JACKSON HOLE AIRPORT
FBO & GA HANGARS

Concept Design Report
FBO Terminal, Hangars & GSE Facilities

DISCUSSION DRAFT
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KLJ Project No. 10517131
Miller Dunwiddie Project No.: KLJ1801

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1. EXECUTIVE SUMMARY

1.1. General

The Jackson Hole Airport Fixed Base Operator (FBO) & General Aviation (GA) Hangars project will develop the general aviation campus on the south end of Jackson Hole Airport (JAC) for proprietary exclusive operation by the Jackson Hole Airport Board. The campus includes several hangars, an FBO terminal and a Ground Service Equipment (GSE) storage facility.

1.2. The Project

The primary objectives for the project include:

- Replacement of aging facilities
- Expansion of FBO & GA Campus' ability to store more aircraft of all sizes.
- Modernization and expansion of the FBO Terminal to meet Jackson Hole's desired level of customer service.

The project includes the following facilities:

1.2.1. FBO Terminal

This facility includes spaces for FBO support spaces, passenger facilities and flight preparation spaces on the first level. Airport administration offices, a conference room, additional passenger facilities and pilot lounge are on the second level. The FBO Terminal is planned to be approximately 28,000 square feet with two stories and a basement.

1.2.2. GA Hangars

Hangars will support roles including aircraft storage, aircraft maintenance, and Aircraft Maintenance staff office, lockers, and storage spaces. Hangars are sized to maximize capacity to accommodate all GA aircraft sizes based on Jackson Hole Airport trends and regional comparisons. The hangars combined area is over 111,000 square feet with the following breakdown:

1.2.2.1. Hangar 3

Hangar 3 is planned to be three-bays wide with an overall dimension of 100-feet x 300-feet. This hangar will primarily support GA storage.

1.2.2.2. Hangar 4

Hangar 4 is planned to be a single bay with an overall dimension of 140-feet x 140-feet. This hangar will primarily support GA storage.

1.2.2.3. Hangar 5

Hangar 5 is planned to be two-bays wide with an overall dimension of 140-feet x 280-feet. This hangar will primarily support GA storage.

1.2.2.4. Hangar 6

Hangar 6 is planned to be a single bay with an overall dimension of 140-feet x 140-feet. This hangar will also include Aircraft Maintenance space and support aircraft maintenance and storage.

1.2.3. Ground Service Equipment (GSE) Building

The GSE Building is intended to accommodate typical FBO ground support equipment. The GSE Building is planned to be 32-feet x 100-feet on a main floor and mezzanine.

1.3. FBO Terminal & GA Hangar Alternatives

1.3.1. Conceptual Design Process

FBO Terminal Building and GA Hangars design alternatives have been developed to explore placement of buildings, relationships of hangars, to terminals, to non-campus buildings, program development, and function/efficiency of designs. Alternative Concept Designs were reviewed with key Jackson Hole Airport stakeholders and revisions were made based on airport and design team input.

1.3.2. Preferred Concept Design

Preferred Concept Designs were developed to a higher level of detail to proof the validity of building assemblies and systems questions. The preferred concept for the FBO Terminal layout aligns most closely with Option 1. Locating the FBO Terminal on the north side of Hangar 4, capitalizes on the views of the mountain landscape. The landside entrance to the building is on the east side off the parking lot and under a canopy. The 2 story passenger lobby is located on the northwest side of the building, with the Second-Floor lobby adjacent to the open space.

1.4. Description of the Facilities

Building assemblies and systems are described at a conceptual level to identify quality and performance parameters for the project. These descriptions also support development of project schedule.

1.5. Schedule

1.5.1. Phasing

The FBO Terminal and GA Hangar Development project must be developed in a logical phased sequence to allow continuous effective operation of the FBO functions that support General Aviation activity and to allow the JAC Board to develop the FBO facilities as needed. A four-phase plan has been prepared to allow for increased capacity, sequenced demolition, and replacement, of the existing facilities. The phasing diagrams are included in Appendix E.

