: 4” nominal studs (acoustic batt)
      5/8” Gypsum Tile Board
      Ceramic tile
   c. **Interior Partition 3**: 4” nominal firring studs (acoustic batt)
      5/8” Gypsum Board with smooth finish
   d. **Interior Partition 4**: 8” Concrete masonry
   e. **Interior Partition 5:** Epoxy painted precast concrete (Wash Bay)
   f. **Interior Partition 6:** Janitor Closets will have Fiberglass Reinforce Panels (FRP) for ease of maintenance and low cost
2. Wall Base:
   a. Restrooms will have ceramic tile base.
3. Floor Finishes:
   a. **Carpet 1:** FIELD CARPET TILE

MFR:	Tandus / Centiva
STYLE:	2nd Power 04987
COLOR:	Natural
SIZE:	24"x24"

b. **CPT 2**: FIELD CARPET TILE

MFR:	Tandus / Centiva
STYLE:	Grid Overlay 02969
COLOR:	Natural with Blue Accent
SIZE:	24"x24"

c. **WT 1:** CERAMIC (WALL) TILE - FIELD

MFR:	Corrosive
STYLE:	Color By Numbers
COLOR:	1812 Overture WT18
SIZE:	4"x8"

d. **WT 2:** CERAMIC (WALL) TILE – ACCENT

MFR:	Florim USA
STYLE:	Antracite III
COLOR:	Antracite III, Natural
SIZE:	2'x2' Mosaic

e. **CONC CS- 2:** POLISHED CONCRETE

FINISH:	POLISHED

f. **CONC CS- 3:** EMERY TOP 400 DENSIFIER

FINISH:	SMOOTH TROWEL

g. **CONC CS- 4:** SEALING & DUSTPROOFING

FINISH:	SMOOTH TROWEL

4. Ceiling Finishes:

   a. The Administration areas will have Acoustic Ceiling Tile (ACT) ceilings.

   b. Restrooms will have painted Gypsum Board ceilings.

   c. Shop and Maintenance spaces will have dry-fall painted exposed structure ceilings.

   d. Wash Bay will have epoxy painted ceiling.

5. Doors and Windows:

   a. Interior doors will be solid wood. Kick plates will be used at high traffic areas. Door frames will be painted with an enamel finish. Exterior windows will have prefinished fiberglass frames. Door hardware will have a brushed stainless steel finish.

   b. Window sills will be solid surface.

6. Cabinets and Restrooms:

   a. Restrooms will have Solid color reinforced composite toilet partitions, anchored at the floor and ceiling anchored toilet partitions for strength and durability. All toilet accessories will be stainless steel.

7. Typical Room Finishes:

Restrooms

Floor	Polished concrete
Base	Ceramic tile
Walls	Ceramic tile and painted gypsum board
Ceilings	Painted gypsum board
Casework	n/a
Toilet partitions	Solid color reinforced composite Floor and ceiling anchored toilet partitions

Corridor

Floor	Polished concrete
Base	Rubber cove base
Walls	Painted gypsum board
Ceilings	Acoustical tile / painted gypsum board / exposed

Janitor Closet

Floor	Sealed Concrete
Base	Rubber cove base
Walls	Fiberglass Reinforced Panels / paint

Ceilings	Painted gypsum board

SECTION 7 STRUCTURAL

A. Design Criteria

1. Allowable Soil Bearing Pressure

   The building will be supported on bedrock at 2 to 3 feet below the existing surface. Per soils report by Golder Associates 1535646_7407-002-R-REVA allowable bearing pressure for the basalt bedrock is very high and not a design restraint. However, the building contact pressure is expected to be less than 2000 psf.

2. Snow Loading

   Per Merrick & Company — use 40 PSF ground snow load

3. Wind Loading

   Per Merrick & Company — use 150 MPH Ultimate, Exposure D
   For Risk Category II

4. Seismic Loading — Site Classification B
   Risk Category II
   Short Period Accel. Ss=0.454
   Long Period Accel. Ss=0.128

5. Floor Loading — Administration (Lockers, office break/kitchen, etc.) 100 PSF

   Storage (Battery, supply, parts room, lube/compressor etc.) 250 PSF (or equipment weights)

   Machine/welding, light bays 250 PSF or (32,000# axle load)

   Heavy Bays, 111,000# gross vehicle weight
   High bay storage 350 PSF

6. Mezzinine Loading Mechanical/Electrical 125 PSF

   Boiler 200 PSF

B. Basic Materials of Construction

1. Foundation/Slab-on-grade Systems

   a. The foundation system purposed for the project is unique because the foundation and the slab-on-grade will be the same precast concrete components. The precast floor panels will be 12 inches thick with dimensions of approximately 10 feet by 30 feet (±) to correspond with grid location and bay sizes. They will be mild steel reinforced and contain radiant heat tubing and intregral floor surface hardener where specified. Precast panels will also include trench drains, embedded column base plates, embeds for masonry wall reinforcing, and blockouts for radiant heat tubing connections. Panels will be connected by keyways and grouted post-tensioning cable plus NMB splice sleeves. The reinforcing will be designed to transfer the concentrated column and equipment loads to uniformily load the GeoForm or structural fill within their allowable bearing capacity. Several panel designs are anticipated.

   b. Based on the two soil borings at the site it appears that there is 2 to 3 foot of fill over bedrock. The site grading plan indicates significant amounts of cut into the bedrock, which is anticpated to rquire blasting, and significant areas of structural fill to provide a level sub-grade for the facility.

   c. Above bedrock and/or structural fill a layer of 4 feet of Geo-Foam insulation will be installed to insulate the floor. The design loading criteria then becomes the allowable compressive strength of the Geo-Foam. Design is based on GeoForm with a density of 1.80 lb/ft 3 cubic foot and an allowable compressive resistance of 10.9 lb/ft square foot.

   d. The drawings indicate a panel layout scheme and the various types of reinforcing necessary.

2. Wash Bay
   a. The lower level wash bay will use the same basic precast floor panel system as the rest of the facility.
   b. The wash bay precast slabs will slope to a center trench drain.
   c. The trench drain will open into a 10 foot by 4 foot wide x 6 foot deep precast holding tank. The tank lid will be steel grating designed for HS20 wheel loads.
   d. The exterior walls of the wash bay will be precast insulated panels of 10 inches structural + 11 inches insulation + 4 inches face.
   e. Interior precast wall will be 8 inches.
   f. Precast interior foundation wall will be 10 inches.
   g. Roof of wash bay will be precast floor panels of the main level above.

3. Wall Systems
   a. The wall system will be prefabricated metal panels over SIP wall panels. Maximum panel sizes will be 8 feet by 24 feet. With the severe wind loading the panels will require an extensive structural steel support system of wind girts and columns. The current layout anticipates support of panels at 12 feet on center.
   b. Door jambs and headers will be tube steel sections of 10 to 12 inch square with weights in the 60#/ft range.
   c. Exterior columns in the maintenance bays will support roof and wind loads.
   d. For solid walls it is assumed that horizontal girts of 10 to 12 inch square will be required at twelve foot vertical spacing in the maintenance area and the storage area. These will frame to exterior columns at 30 feet on center.
   e. The drawings indicate a typical wind grit layout in the maintenance bays and a typical wind grit layout in the storage wing.

4. Lateral Systems
   a. Wind loading will dictate the required lateral resistance capacity of the facility.

b. Lateral loads will resisted by the structural metal roof decking and will be transferred through the steel roof framing into bracing elements.

c. The bracing elements will be HHS tube members located both near exterior walls and on the interior.

d. Brace forms will be typically 'X's but other forms may be required.

e. Refer to drawings for brace locations and additional information.

5. Roof Systems

a. The basic roof system will be metal roof decking supported on structural steel framing. With shipping and transportation in mind, the roof will be designed to minimalize the number of pieces and total weight.

b. Typical bay sizes for the roof framing will be from 30 feet by 40 feet, to 60 feet by 40 feet. Column locations and bay size determination will be based on crane travel directions and orientation.

c. The roof decking will be 1½ inch type B decking of 18 gauge, which will provide adequate capacity for economical joist spacing. Joists will vary in depth from 22 inches to 40 inches and weight from 7 to 40 lbs/ft. Joists will require design for net uplift.

d. Joists will be supported on steel beams. Steel beams will vary from 21 inches to 30 inches and from 50 to 175 lbs/ft.

e. Interior columns would be approximately W14x90.

f. Crane rails will be W24x62 with MC 12x40 horizontal on top.

g. Refer to roof framing plan for additional information.

SECTION 8 MECHANICAL AND PLUMBING

A. Mechanical and Plumbing Design Codes/Standards

The following codes will be utilized as a basis for design.

International Energy Conservation Code - 2015 (IECC)

International Fire Code - 2015 (IFC)

International Fuel and Gas Code – 2015 (IFGC)

International Mechanical Code – 2015 (IMC)

International Plumbing Code – 2015 (IPC)

International/National Electrical Code – 2014 (NEC)

ASHRAE Standard 55-2013

ASHRAE Standard 62.1-2013

ASHRAE Standard 90.1-2013

Collaboration with the local National Science Foundation representative will be utilized to ensure any unique requirements for this specific site.