1.5.2. Schedule

The schedule approach assumes the Design and Construction Team can move from one phase to the next, employing the synergy of repetitive design elements, and applying lessons learned from the previous stages. Backward planning is required to create a schedule for each project phase that will support seamless progress on this project. The summary and detailed schedules per phase, based on the preferred Concept Design, are included in Appendix E.

End of Section

2. THE PROJECT

2.1. Scope of Work

The Jackson Hole Airport Fixed Base Operator (FBO) & General Aviation (GA) Hangars project will develop the general aviation campus on the south end of Jackson Hole Airport (JAC) for proprietary exclusive operation by the Jackson Hole Airport Board. The campus will include several hangars, an FBO terminal and a Ground Service Equipment (GSE) storage facility.

2.2. History

Based on an existing Landside Master Plan Study, the Airport outlined a project that included three storage hangars (Hangar 3) between the fuel farm and existing Hangar 4 as well as a new Hangar 6 and an FBO Terminal at the south end of the Airport. The conceptual design phase initially presented this option to the airport; however, through design discussions the Airport indicated that based on limited land availability, the existing Hangars 4 and 5 should be replaced as they were reaching the end of their usable lifespan and to maximize buildable area. This decision made the area south of the fuel farm available to planning a phased re-development of the GA Campus to maximize flight line access, hangar storage, GSE storage, to support a healthy GA environment.

The project also has an overall goal to improve the level of service for all general aviation operations. Industry surveys have indicated that JAC is rated lower than comparable mountain destinations such as Aspen, Vail-Eagle, Sun Valley, Montrose, Telluride, etc.

2.3. Constraints

The Jackson Hole Airport is located on and surrounded almost entirely by Grand Teton National Park. The Airport operates under an Agreement with the United States Department of the Interior. The Agreement establishes the site boundary at 533 acres and prohibits expansion beyond the current Airport boundaries. Additionally, the Agreement restricts building heights at the Airport.

The Airport intends to implement the FBO and GA Campus redevelopment in a phased process based on maintaining continuous operations for all users.

2.4. Objectives

The primary objectives for the project include replacement of aging facilities, expansion of FBO & GA Campus' ability to store larger aircraft and additional aircraft of all sizes, along with modernization and expansion of the FBO Terminal to meet a higher level of customer service.

2.5. General Facility Information

2.5.1. Project Number and Title Information

- Name: Jackson Hole Airport FBO & GA Hangars Concept Design
- KLJ Project No.: 10517131

2.5.2. Scope of Work Overview

The design team worked with Airport staff and selected stakeholders to develop a Concept Design for the Jackson Hole Airport FBO & GA Hangars, which will be presented to the Jackson Hole Airport Board. The objectives for the Concept Design of the project are listed below.

- Develop the survey, geotechnical, and historical data needed to support the design.

- Develop a short-term and long-term site plan for the southern portion of the Development Subzone.
- Define the size and functionality of the FBO components.
- Determine the size, uses, and configuration of the GA Hangars.
- Determine location and layout of the FBO terminal.
- Coordinate the Concept Design with other JAC consultants to assist refinement and execution of the JAC Capital Improvement Plan (CIP).
- Determine the interior and exterior architectural design approach for the facilities.
- Document the Concept Design process and decisions.

2.5.3. Departments

The project will support FBO staff, Aircraft Maintenance staff, and a portion of the Jackson Hole Airport Administration staff. The project will also support lease space opportunities for non-airport businesses.

2.5.4. Staff/Occupants

This information has not been finalized.

2.5.5. Hours of Operation

The FBO facilities will have the ability to function 24-hours a day, 365 days a year.

2.5.6. Aircraft

See JAC FBO Site Plan Report for aircraft details.