B. HVAC Mechanical Design Criteria

Space Design Conditions

Office/Social Areas:

Cooling: Outside air

Heating: 68 °F

Interior Service Areas (Conditioned Warehouse):

Cooling: Outside air

Heating: 65 °F

Transitional Service Areas (Entries, Semi-Conditioned Warehouse, Vehicle Maintenance):

Cooling: Outside air

Heating: 60 °F

Internal Loads

Space Type	Miscellaneous	Occupants	Lighting (max)
Admin/Office	0.5 W/SF	143 SF/person	0.9 W/SF
Conference	2.0 W/SF	15 SF/person	0.9 W/SF
Trades/Shops	5.0 W/SF	150 SF/person	1.2 W/SF
Warehouse	0.0 W/SF	300 SF/person	0.7 W/SF

C. Minimum Ventilation Quantities (per ASHRAE 62.1-2016)

Space Type	Min CFM/SF
Admin/Office	5 CFM/person + 0.06 CFM/SF
Conference Rooms	7.5 CFM/person + 0.06 CFM/SF
Janitor Closets	2 CFM/SF
Mechanical/Electrical	Based on heat loads in space
Restrooms	75 CFM/toilet or 2 CFM/SF
Trade Shop	Based on space exhaust
Warehouse	10 CFM/person + 0.06 CFM/SF

D. Sound Criteria

Space Type	Max NC
Lobbies, Offices, Conference Rooms	NC-35
Restrooms, corridors	NC-45
Trades, Shops, Warehouses	NC-55
Mechanical/Electrical Rooms	NC-60

E. Ventilation

Maintenance Bays

Maintenance bays will be provided with the minimum ventilation required to make up the exhaust requirement of 0.05 CFM/SF. In CO (carbon monoxide) alarm situations, the alarming bay will exhaust 0.75 CFM/SF. The VFD (variable frequency drive) on the ventilation air fan will increase the ventilation to make up for this increased exhaust rate. A heat pipe system will be utilized within the exhaust system of the building to recover as much heat as possible and pre-temper the outside air coming in to the building. The outside air will then be distributed to two air handler units (AHU) – one for the office area and one for the bay areas. Each AHU will have a hot water coil to temper the air to 55 degrees. Ventilation air will be distributed throughout the maintenance bay via duct work to ensure evenly distributed ventilation air is provided at lower velocities reducing cold pockets. The exhaust fans in the space will be modulated to ensure adequate building pressurization as the heat pipe modulates to properly ventilate the maintenance bays.

Snorkel type exhaust inlets will be provided at each location where machining and woodworking is required. This air will be collected through a cyclonic tap prior to discharge. Welding operations will also be provided with snorkel exhaust inlets at each welding station.

All areas surrounding the maintenance bays will be balanced to be positive in comparison to the maintenance bays.

Mechanical/Electrical Spaces

Mechanical and electrical rooms will be provided with 100% outdoor air as required. No air will be returned from these rooms and any regularly occupied spaces surrounding these rooms will be positively pressurized in comparison.

All combustion air will be supplied through a dedicated heating/ventilating unit or a passive cold trap system.

Locker Rooms/Restrooms

Ventilation air will be provided to the locker and restroom areas via duct work from a shared core area make-up air unit that will be provided. This make-up air unit will utilize return air in conjunction with carbon dioxide sensors which will modulate the percentage of outside air required. This demand ventilation system will reduce overall energy consumption and provide ventilation air only when necessary.

Offices

Ventilation air will be provided to the office areas via duct work from a shared core area make-up air unit that will be provided. This make-up air unit will utilize return air in conjunction with carbon dioxide sensors which will modulate the percentage of outside air required. This demand ventilation system will reduce overall energy consumption and provide ventilation air only when necessary.

Warehouses

The warehouses will be constantly ventilated to meet the requirements presented in ASHRAE 62.1-2016. The small office area near the heated and cold warehouses will share a make-up air unit with the warehouses. This unit will mix the incoming outside air and return air from the spaces to pre-temper the air before it is heated to the proper supply temperature for the spaces.

Battery Charging Area

The battery charging area will be provided with a dedicated exhaust system designed to meet IFC 608 requirements. This exhaust system will be tied to a make-up air unit which will provide adequate fresh air the area to ensure hydrogen out-gassing is maintained below hazardous levels. Compressor and liquid waste rooms systems shall be in compliance with IFC 57 requirements including quantities and categories stored.

Laundry

Laundry rooms will be provided with cascaded Class 1 or 2 air for dryer makeup. No air will be returned from laundry rooms.

Outside Air Intake/Discharge

Tamco Series 9000 BF dampers will be provided at all building air intake and discharge locations to ensure positive shutoff. Hoods will be provided over each louver to reduce entrainment of snow. Intake hoods will be provided with a basin and drain to evacuate any snowmelt within the duct. Outside air intake ductwork will be insulated to prevent frost buildup and protect the building thermal envelope. Where passive intake systems do not prevent snow and ice blockage, active heating systems may be required at air intake ductwork to remove entrained snow and ice.

Ductwork

Air distribution ductwork will be sheet steel or aluminum and fabricated to SMACNA standards. Outside air intake ductwork and plenums will be insulated. Heating and

DOAS ductwork within the building envelope will be insulated where the ambient air temperature exceeds duct temperature by more than 20 °F.

F. Air Conditioning

IT Closets

Overall, cooling is not required, however the MDF and IDF closets will require some level of cooling. This will be accomplished utilizing a blower coil unit with a modulating outdoor air damper. The outdoor air damper will open when the rooms require cooling, allowing the outdoor air to cool the space. The heated exhaust air will be distributed to the adjacent space capturing any residual heat from the MDF/IDF rooms.

G. Space Heating

General

In the Antarctic environment where temperatures range from -40 degrees F to +40 degrees F our calculations have concluded that cooling is not required. The HVAC system is focused on heating and ventilating the space. A critical part of ensuring energy usage for heating the space is minimized includes several factors. These factors include building envelope, stratification, heat recovery, and ventilation requirements. The more heat we can keep inside the building the less energy that is utilized.

Maintenance Bays

The main vehicle maintenance bay portion of the building, which accounts for approximately 32,000 square feet, represents a significant portion of the building where the majority of the work is performed. All maintenance bays will be heated using in-slab radiant heating. A plate and frame heat exchanger will be utilized to isolate the underfloor radiant system from the main building heating system. The

system will be zoned to maintain a maximum temperature drop through the piping of 20 °F.

In order to ensure the heat coming from the in floor radiant is utilized to its full potential, it is important to prevent stratification within the building. The large height and volume required to maintain some of the vehicles, creates a challenge to prevent this stratification. Large circulating airfoil type de-stratification fans will be utilized to ensure the heated air does not stagnate at the top of the facility.

Locker Rooms/Restrooms

The locker Rooms and Restroom area will utilize a radiant in-floor heating system. This area will utilize the same central boiler system as the maintenance bay, but will be provided with its own separate zones for temperature control.

Offices

The offices will utilize a radiant in-floor heating system. This area will utilize the same central boiler system as the maintenance bay, but will be provided with its own separate zones for temperature control.

Warehouses

The warehouse area is broken up into different components. The cold storage area, of approximately 23,000 square feet, will not be heated. The heated storage area, of approximately 12,000 square feet, will utilize hydronic unit heaters throughout. The storage area is occupied much less frequently than the maintenance area and justifies a different approach to maintaining a temperature set point with a much lower initial cost. Where practical, large diameter overhead fans will prevent hot air stratification at warehouse ceilings. Stratification fans will be interlocked with the fire alarm systems to automatically shut down the fans upon smoke detection.

Entry Vestibules

Entry vestibules will be provided with local hydronic forced air heating units with localized thermostatic control.

H. Heat Generation

A microturbine will be utilized as the primary heating source for the building. A back-up fuel oil boiler will provide the N+1 redundancy required. A waste oil boiler will be used when waste oil is available. This boiler is not sized for the full load of the building, however it will still offset some of the energy use required by the building.

The heating loop will be designed to accommodate connection to the site heating distribution loop in the future. Currently there is no plan to bring the site heating distribution to the VEOC site. When and if the site heating distribution loop is connected any excess heat generated at the building will be rejected to the site distribution loop via a plate and frame heat exchanger to allow isolation of the site heating loop from the building heating loop. In addition, a plate and frame heat exchanger will also be provided to capture heat rejection from the emergency generator and will tie back into the main heating loop for heat recovery.

Hydronic distribution will be via Schedule 40 steel piping with flanged or Victaulic style fittings for piping over 3” in diameter and Type L copper with wrought fittings for piping 3” in diameter and under. Wirsbo hePEX will also be considered acceptable for 3” diameter and under piping. Piping insulation will comply with ASHRAE Standard 90.1 recommendations for 180 °F heating pipe. Piping will be sized based on an average of 4 feet per second and friction loss factors.

I. Pumping

System pumps shall be cartridge style in-line with variable speed drives. Pumps shall be selected to provide full flow to all connecting loads within 5% of their peak efficiency. Motors under ¾ horsepower shall be 120 volt, single phase and motors ¾

horsepower and greater shall be 480 volt, 3 phase, premium efficiency inverter duty-rated. Pumps will be provided in a redundant (N+1) configuration. DDC controls will provide automatic switchover to the redundant unit upon failure of the primary unit and provide local and remote operator alarms. Similarly, lead/lag controls will provide equipment sequencing, automatically controlling and alternating equipment to extend equipment life and reduce maintenance expenses. Pumps in primary (lead) operation will be monitored and, if failing, will be rotated to the redundant unit.

Freeze Protection

The hydronic loop will utilize a 50/50 mixture of reverse-osmosis (RO) water and propylene glycol (program standard is Dowfrost HD as manufactured by Dow). Coils exposed to 100% outside air will be controlled to provide a minimum flow for freeze protection.

J. Operation and Maintenance

Temperature setbacks are to be utilized for energy conservation. Carbon dioxide sensors are to be utilized for energy conservation.

Required clearances and access doors are to be provided for equipment that may require maintenance or repair.

BACnet building automation system is to be installed to monitor all building equipment and systems. See specifications for BACnet requirements.

K. Testing, Adjusting, and Balancing (TAB)

Testing and balancing of air and hydronic systems, using a firm certified for testing and balancing will be completed. The prime contractor should hire the TAB firm directly, not through a subcontractor. The TAB should be performed in accordance with the requirements of the standard under which the TAB firm's qualifications are approved. All recommendations and suggested practices contained in the TAB standard shall be considered mandatory. Use the provisions of the TAB standard, including checklists, report forms, etc., as nearly as practicable to satisfy the contract requirements. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB standard, adhere to the manufacturer's

recommendations. All quality assurance provisions of the TAB standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB standard, the TAB specialist shall develop TAB procedures. All TAB procedures must be approved by NSF prior to implementation.

L. Commissioning

Commission all HVAC systems and equipment, including controls and all systems requiring commissioning in accordance with ASHRAE Guideline 1, ASHRAE Guideline 0, IECC 2015, and UFC 1-200-02. Commission 100% of the HVAC controls and equipment. Hire the commissioning authority (CA) as described in Guideline 1. The CA will be an independent subcontractor to the contractor and not an employee or subcontractor of any other subcontractor on this project. The CA will not have business connections with any other party on the project. The CA will not have any other role or responsibilities outside of commissioning activities. The CA will communicate and report directly to the Government in the execution of the commissioning activities.

M. Sanitary

General

The sanitary sewer system will consist of a 4-inch sanitary line that will be connected to the site sanitary sewer system. We anticipate one sanitary connection out of the building. This will minimize/eliminate any subsurface trenching for the sanitary system. All sanitary vents shall vent to atmosphere through a combined vent system minimizing the number of roof penetrations. Air admittance valves will be provided on remote plumbing fixtures.

Maintenance Bays

The maintenance bay drainage system will be routed through a 3-compartment sand/oil interceptor. Each maintenance bay will consist of a poured-in-place trench drain. Each trench drain will be provided with sump box trap to prevent main drain blockage. This will minimize the contaminants being delivered to the waste water treatment plant. We anticipate a 4-inch sand/oil drain line will be routed to the sand/oil interceptor and then connected to the site sanitary sewer system.

The wash bay will utilize a water recovery/filter system, sized and provided by owner, to minimize water usage. This system will be refreshed on a periodic basis and drained through the sand/oil interceptor prior to entering the site sanitary sewer system.

Locker Rooms/Restrooms

Restrooms and Locker Rooms will be connected to the building sanitary sewer system.

Offices

Office break room sinks and water fountains will be connected to the building sanitary sewer system.

Storage

Sanitary sewer drains are not anticipated within the dry or cold storage building.

N. Domestic Water

Domestic Cold Water

The domestic cold water system will consist of a 2-inch water main. The water main will tee off from the fire service line in the water entry room and be routed through a backflow preventer located in the water entry room. No booster pump is anticipated at this time, water pressure from the main site water delivery system is anticipated to be sufficient. Domestic cold water entering the facility at exceeding 80 psi will be reduced to 80 psi by a water pressure reducing valve. Cold water will be distributed throughout the facility to locker rooms, restrooms, break room, wash bay, and hose bibbs located throughout the maintenance bays.

Domestic Hot Water

Hot water will be generated at 140°F by a hydronic heat exchanger. A domestic hot water storage tank will be utilized. A master mixing valve located downstream of the water heater tank will provide 120°F hot water to all other fixtures within the facility. Each lavatory and hand washing sink will have a thermostatic mixing valve to temper the water from 120°F to no more than 110°F. A hot water circulating pump will be provided to maintain consistent temperatures in all domestic hot water systems. The domestic hot water recirculation system will be designed to limit non- recirculated

branches to 10 feet maximum length. Hot water will be distributed to locker rooms, restrooms, break room, and wash bay.

Hot water for lavatories in remote restrooms to be provided by an electric point of use water heater.

O. Storm Water

General

Any storm water will be distributed via downspout and surface drainage. No piped storm water system is anticipated.

P. Fuel Piping

Mechanical Room

Piping for fuel oil delivery to boilers will be from outside storage tanks. As the boilers are anticipated to be located on a second level of the building, pumping systems for the fuel will be required.

Q. Plumbing Fixtures

General

Plumbing fixtures throughout the facility will be of the type outlined below:

Water closets will be wall-mounted, water conserving, dual-flush, flush valves with a 15” rim height and 17” rim height for ADA.

Urinals will be wall-mounted with electronic, water conserving (0.0125 gallons per flush) flush valves with a 24” rim height.

Janitor’s closets will have a floor-mounted, manufactured, stone-type (Durastone or Terrazzo) sink with wall-mounted faucet with bucket hook, 3/4” hose thread, and anti-siphon vacuum breaker.

Lavatory sinks will be wall-mounted or counter-mounted, vitreous china type with electronic actuated faucets. Faucets will have a thermostatic mixing valve set to provide 110°F hot water maximum and a 0.5 gpm aerator.

Showers will be floor mounted, terrazzo or other approved manufactured stone basin. Shower valves will be pressure-balanced thermostatic mixing valves set to provide 120°F maximum at 1.5 gpm.

Break room sinks will have 18-gauge stainless steel with a single bowl, 1.0 hp garbage disposal and gooseneck faucet.

Drinking Fountains will be wall mounted, stainless steel, non-cooled, with bottle filter.

R. Piping Materials and Accessories

Domestic Water: Type K hard drawn copper. 1” insulation with flame retardant jacket, PEX for domestic water piping 1” and smaller. Domestic Waste and Vent: Cast iron, no-hub DWV pipe and fittings.

Water hammer arrestors will be provided at flush valve and solenoid valve assemblies before the last fixture.

A floor drain with a perforated strainer and 1/4” diameter perforations will be provided for each toilet room and janitor closet. Floor sinks and floor drains will be provided in the mechanical rooms to accommodate routine maintenance and drainage of equipment. Floor drains in mechanical rooms and infrequently used areas will be provided with a mechanical trap primer and piped from the nearest cold water source.

S. Operation and Maintenance

All piping is to be insulated with text and color identification.

Plumbing fixtures are specified as water-saving type.

Trap primers with a service valve are to be provided on all floor drains for maintenance and repair.

Domestic water circulation pump shall be tied into building occupancy programming.

T. Metering

All utility services (except sanitary sewer) are to be metered. Each meter shall be capable of providing 15-minute interval demand and energy consumption data (as applicable).

SECTION 9 FIRE PROTECTION

A. Building Description

1. A fire protection system will be installed. This system will include different approaches depending on the location within the building. The fire service main will enter the building in the water service room. The fire service main is to be a minimum of six inches in diameter. Separate zones will be provided for each major occupancy of the building. Areas subject to freezing will be provided with a nitrogen-charged dry-pipe sprinkler system.
2. Sprinkler piping will be Schedule 40 black steel in conformance with NFPA 13. Sprinkler heads will be quick response type, except as required by NFPA 13 at special hazard occupancies.