2.5.7. Facilities Program

The FBO Terminal program was developed based on space needs for the FBO, Aircraft Maintenance, Airport Administration, and lease opportunities. The Concept Design accounts for current traffic levels and future growth. See Appendix A for detailed program information

2.5.7.1. FBO Terminal

The FBO Terminal includes FBO support spaces, passenger facilities and flight preparation spaces on the first level. Airport administration offices, a conference room, additional passenger facilities and pilot lounge are on the second level. The basement level is comprised of storage and mechanical spaces. The total FBO Terminal program is summarized as follows:

- FBO Terminal: 28,300 SF
  - Basement: 9,700 SF max
  - First Floor: 9,800 SF
  - Second Floor: 8,800 SF

2.5.7.2. Hangars

There are four hangars being constructed. Hangar 3 is comprised of three 100-feet x 100-feet bays and a mechanical, electrical and fire protection area at the east side of the hangar. Hangar 3 will support 23-feet tail height aircraft. Hangars 4-6 are all connected. Hangar 4 is connected to the FBO Terminal and is 140-feet x 140-feet-. Hangar 5 is two 140-feet x 140-

feet bays. Hangar 4 and Hangar 5 each have a mechanical, electrical and fire protection addition at the east side. Hangar 6 is also 140-feet x 140-feet and has a two-level building at the east to house the FBO's aircraft maintenance operation as well as mechanical, electrical and fire protection equipment. Hangars 4, 5, and 6 will support 26-feet tail height aircraft.

- Hangar 3: 30,000 SF (main hangar and support space)
- Hangars, 4, 5, & 6: 81,600 SF (main hangars and support space)

2.5.7.3. GSE Building

The GSE building is 32-feet x 100-feet with overhead doors on the south and west sides of the building. The building is intended to accommodate typical GSE equipment such as trucks, tugs, bag carts, air stairs, lavatory carts, water carts, tow bars, ground power units and pre-conditioned air units. Overhead door sizes are planned as 12-feet wide x 14-feet high but need to be verified with the actual equipment inventory. There is a storage mezzanine at the north of the building for seasonal or infrequently used supplies.

- GSE Building: 4,400 SF
  - Main Level: 3,200 SF
  - Mezzanine: 1,200 SF

2.5.8. Building Codes and Standards

Building Codes and Standards are based upon those adopted by Teton County, Wyoming. Current codes are outlined below, but all future work will comply with the current adopted codes. Primary codes and standards include (but are not limited to):

- 2015 International Building Code
- 2006 International Fire Code
- 2015 International Plumbing and Mechanical Codes
- 2014 National Electric Code

2.5.9. Accessibility

Accessibility requirements are based on the 2015 International Building Code and the Americans with Disabilities Act (ADA) and will be incorporated into the project. Jackson Hole Airport may require accessibility standards above and beyond the code requirements. No added requirements have been identified at this time.

2.5.10. Sustainability

Energy goals are based on the 2012 International Energy Conservation Code as adopted by Teton County. No additional sustainability standards or third-party measurement systems such as LEED Certification have been identified for this project. Jackson Hole Airport may require energy or sustainability standards above and beyond the code requirements. No added requirements have been identified at this time.

2.5.11. Security Requirements

Security requirements are based on Jackson Hole Airport Security Program and TSA standards for General Aviation facilities. The FBO & GA Campus will straddle the AOA line and will require secure AOA fencing, gates, and pedestrian access points throughout the campus. The FBO and GA facilities will require coordination with Jackson Hole's Airport Security Plan.

End of Section

3. FBO TERMINAL & GA HANGAR ALTERNATIVES

FBO Campus alternatives were developed to explore placement of buildings, relationships of hangars to terminals to non-campus buildings, program development, and function/efficiency of designs.

3.1. FBO Terminal Building

The FBO Terminal Building options were developed based on the relationship to Hangar 4, location of main terminal entrance, size of building, location of passenger lobby, and program.

3.1.1. Concept Design Options

3.1.1.1. Option 1

Option 1 is located on the north side of Hangar 4. It has an east entry with a 2-story passenger lobby at the northwest to capitalize on the views of the mountain range to the west. This option is 68-feet in depth.

3.1.1.1.1. Option 1 Advantages

- Located on the north side of Hangar 4 to capitialize on the views
- Provide central location and make efficient use of applicable height restriction.
- Airfield visible at entry
- Available leasable space

3.1.1.1.2. Option 1 Disadvantages

- Vehicle approach requires multiple turns and is less intutitive than Option 2.

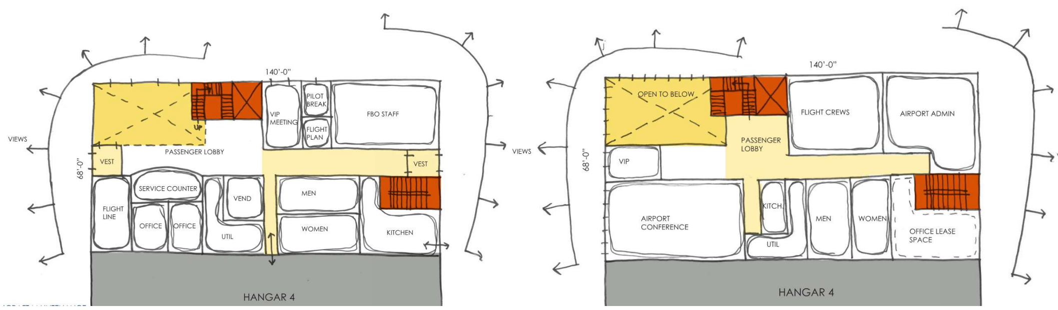


Figure 1. Option 1 First and Second Floor Plans

3.1.1.2. Option 2

Option 2 is located on the south side of Hangar 4. It has an east entry but the 2-story passenger lobby is shifted to the interior. This option is 68-feet in depth.

3.1.1.2.1. Option 2 Advantages

- 2-story passenger lobby at interior allows usable space at the entire perimeter of the second floor
- Available leasable space

3.1.1.2.2. Option 2 Disadvantages

- Airfield not visible from entry

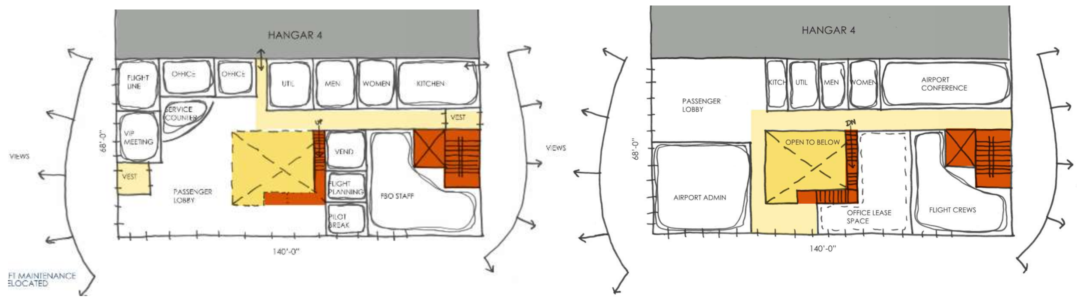


Figure 2. Option 2 First and Second Floor Plans

3.1.1.3. Option 3

Option 3 is located on the north side of Hangar 4. It has a north entry and a 2-story passenger lobby on the northwest. The building has a stepped depth that changes from 64-feet to 88-feet to allow for the passenger drop-off and entry near the center of the terminal.