B. Occupancy Hazard Classification

1. This building has several types of occupancy hazards. For the purposes of determining automatic sprinkler densities the following classifications are used:
2. Light Hazard - Offices, conference rooms, break areas, restrooms
3. Ordinary Hazard, Group 1 – Laundry rooms, storage rooms, communications rooms, mechanical rooms, electrical rooms
4. Ordinary Hazard, Group 2 – Kitchens, vehicle apparatus bays, shop areas
5. High-Piled Storage Areas – Hazard and density classification per NFPA 13 requirements
6. Water Flow Demand Criteria

A. Water Flow Demand Criteria

1. <u>Light Hazard</u>

   Design Density: 0.10 gpm/square foot

   Design Area: 1500 square feet

   Hose Allowance: 250 gpm

   Duration: 60 minutes

2. <u>Ordinary Hazard, Group 1</u>

   Design Density: 0.15 gpm/square foot

Design Area: 1500 square feet

Hose Allowance: 250 gpm

Duration: 60 minutes

3. Ordinary Hazard, Group 2

   Design Density: 0.20 gpm/square foot

   Design Area: 1500 square feet

   Hose Allowance: 500 gpm

   Duration: 60 minutes

B. Fire Suppression and Standpipe System

1. This section does not apply to the project.

C. Fire Alarm and Mass Notification System

1. A single, addressable, UL listed combined fire alarm (FA) and mass notification (MNS) panel shall provide alarm notification and automated monitoring of the sprinkler system in the facility as well as mass notification. The FA/MNS panel shall be field programmable via the FA keyboard or control panel without the use of proprietary programming software or device. The FA/MNS panel is located in the facility entry vestibule. The fire alarm system monitors the manual pull stations at each exit, sprinkler tamper and flow switches, smoke detectors and duct-mounted smoke detectors on air handling units in accordance with UFC 3-600-01, NFPA and IBC criteria. The addressable duct smoke detectors report to the FA/MNS panel as supervisory devices and disable the associated air-handling unit if smoke is detected. Alarm, trouble, supervisory, and water flow signals are transmitted by radio frequency to the base monitoring system for fire department response.

2. The Fire Alarm Transmitter is a Monaco BT-XF radio transceiver operating at a frequency of 138.9250 MHz with a whip antenna length of 51-1/8 inches mounted a minimum of 3 feet above the roof gutter.

3. Occupant fire notification is provided utilizing a combination of strobes and speaker/strobes with white faceplates marked “FIRE” are provided throughout the facility in accordance with NFPA 72, ADA, and UFAS. All fire strobes employ clear

lenses. Occupant notification is activated upon any fire alarm signal initiated by a manual pull station, sprinkler water flow switch, or common area smoke or heat detector. All Signaling Line Circuits (SLCs) are Class A, Style 6 and Notification Appliance Circuits (NACs) are Class A, Style Z.

4. Mass notification is provided throughout the building. An autonomous control unit and local operator consoles are provided to broadcast emergency messages utilizing speaker/strobes located throughout the building. The speaker/strobes are spaced throughout the facility to ensure intelligibility as required by NFPA 72 and UFC criteria. Mass notification strobe and speaker/strobe lenses are amber in color with white faceplates marked “ALERT”. Combination fire alarm and mass notification speaker/strobes with both clear and amber lenses may be utilized where feasible. Upon activation of the mass notification system, fire alarm audible and visual signals are deactivated in accordance with UFC 4-021-01. A supervisory signal is displayed at the fire alarm panel during the emergency voice messaging. The fire alarm audible and visual signals continue after the emergency voice message is completed.

SECTION 10 ELECTRICAL AND COMMUNICATIONS

A. Electrical Power Systems - Normal Power Distribution

The electrical service will be fed from the site electrical loop. The 4160 Volt primary connection will feed a 750 KVA 4160-480Y/277 Volt pad mounted transformer. The transformer will feed electrical distribution panels to serve the majority of the loads, including HVAC, maintenance equipment, cranes, and lighting. It is anticipated the electrical service will be 2000 Amps. Step down transformers will be utilized to provide for 208Y/120V loads within the facility. The switchboards and panelboards shall contain copper busing. Feeder and branch circuit conductors shall be copper type routed in EMT conduit. Full size grounding conductors are provided for feeders and branch circuits. The electrical power system is designed with 20% spare capacity and 20% spare circuit breaker spaces. A main electrical room approximately 30 feet x 15 feet will be required to accommodate all of the equipment including the unit substation.

The VEOC building will be considered a Tier 2 Building as described in the NSF Standard Requirements and Equipment Template. The electrical system and equipment will utilize smart technology in order to allow for Microgrid control. Circuits within the building will be designed with the following hierarchy in mind.

Class 0 - circuits never open unless there is a safety fault.

Class 1 - circuits are the last to disconnect from the grid

Class 2 - circuits are operationally necessary but not life safety

Class 3 - circuits are convenience loads.

Class 4 - circuits are enabled for use of excess renewable energy.

Class 5 - circuits are enabled for use of excess renewable energy for storage.

Electrical system will be sized and prepared for the interconnection of a large 320 kW rooftop photovoltaic system. The maximum size of the system will be determined based on the amount of physical space on the roof.

A 200kW microturbine will be installed with thermal priority for the heating system. Residual electrical generation will be utilized to reduce overall electrical demand. The microturbines will utilize fuel oil as the fuel source. Controls will be implemented to allow for interface with central utility plant distribution.

Electrical metering shall be installed in the building service to measure energy usage of the facility. Meter shall be connected to the station energy management system.

Surge protective devices (SPD) shall be installed at the service distribution equipment.

A 100Kw, 400Hz solid state frequency converter will be installed for aircraft electronics in the work bay.

Branch Circuit Power

Equipment

Refer to vehicle maintenance equipment supplier narrative and schedules for equipment to be included in this facility and associated required power connections. Refer to mechanical and plumbing systems narrative for mechanical and plumbing equipment connections. Motor starters with disconnect switches, combination motor starters, or variable speed drives for motor controls shall be provided as required by the mechanical engineer. Circuits and connections for motors will be provided as required by equipment manufacturer.

Maintenance Bays

Branch circuit power will be distributed throughout the maintenance bay from overhead. All devices will terminate 30-inch above finished floor, keeping out of the NEC (National Electrical Code) hazardous classified areas. We are not anticipating any hydrogen type vehicles so the area at the roof level will not be considered a hazardous classification.

Locker Rooms/Restrooms

Locker Rooms and Restrooms will be provided with convenience receptacles throughout. The receptacles will be GFCI protected.

Offices

Office receptacles will be distributed as needed based on user requirements. These requirements will be identified in the next phase of the project.

Storage

Office receptacles will be distributed as needed based on user requirements. These requirements will be identified in the next phase of the project.

Electrical Equipment

The electrical systems will utilize the following equipment:

Transformers:

Building Service, outdoor – pad mounted, sealed, nitrogen filled, 4160V delta primary, wye connected secondary at facility utilization voltage; Niagara Transformer Corp.

Step Up/Step Down, indoor – general purpose, dry type, high efficiency, copper wound; Schneider Electric Square D™ Watchdog™ or Premium 30

Main Power Distribution Panels / Switchgear:

1,200 amps and above; Power-Style™ QED-2 as manufactured by Schneider Electric Square D™

800 amps and below; I-Line™ series as manufactured by Schneider Electric Square D™

Panelboards:

208/120 volts; Schneider Electric Square D™ type NQ supplied with copper bus and type QOB bolt-on branch breakers (minimum 20 amps for 120V, 1 pole)

480/277 volts; Schneider Electric Square D™ type NF supplied with copper bus and type EBD bolt-on branch breakers (minimum 20 amps for 277V, 1 pole)

Safety Switches:

Fusible/Non-Fusible – 240V or 600V, heavy duty, visible blade, enclosure suitable for installation environment; Schneider Electric Square D™ catalog type H

Motor Starters:

Magnetic; Schneider Electric Square D™ catalog type S in enclosure suitable for installation environment

Variable Frequency Drives:

Variable Torque; Schneider Electric Square D™ Altivar™ 212 or Altivar™ S-Flex™

B. Electrical Power Systems – Standby Power Distribution

The entire facility will be provided with emergency power. A 500kW emergency electrical generator shall be provided and will deliver the emergency power to the facility. The systems will be served from power panels rated at 480Y/277V and 208Y/120V placed in select areas of the facility. One automatic transfer switch will be provided for emergency loads and one automatic transfer switch will be provided to serve as standby power for the remainder of the facility. Both transfer switches shall be located in the main electrical room, the larger whole building standby automatic transfer switch shall be integrated into the main switchboard. The standby generator

shall be designed to provide 72 hours of backup power. Generator backed loads shall include but not be limited to:

1. Emergency lighting systems
2. Fire alarm and mass notification systems (local battery backed power supplies)
3. Fire suppression systems
4. Security systems (local battery backed power supplies)
5. Communication room HVAC equipment
6. Communication room critical equipment (local rack mount UPS by others)
7. Mechanical systems serving critical mechanical loads
8. Select power panels serving critical loads

C. Electrical Power Systems – Power Quality and Grounding

1. Power quality for the project is preserved by using surge protective devices (SPD) at the service distribution equipment and where sensitive electronic loads exist. SPD's limit the intensity of over voltage transients from external power distribution events and internal power events. SPD's shall be integrated into the distribution panels.
2. Interior electrical systems are grounded in accordance with Article 250 of the 2014 National Electrical Code. Communications systems use grounding methods consistent with J-STD-607-A "Commercial Building Grounding and Bonding Requirements for Telecommunications", per UFC and Lackland Base NEC standards. Main power distribution system shall be grounded to cold water pipe, building steel, and site distribution ground loop.

D. Interior Lighting Systems

1. Overview

a. Objectives

i. Provide architecturally integrated lighting solutions to enhance the building experience, both interior and exterior.

ii. Specifications shall provide for easily maintained solutions with life cycle costs that are beneficial to the owner.

iii. The lighting design shall be consistent with what is expected of a sustainable solution fitting of a LEED project.

b. Products
   i. All luminaires shall be provided with dedicated LED sources, replacement or retrofit LED lamping is not suitable other than for small quantities of decorative luminaires as required.
   ii. All LED luminaires shall be provided with 0-10V dimming for optimizing control solutions and maximizing daylight harvesting potential.
   iii. Luminaires shall be provided with a minimum CRI (color rendering index) of 80.
   iv. Provided luminaires, control devices and associated systems provided shall be suitable for the Arctic environment and extreme cold weather conditions, as per project requirements.
   v. Provided luminaires, control devices and associated systems shall be from quality manufacturers serving North America and shall have minimum 5 year product warranty.
   vi. Stand-alone control devices in unconditioned spaces shall be capable of operating in ambient air temperatures of -40°C.
c. Emergency Lighting
   i. Emergency egress lights required for code compliance will be powered by the generator.
   ii. Frog-eye and standalone emergency lighting units shall not be utilized.
   iii. UL-924 transfer devices shall be provided, (1) per control zone with emergency lighting, such that the luminaires are fully controllable with the associated zone, by-passing all control for output upon loss of normal power such that the luminaires regularly control and function fully with their associated zone control.
   iv. Luminaires designated as emergency are hatched on plan and designated by an “E” after the luminaire type tag.
d. Interior Lighting Systems
   i. Base Lighting Design: The base lighting design solution shall be a static white LED lighting system throughout the building interior and exterior. As shown on plans.
   ii. Add Alternate 1: Add Alternate pricing shall be provided for upgraded lighting in the open offices, private offices and break rooms (as shown on

EA103). Using a recessed LED troffer with the capability to create slow moving scenes along the ceiling plane helps bring added visual interest into the space without having the infrastructure for color temperature tuning. This is important in locations where the exterior environment does not have a lot of visual interest or perceptible changes in light and pattern.

1. Suggested approach: Acuity Rubik. See EA103 for layout.

iii. Add Alternate 2: For added circadian support given the daylight environment, Add Alternate Pricing shall be provided for a tunable dual channel 0-10V lighting system capable of adjustable intensity (dimming) and adjustable color temperature tuning of white lighting from the range of 3000K – 5000K.

1. This shall apply to all luminaires utilized within the following space types:
   a. Open Office
   b. Private Office
   c. Circulation
   d. Conference & Meeting Rooms
   e. Lobby
   f. Break Rooms
2. Additional control infrastructure will be required to accommodate the two-channel system with additional zones.

e. Exterior Lighting Systems

i. The exterior lighting system shall consist of wall mounted LED area luminaires using a type III distribution. Luminaires shall be mounted 24' above finished ground in the locations shown on plan.

ii. All exterior lighting shall be rated for temperatures of -40°F and for wind loads of 150 MPH.

iii. Exterior luminaires shall be controlled by a combination of an astronomical timeclock and north facing exterior photocell via the digitally distributed lighting control energy management system.

2. Lighting Design Codes & Standards

a. Energy Code – IECC 2015

i. The lighting system shall be designed for compliance with IECC 2015 and IBC 2015 standards.

1. Note that this requires substantially more daylight harvesting photocell devices to comply with the daylight harvesting requirements of the updated IECC code. Provide addition cost allowance as required for code compliance.

b. NEC 2014.

c. IESNA – 10th Edition Lighting Handbook.

d. Standard Requirements and Equipment for McMurdo Station as per National Science Foundation.

3. Lighting Systems by Space Type

a. Refer to the included *TABLE* outlining the following requirements by space type:

i. Average illumination design target levels in Footcandles.

ii. Color Temperature (CCT).

iii. Luminaire types intended for each space.

iv. Control intent for IECC 2015 compliance.

1. Note that Daylight Harvesting will be provided for all areas as per code requirements and has been listed under space types that may have suitable daylight conditions.

4. Lighting Control

a. Overview

i. A non-proprietary digitally distributed lighting control energy management system, shall be provided to control all lighting loads, both interior and exterior.

ii. System shall be capable of the following control types:

1. **Smart Time Scheduling** with Astronomical time-clock control.
2. **Daylight Harvesting** with photo sensors.
3. **Task Tuning** with preset light level settings.
4. **Occupancy Control** with occupancy sensors.
   a. Occupancy sensors shall be provided for all enclosed spaces, as per IECC 2015 requirements.
5. **Variable Load Shedding** based on peak demand scheduling.
6. **Personal Control** with localized software for viewing or control, as determined by owner, of light settings by occupants or authorized personnel.

7. **Plug Load Control** of receptacle loads *(optional).*
8. **Graphic Interface** with user graphic software for user control of luminaires/zones, time settings, energy reporting and as a maintenance and usage tracking tool.

b. Hardware:

i. Power Bar
ii. Ethernet Switch
iii. cable network – two pre-terminated 18 AWG conductors, Class 2
iv. Luminaire Control Modules
v. Sensor Interface Modules
vi. Push Button Wall Control Stations
vii. Occupancy Sensors
viii. Daylight Sensors and Photocell Controls
ix. BACnet Interface Module *(as required)*

c. Software:

i. The lighting control system shall be provided with web-based graphic display software interface.
   1. The user interface for the lighting control system shall be via a software platform which shall use a basis of plan view graphics for all user interfaces and lighting control strategy programming.
   2. The software shall allow programming of lighting control strategies as drop down menus triggered from the graphics screens or by drag and drop from menu boards on either side of graphic screens.
   3. The plan view graphics displays shall feature different tabs/pages of plan view graphics for each lighting control strategy so the end user can see a physical representation of which fixtures are assigned to each strategy and the zones the fixtures are organized into for each strategy.

ii. Program functionality shall include:
   1. The lighting control system software shall offer visual representation of communication status with each control module on the plan view graphics screen. Upon loss of communication

with any system device the plan view software shall immediately notify the user by visual indication that the device is off line.

2. The lighting control system software shall utilize a familiar scheduling calendar template such as a template similar to Outlook. The scheduling calendar screen shall be triggered from a drop down menu at the base level timer zone graphics screen.
3. The lighting control system shall be capable of allowing multiple discrete set points for each zone of lighting controlled by a specific photocell.
4. The lighting control system shall be capable of adjusting time delays for occupancy sensors from the software.
5. The lighting control system software shall control each luminaire module and its associated lighting load(s) by combining all associated control strategies for that module in a conditional control logic formula which is transparent to the end user. This will allow discrete lighting loads to be controlled by layered control strategies without the end user viewing or programming complex nested logic statements.
6. The software shall also feature a logging system which records all system activity (lighting activity, configuration changes, etc.) for a 30 day period. The system shall allow the owner to call back previous

   configurations if a user made programming changes that resulted in undesirable results.
7. The system shall feature an energy reporting module which will graphically show instantaneous energy usage in totality and by control strategy for lighting controlled by the system. This data shall also be capable of export to remote energy reporting systems via TCP/IP data packets or CSV packets.

iii. BACnet interface programming shall be provided for interconnected controllability.

d. Commissioning Services:

i. Contractor shall provide the lighting control system with manufacturer services to coordinate with building commissioning agent, as required,

to ensure:

1. Accurate system as-built documentation.
2. Full system program commissioning.
3. Program commissioning verification documentation.
4. Owner training.

ii. Contractor shall include additional site visits as required by specification for owner support (programming adjustments, additional training) during and immediately after building hand off.

5. **Daylighting Harvesting**

a. The usage of electric lighting in the high bay spaces and the wash bay can be reduced using the proposed vision glass bay doors combined with a daylight harvesting dimming control system. The electric lighting in the light and heavy duty bays combine to use
24.4 Kilowatts per hour when running at full output. With the high availability of daylight during specific times of the year, the luminaires could be dimed at certain times of the year, specifically in the early mornings from October to March. This has the potential to result in an estimated energy savings of 11% Refer to the included daylight analysis report for more detailed daylighting information, and to the drawings for daylight harvesting zone designation.