3.1.1.3.1. Option 3 Advantages

- Located on the north side of Hangar 4 to capitalize on the views
- North entry eliminates the long hallway feel of an east entry
- Available leasable space

3.1.1.3.2. Option 3 Disadvantages

- Building footprint is greater than the overall site will allow
- Airfield not directly visible upon entry
- Vehicle approach requires a 180-degree turn at the entry for passenger drop off

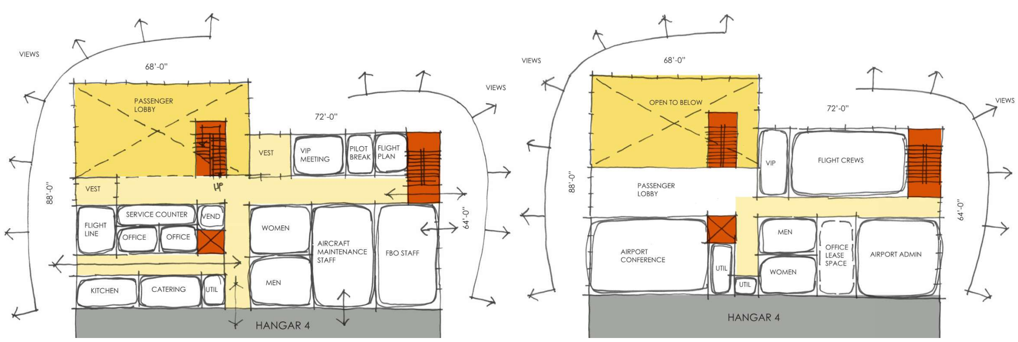


Figure 3. Option 3 First and Second Floor Plans

3.1.1.4. Option 4

Option 4 is located on the north side of Hangar 4. It has a north entry and an adjacent 2-story passenger lobby adjacent to the entrance on the northwest. The building has a stepped depth but less of a step than option 3 changing from 55-feet to 64-feet.

3.1.1.4.1. Option 4 Advantages

- Located on the north side of Hangar 4 to capitalize on the views
- North entry eliminates the long hallway feel of an east entry
- Available leaseable space

3.1.1.4.2. Option 4 Disadvantages

- Airfield not directly visible upon entry

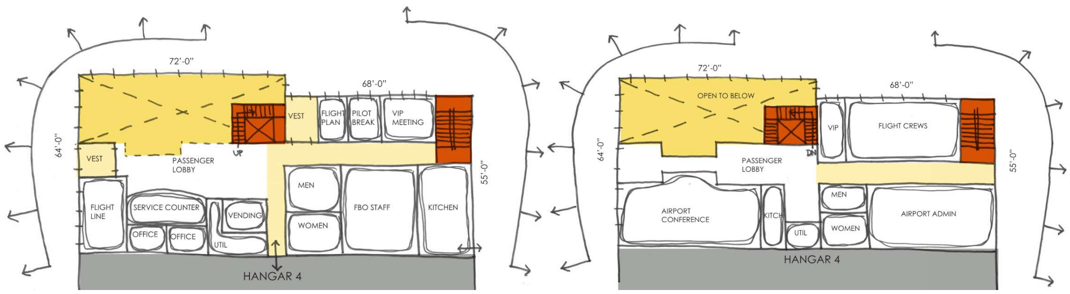


Figure 4. Option 4 First and Second Floor Plans

3.1.1.5. Option 5

Option 5 is located on the south side of Hangar 4. It has an east entry and an 2-story passenger lobby at the west. The building has a reduced program to fit into the footprint. The depth of the building is 55-feet.

3.1.1.5.1. Option 5 Advantages

- Smaller building footprint allows for more room on overall site
- Airfield visible at entry

3.1.1.5.2. Option 5 Disadvantages

- Reduced program due to smaller footprint
- No space for future expansion
- No leasable space