** Please see appendix for additional daylighting reports and information.

SPACE TYPE	AVERAGE ILLUMINATION *(FC)*	COLOR TEMPERATURE *(CCT)*	LUMINAIRE TYPES	LUMINAIRE IMAGE	LIGHTING CONTROLS
Battery Storage	50	4000 K	Lensed strip luminaires.		Occupancy Sensor Control + Local Switch Control
Break Room / Kitchenette	15	3500 K	Downlights for geneal illumination, lensed LED tape luminaires for undercabinet task illumination at the counter, small scale decorative pendants over the seating area for visual interest.		Occupancy Sensor Control + Daylight Harvesting + Local Switch Control
Hallway / Circulation	5	3500 K	Recessed 4" round downlights or pendant cylinder downlights, depending on ceiling conditions		Occupancy Sensor Control + Timeclock Overrides
Cold Warehouse	40	4000 K	High bay luminaires rated for -50F. It's recommended that the LED drivers be remotely mounted within conditioned space.		Occupancy Sensor Control + Local Switch Control+ Timeclock Overrides + Daylight Harvesting
Conference	35	3500 K	Pendant direct/indirect linear luminaire over table with wallwash downlights around the perimeter.		Occupancy Sensor Control + Local Switch Control+ Daylight Harvesting
Electrical Room	30	4000 K	Lensed strip luminaires.		Local Switch Control
Entry	15	3500 K	Recessed 4" round downlights or pendant cylinder downlights, depending on ceiling conditions.		Occupancy Sensor Control + Timeclock Overrides + Daylight Harvesting
Exterior Building	1 - 5	4000 K	Exterior wall mounted area luminaires with full cut- off optics. Luminaire and mounting shall be able to withstand wind load of 150 MPH. Luminaire shall be rated for -40F and it's recommended that the LED drivers be remotely mounted within conditioned space where possible. Luminaires shall be located above all egress doors with emergency power		Photocell for dusk-to-dawn operation
Flamable Storage	30	4000 K	Lensed industrial strip luminaires rated for hazardous conditions.		Occupancy Sensor Control + Local Switch Control
Lube / Compressor & Hazardous Waste	30	4000 K	Lensed industrial strip luminaires rated for hazardous conditions.		Occupancy Sensor Control + Local Switch Control
Heated Warehouse	40	4000 K	High bay luminaires with wall mounted direct/indirect luminaires around perimeter circulation pathways.		Occupancy Sensor Control + Local Switch Control+ Timeclock Overrides + Daylight Harvesting

Janitor	15	4000 K	Lensed strip luminaires.		Occupancy Sensor Control
IT Room / IT Node	30	4000 K	Lensed strip luminaires.		Occupancy Sensor Control + Local Switch Control
Large Tool Storage	30	4000 K	Suspended lensed industrial strip luminaires.		Occupancy Sensor Control + Local Switch Control+ Timeclock Overrides + Daylight Harvesting
Laundry	30	4000 K	Lensed strip luminaires.		Occupancy Sensor Control

SPACE TYPE	AVERAGE ILLUMINATION *(FC)*	COLOR TEMPERATURE *(CCT)*	LUMINAIRE TYPES	LUMINAIRE IMAGE	LIGHTING CONTROLS
Library	30	3500 K	Recessed volumetric troffer luminaires with recessed wall wash downlights for bookshelf accent illumination.		Occupancy Sensor Control + Local Switch Control+ Timeclock Overrides
Locker Room and Showers	5 - 15	3500 K	Cove luminaires mounted to tops of lockers to indirectly illuminate the space for general illumination. Decorative wall mounted vanity luminaires at mirror and vanity sink locations. Downlights for circulation, stall lighting, and for showers with wet rating.		Occupancy Sensor Control + Daylight Harvesting
Machine	50	4000 K	Lensed industrial strip luminaires.		Occupancy Sensor Control + Local Switch Control+ Daylight Harvesting
Mechanical Room	30	4000 K	Lensed strip luminaires.		Occupancy Sensor Control + Local Switch Control
Office - Open	35	3500 K	Recessed volumetric troffer luminaires for general task illumination.		Occupancy Sensor Control + Local Switch Control + Timeclock Overrides + Daylight Harvesting
Office - Private	35	3500 K	Recessed volumetric troffer luminaires for general task illumination.		Occupancy Sensor Control + Local Switch Control + Daylight Harvesting
Restrooms	20	3500 K	Downlight for general circulation illumination with wall mounted vanity luminaire mounted above the vanity mirror.		Occupancy Sensor Control
Supply / Storage	10 - 30	4000 K	Lensed industrial strip luminaires.		Occupancy Sensor Control
Tool Room	30	4000 K	Lensed industrial strip luminaires.		Occupancy Sensor Control + Local Switch Control + Daylight Harvesting

Warehouse Desk	35	3500 K	Recessed volumetric troffer luminaires for general task illumination.		Occupancy Sensor Control + Local Switch Control
Warranty	15	4000 K	Lensed industrial strip luminaires.		Occupancy Sensor Control
Wash Bay	50	4000 K	Lensed wall mounted wet rated industrial strip luminaires.		Occupancy Sensor Control + Local Switch Control + Timeclock Overrides
Welding	50	4000 K	Lensed industrial strip luminaires.		Local Switch Control+ Timeclock Overrides + Daylight Harvesting
Work Bays *(Light, Heavy, Tire)*	50 General 80 Task	4000 K	High bay luminaires with wall mounted direct/indirect luminaires around perimeter circulation pathways.		Occupancy Sensor Control + Local Switch Control+ Timeclock Overrides + Daylight Harvesting

E. Telecommunication Systems

1. Backbone Cabling

   a. Primary outside plant telecommunication cabling will consist of single mode fiber optic (SM FO) cabling which enters the facility at the telecommunications entrance room (TER). This cabling shall terminate on rack mounted 24 port optical fiber entrance patch panels with SC/APC connectors. The TER shall be 10’x12’ and contain three 2’x3’ racks/cabinets. The door shall be 42” wide, fire rated and swing outward.

      Primary outside plant copper cabling shall terminate on a series of backboard mounted 110 blocks with service entrance overvoltage protectors in a 1:1 arrangement.

   b. Telecommunication rooms (TRs), in addition to the TER, will be located throughout the facility so that the length of horizontal cabling between the rack to each outlet is less than 295’ per TIA standards. Each TR shall be 10’x12’ and contain up to three 2’x3’ racks/cabinets.

   c. High pair copper CAT3 telephone backbone cables will be routed from wall mounted 110 blocks in the main communications room to wall mounted 110

blocks in the communication rooms on each floor. Cabling will jumper from parallel 110 blocks, then jumper to rack mounted patch panels. All TRs shall have 25 pair CAT3 copper provided from the TER.

d. Data backbone cabling consists of multiple 12-strand single mode fiber optic (SM FO) cables routed from rack mount fiber patch panels in the TER to rack mounted FO patch panels in the telecommunication rooms on each floor. Backbone fiber optic cabling utilizes SC/APC style connectors.

e. Backbone cabling shall be riser rated where it does not run in plenum rated air spaces. Plenum rated cable shall be used for cables that pass through air handling spaces. Any cable that passes through an air handling space shall be plenum for its entire length from termination to termination.

3. Horizontal Cabling

a. Category 6 horizontal structured cabling systems shall ensure signal transmission up to 400MHz performance in compliance with TIA 568-C. Maximum horizontal distance shall be 295’-0” (90 meters) per link independent of media type. This is the cable length from mechanical termination of the media at the horizontal cross connect in the telecommunication room to the telecommunications outlet/connector in the work area. Patch cables may not exceed 32’ (10 meters) per channel; it is recommended that each patch cable be less than 16’ (5 meters) for each end.

b. The voice/data telecommunication infrastructure includes pre-wired jacks with a minimum of four jacks per wall plate, which will be a combination of data and voice in the same wall plate. Jacks will be labeled as voice/data once installation occurs depending on the need. Jacks are provided for offices, workstations, classrooms, etc. Station data wiring use Cat-6, 4-pair 24AWG Cu RJ-45 jacks and employs TIA 568C wiring topology. All telephone voice jacks are terminated on rack mounted patch panels for Voice Over Internet Protocol (VOIP) implementation. All data jacks are terminated on rack mounted patch panels. Wall jacks are located within 18” of power receptacles and with a

minimum of 2 per private office. Telecomm station cabling is routed in a combination of conduit and cable tray and terminated at the nearest telecommunications room rack mounted patch panels. The cable shall be run in one continuous run with no splices or breaks to the workstation outlet.

4. Telecommunication Rooms

   a. There are two Telecommunication Rooms located in the facility to support Voice/Data, Audio Video, Security, Surveillance and other department equipment and connections. TIA 569-A requirements serve as the design basis.

   b. The location of the Telecommunications Rooms are centrally located to the floor area being served. Room space shall not be shared with electrical equipment other than for electrical panel dedicated to the TR load. The length of horizontal distribution cable required to reach the work area shall not exceed 295’ (90 m).

   c. Two walls are to be covered with 8’ (2.6 m) high, 1” (20 mm) plywood and all walls shall be painted with fire retardant paint, to provide robust substitute for wall mounted requirements hardware.

   d. Wall, floor and ceiling finishes should be light in color to enhance room lighting. No false ceilings should be provisioned. For powering equipment, at least two dedicated duplex electrical outlets on separate circuits are to be provided. For racks, cabinets’ convenience, duplex electrical outlets should be placed at 5’9” (1.8 m) intervals around perimeter walls.

   e. Room penetrations (sleeves, slots, horizontal pathways) must be properly fire stopped in compliance with applicable codes and local jurisdiction/authority requirements.

   f. The door shall be provided with card reader access control. Each TR shall be provided with a surveillance camera to show people entering and leaving the room. Fire detection shall be provided as required by the Project Fire Protection Engineer and local jurisdiction/authority requirements.

g. Access to the TR shall be provided by a minimum of one door of 36” (910 mm) wide and 80” (2000 mm) high.

h. Cooling requirements for TRs shall be based upon 2.5 kW per cabinet. Multiple levels of overhead ladder tray will be installed around the perimeter of the room as well as over the equipment racks to provide cable support and routing. Ladder tray shall be mounted at a minimum of 6” (150mm) above the equipment cabinets. Pathways will include ladder tray for copper cabling, power and specialty fiber optic pathway. All cabling shall be run in cable tray above the cabinets.

i. Lighting shall be provided in each row and shall be hung even or no less than 2” (50mm) above the top of the cabinet in the middle of the row. Lighting shall be provided to achieve 50 foot candles for entire room.

j. Each telecommunication room includes a minimum of one LAN rack with RJ-45 jack, TIA 568C configuration patch panels and 24 port optical fiber patch panels with SC/APC connectors. Each TR will contain two Telco (relay) racks and one cabinet (19”x45”x42RU). This will compartmentalize incoming backbone connections, outgoing backbone connections, and active telecomm equipment. Quad-plex receptacles with dedicated circuits are provided at the lower right corner of telephone backboards and above each communication system rack. A 208V, 1 phase twist lock receptacle shall be provided above each telecomm rack. Rack space will be provided for GFGI LAN switches and network equipment in each rack.

k. Each telecommunication room shall have a dedicated telecommunications grounding busbar (TGB) grounding bus with a ground conductor tied to the telecommunications master grounding busbar (TMGB) in the main TEF. The TMGB is bonded to the facility power system grounding system per J-STD 607-A. The communications grounding between any TGB and the TMGB is designed for no more than 100 milliohms resistance. Quad-plex receptacles with dedicated circuits are provided at the lower right corner of telephone backboards and above each communication system rack.

F. Special Electrical Systems

1. Wireless Network Access

   a. A Wireless local area network (WLAN) links two or more devices over a short distance using a wireless distribution method, usually providing a connection through an access point for internet access.

   b. Wireless access points (WAP) are located throughout the interior of the building and provide full coverage to all normally occupied spaces. WAP's consist of high speed, dual band, wireless routers linked together from the closest telecommunication rooms. It is recommended that the wireless access points run over Category 6A cable. WAP data outlets will require a minimum of (1) Category 6A cable, although (2) is recommended. The wireless access point system will be powered via Power over Ethernet (POE). Each Wi-Fi system will be password protected for access control.

   c. Wireless access points shall be designed for high capacity use in compliance with the TIA TSB-162a Standards Document.

   d. WAP locations will be based on owner selected vendor criteria, and should support A, B, G, N and A/C transmission technologies.

   e. 802.11ac Access points shall be deployed. It is recommended that a predictive survey be performed prior to construction and also on site when construction is neat completion. Utilization of both 2.4GHz and 5 GHz.

2. Physical Security

   a. Closed circuit television (CCTV) system is used to monitor all exterior exits and any sensitive areas. The system consists of IP addressable, pan-tilt-zoom, color, cameras that will be linked back to the nearest telecommunication room. Monitoring of the camera signals is performed at a variety of areas around the station and will be assigned as needed. Data storage will be located in the EOC area with data storage located in a rack-based video servers in one or both of the data centers.

b. An access control system (ACS) is provided for all exterior entrances and exits and any sensitive areas. The ACS consists of a card key and PIN keypad for maximum user flexibility and security. Monitoring and control of all access points is maintained in the mission operation center area.

3. Collaborative Communications

a. Collaborative communications includes public area displays (PAD), Internet Protocol Television (IPTV) and Radio Music and Information (RMI).

b. General

1. Design will comply with all applicable codes and standards for this type of facility. Applicable code references are as follows:
2. ANSI/TIA/EIA 569-B Commercial Building Standards for Telecommunications Pathways and Spaces.
3. ANSI/TIA/EIA 606-A The Administration Standard for The Telecommunications Infrastructure of Commercial Building.
4. ANSI/J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. BICSI Telecommunications Distribution Methods Manual (TDMM) 11th Edition.
6. ISO/IEC 11801 – Information Technology – Generic Cabling for Customer Premise.
7. NFPA-70 National Electrical Code (NEC) 2014 edition
8. Federal Communications Commission Part 15 and Part 68
9. UL 444 – Standard for Safety of Communications Cable
10. UL 1666 – Standard for Safety of Flame Propagation Height
11. NFPA 262 – Flame Travel and Smoke of Wires and Cables
12. Local Authority Having Jurisdiction

c. Public Area Displays – (PAD)

Located at entrance/exit vestibules, PADs deliver visual information to personnel.

1. Interactive design – PADs shall allow personnel touch access to detailed weather and schedule information.
2. Content Manager – Headend CPU executes commands for translation of digital information into visual presentations.
3. Visual Interface – 32" profession grade displays for 24/7 continuous operation. Includes onboard quad core processor.
4. Touch Interface – Converts standard display into a dynamic touch screen providing scratch resistance.

d. Internet Protocol Television – IPTV

IP communications equipment which provides video signals for the majority of all areas that have video displays. This includes all public areas, lounges, gym and multi-use venues.

1. Content Server – Centralized content delivery system distributed via data center content distribution network (CDN).
2. Video on Demand (VOD) – content management and delivery of downloaded AFRTS content.
3. Access controller – Personnel access content with handheld remote via 'set top box' recessed behind each display throughout the facility.

e. Radio Music and Information – RMI

The facility-wide audio system will provide high quality audio reproduction of RMI sources and coverage.

1. RMI Zoning - Each zone will be adjustable in output level and source selection and any area may be scheduled for automated adjustments over time.

2. RMI Quality - RMI system will provide high quality audio reproduction at levels needed to overcome local ambience.
3. RMI Distribution - Signals are transmitted and received using audio digital signal processing (DSP). The DSP is an open−architecture design that is custom pre-configured and controlled by remote panels.
4. Radio Selector Remote Touch Panels – Custom user interface allows source and channel selection in each zone.

4. Station Notification

a. General

1. Design will comply with all applicable codes and standards for this type of facility. Applicable code references are as follows:
2. ANSI/TIA/EIA 569-B Commercial Building Standards for Telecommunications Pathways and Spaces.
3. ANSI/TIA/EIA 606-A The Administration Standard for The Telecommunications Infrastructure of Commercial Building.
4. ANSI/J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. BICSI Telecommunications Distribution Methods Manual (TDMM) 11th Edition.
6. ISO/IEC 11801 – Information Technology – Generic Cabling for Customer Premise.
7. NFPA-70 National Electrical Code (NEC) 2014 edition
8. Federal Communications Commission Part 15 and Part 68
9. UL 444 – Standard for Safety of Communications Cable
10. UL 1666 – Standard for Safety of Flame Propagation Height
11. NFPA 262 – Flame Travel and Smoke of Wires and Cables
12. Local Authority Having Jurisdiction

b. Mass Notification/Public Address Systems

Station notification includes combination mass notification/public address speaker array system. The system of speakers will be mounted throughout the facility to provide the ability to communicate pre-recorded and live messages. These are specialized audio subsystems that provide the means to communicate one-way with personnel in specific areas serviced by a paging speaker system as follows:

1. The paging system shall allow personnel operating the facility to select the intended zone or zones to be addressed.
2. The intended sound shall be announcements conducted by personnel operating the facility.
3. The announcements may be voice announcements made with a microphone or reproductions of pre-recorded announcements.
4. The intended time of sound delivery shall be at the discretion of the personnel operating the facility and may also be determined by an external system. The function of the paging system shall be to deliver announcements intelligible to all intended listeners at the intended time.

c. Systems Function

1. All Mute - When commanded to execute an All Mute, the A/V System shall mute all Show Sound. All sources of Show Sound shall continue synchronous playback during the execution of an All Mute. The Show Page, Priority Page, All Page, and Fire Announcement functions shall operate normally during an All Mute. The Fire Alarm System via the Fire System Interface (FSI) shall be able to execute an All Mute. When the A/V System is executing the All Mute function, the A/V System shall notify an external system. The A/V System shall be capable of executing an All Mute if Technical Power is not available.

2. Zone Page - When commanded to execute a Zone Page, the Paging Sub-System shall direct the Zone Page signal to the intended zones. During a Zone Page - All sources of RMI shall duck. The level and rate of signal reduction shall be adjustable.
3. All Page - When commanded to execute an All Page, the A/V System shall direct the desired Page signal to all zones.
4. Release of Paging Functions - When commanded to stop execution of a page or a mute, the A/V System shall resume normal show operation. Paging functions other than those initiated via the FSI control interface shall be automatically released after a programmable interval of time.
5. Timing of Paging Functions - The A/V System shall perform a Paging function in less than 250 milliseconds after it is commanded to perform the Paging function.
6. Paging Sub-System Failure - In the instance of a failure of the Paging Sub-System, an external system shall be notified.
7. Priority queue – Paging functions shall stack messages and initiate per priority level.
8. Paging Indicators - All buttons on paging Panels shall be momentary (non-latching) and have illuminated indicators to inform operators of the status of the A/V System. All indicators shall be controlled by a programmable controller capable of providing the following five illumination states. The conditions resulting in these states is described in the following section:

    Indicator ON

    Indicator OFF

    Indicator FLASH SLOW (frequency = 0.5 Hz, 50% duty cycle)

    Indicator FLASH FAST (frequency = 2 Hz, 50% duty cycle)

Lamp Test (All indicators on)

d. Panel Design

1. Panel Layout - Panel layout drawings shall clearly depict the dimensions and location of all mounted devices (e.g., buttons, GUI touch panels, microphones, designation strips). The intended back box or enclosure and mounting elevation and type (flush or surface) shall also be listed.

5. Industrial Controls

a. A new industrial controls system is provided for the facility. It interfaces, via CAT 6 cabling, from the various HVAC and lighting controls panels to the mission operations center. It's used to monitor and control the various lighting and environmental controls throughout the facility. Specific environmental zones are established and programmed into the system based on the specific occupants needs. In addition, the control interface, located in the mission operations center, monitors and controls all the other facilities and power sources at the station via the microgrid energy management system.

G. Lightning Protection

1. A lightning protection system is not anticipated for this project.

H. Basic Materials of Construction

1. Conductors are copper with THHN/THWN rated insulation.

2. Interior conduit is EMT with flexible liquid tight metal conduit for mechanical equipment and motors.

3. Exterior conduit is RGS above grade; PVC below grade with threaded bodies and bushings.

4. Electrical equipment and panels use 100% copper buses with 100% neutrals for normal loads. Feeder and branch circuit overcurrent protective devices 225 amps

and lower are 80% rated; feeder circuit breakers greater than 225 amps are 100% rated devices.

5. Oil-filled transformers and dry-type transformers have copper windings.
6. Fluorescent lighting fixtures employ program start electronic ballasts. Fluorescent lamps have a color temperature as indicated in the lighting section, a CRI of 80 or better, and are T5HO, T8 or compact fluorescent.
7. LED lighting fixtures shall be used for exterior lighting and interior lighting.
8. Communications cabling with open cable tray routing in air plenum spaces is plenum rated. Data and telephone cabling is Cat-6 copper. Optical fiber cabling meets the station standards.
9. Communications jacks and wall plates use modular assemblies.

SECTION 11 ENVIRONMENTAL COMPLIANCE (SECTION NEEDS EDITING BY ASC)

A. Environmental Protection Compliance

1. <Place Holder>.

B. Basic SWPPP (Outline)

1. Summary
   a. <Place Holder>.
2. Project Identification
   a. Project Title: <Place Holder>.
3. Project Description
   a. <Place Holder>.
4. Standard Industrial Classification (SIC)
   a. <Place Holder>.
5. Location
   a. <Place Holder>.
6. Receiving Waters
   a. <Place Holder>.

C. Site Description

1. Existing Condition
   a. <Place Holder>.
2. Future Condition
   a. <Place Holder>.
3. Construction Phasing
   a. <Place Holder>.

D. Soils Data

1. <Place Holder>.

E. Drawings

1. <Place Holder>.

F. Erosion and Sediment Controls

1. Temporary Stabilization
   a. <Place Holder>.
2. Permanent Stabilization
   a. <Place Holder>.
3. Temporary Sediment Basins
   a. <Place Holder>.
4. Silt Fences
   a. <Place Holder>.
5. Inlet Rock Berm
   a. <Place Holder>.
6. Storm Structural Controls
   a. <Place Holder>.

G. Storm Water Management Controls

1. <Place Holder>..

H. Best Management Practices (BMP) Construction

1. <Place Holder>.
2. Waste Materials
   a. <Place Holder>.
3. Hazardous Waste
   a. <Place Holder>.
4. Sanitary Waste
   a. <Place Holder>.
5. Off-Site Vehicle Tracking and Dust
   a. <Place Holder>.
6. Construction Vehicle Maintenance and Repair

a. <Place Holder>.

7. Vehicle Fueling

a. <Place Holder>.

I. Timing of Controls and Activities

1. The Contractor shall perform the following control activities:

a. <Place Holder>.

J. Compliance with Federal, State and Local Regulations

1. <Place Holder>.

K. Maintenance and Inspection Procedures

1. <Place Holder>.

L. Material Inventory

1. <Place Holder>.

M. Non-Storm Water Discharges

1. <Place Holder>.

N. Contractor Compliance

1. <Place Holder>.

NOI Mailing Address:

O. Attachments

1. Site Notice, Project TPDES General Permit, NOI and NOT

a. <PlaceHolder>

SECTION 12 CONTRACTING STRATEGY (SECTION NEEDS EDITING BY ASC)

A. <Place Holder>.

SECTION 13 SUSTAINABILITY DESIGN

A. Required Rating Systems

None. The facility is designed to be LEED Silver/Gold certified. All LEED submittal review standards will apply as does necessary reporting.

B. Minimum Building Lifespan

1. 50 years
2. Efficiency and durability of materials is critical.
3. Functionality versus long term serviceability and maintenance, equipment, products, and systems must be weighed and vetted with ASC.

C. Durability and Material Quality

1. The materials and systems selected for this facility are based on the abusive nature and durability required for vehicle and equipment maintenance and operations facilities.
2. Sustainable buildings are ones that last, and the selected finishes are in line with the facility's 50 year expectation lifespan.
3. The exterior materials and systems selected for this facility are also expected to hold up to the extreme environment of Antarctica.
4. No materials are maintenance free, and in this environment, increased maintenance will be required on components like man doors, large vehicle doors, etc.

D. Energy Efficiency

1. ARCHITECTURE
   a. Strategic use of daylight with highly insulated window and glazing assemblies
   b. R-72 structural insulated panels walls
   c. R-100 roof assembliesR-60 operable wall panels with structural insulated panelsR-240 Structural foam (4' of Geofoam) under the radiant floor, betweenfloor and fill, with an option for addition foam up to R-480Insulated translucent glazing
   d. Fiberglass insulated glazing & door systems

e. Effective thermal envelope (robust thermal breaks, and air tightness for assemblies and door seals)

f. Snow modeling form to decrease snow accumulation

2. LIGHTING

a. High efficiency dimmable LED lighting systems

b. High efficient ambient lighting with controls, emphasis on task lighting

3. MECHANICAL

a. Integrated Building Automation System (HVAC & lighting included)

b. De-stratification fans

c. Radiant concrete floors

d. High efficiency boilers (3 types - electric, fuel oil, and used oil)

e. Dedicated outside air system for office

f. Demand controlled ventilation in offices

b. Dedicated outside air system for office

c. Demand controlled ventilation in offices

d. Variable flow exhaust control for shops and locker room (min + variable)

e. Shop exhaust with CO / NOx control

f. Locker room exhaust with humidistat / twist-timer control

g. Energy recovery to preheat supply air with building exhaust air (heat pipe energy recovery)

h. No ventilation in unheated storage

i. Use waste oil for heating

j. Domestic and vehicle wash hot water

- Efficient fixtures
- Efficient heating source from heating hot water loop
- Drain heat recovery

4. ELECTRICAL

a. Efficient shop and office equipment

b. Energy recovery from load bank

c. Combined heat and power (CHP) – (Microturbine(s) for electricity and hot water located at the VEOC)

E. Water Efficiency

1. Combined potable / fire water system
2. Vehicle wash to support washing each vehicle 2X week
3. Investigate recycled water and non-potable water options

F. Active Solar

1. PV potential: 320 kW with 15% efficient panels covering 90% of roof with 0.4 ground coverage ratio at 0 degree azimuth (north) and 40 degree tilt gives 850 kWh/kw

G. Design Modeling Analysis

1. Energy modeling (see below)
2. Daylight modeling
3. NavisWorks
4. Snow modeling

H. Life Cycle Cost Analysis

1. Utilize the energy modeling results and cost estimating info to deliver a complete and concise immediate costs versus long term payback analysis for the following systems:
2. THERMAL ENVELOPE
   - Wall insulation
   - Large vehicle door systems
   - Roof insulation
   - Glazing systems
3. HVAC
   - Boiler efficiency
   - Boiler types – gas versus electric
   - Energy recovery ventilator
   - Used oil furnace/boilers
   - Microturbines

I. Building Orientation

The building has been sited to achieve the full program on the site area allotted for the project. The largest volume of the facility (Storage) is placed into the hillside and is intended to shield the facility's bays and exterior maneuvering/vehicle parking from the prevailing winds.

J. Energy Modeling

1. See Ambient Energy's report appendix

SECTION 14 SITE PHOTOGRAPHS (SECTION NEEDS EDITING BY ASC)

1. Title

2. Title