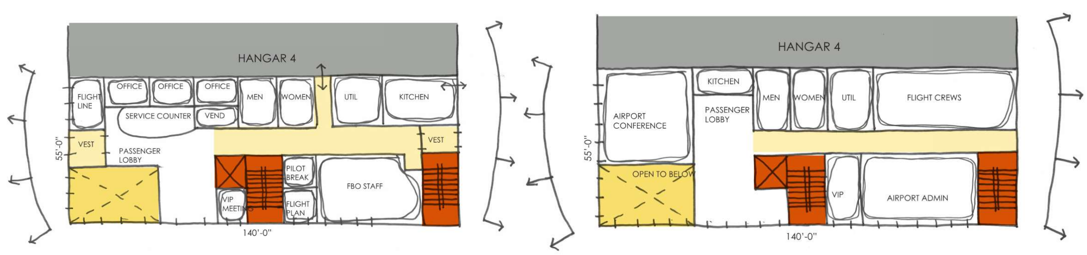


Figure 5. Option 5 First and Second Floor Plans

3.1.2. Preferred Concept Design Layout – FBO Terminal

The preferred FBO Terminal layout aligns most closely with Option 1 with the location of several spaces moving around and the entry on the east being pulled out from the main footprint of the building. The entry sequence and overall footprint remain unchanged. Spaces within the building are also reorganized after further review. Locating the FBO Terminal on the north side of Hangar 4, capitalizes on the views of the mountain landscape. The landside entrance to the building is on the east side off the parking lot and under a canopy. The 2 story passenger lobby is located on the northwest side of the building, with the Second-Floor lobby adjacent to the open space. A full basement is shown but will be dependent on the need and requirements for mechanical and storage space. The basement may be sized to be a partial foot print of the first floor.

3.1.2.1. Site Integration

The location of the FBO Terminal on the north side of Hangar 4 allows it to be centrally located in the GA complex. Passengers will not have to travel the entire site to arrive at the Terminal. Parking is directly adjacent to the east entrance. A drop off lane with a canopy is provided at the east entrance and has good visibility for arriving passengers. An airfield gate is located on the north side of the FBO Terminal for vehicles to access the flight line and will bring passengers directly to their aircraft. Rental car staging will be adjacent to the airfield access gate and the FBO Terminal for passenger convenience.

3.1.2.2. FBO Terminal Floor Plan(s)

Refer to Appendix C for FBO Terminal floor plans.

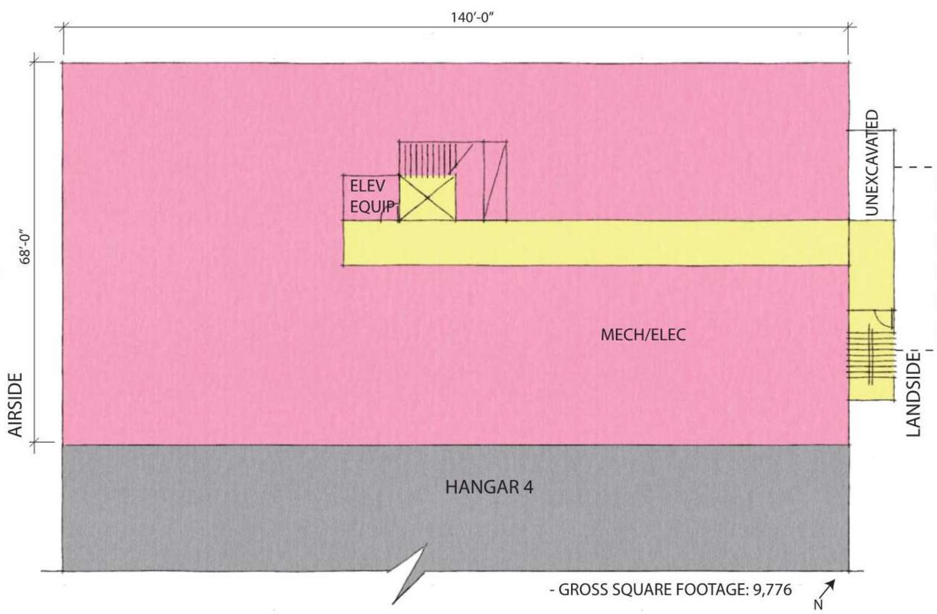


Figure 6. Preferred Concept – FBO Terminal Basement Floor Plan

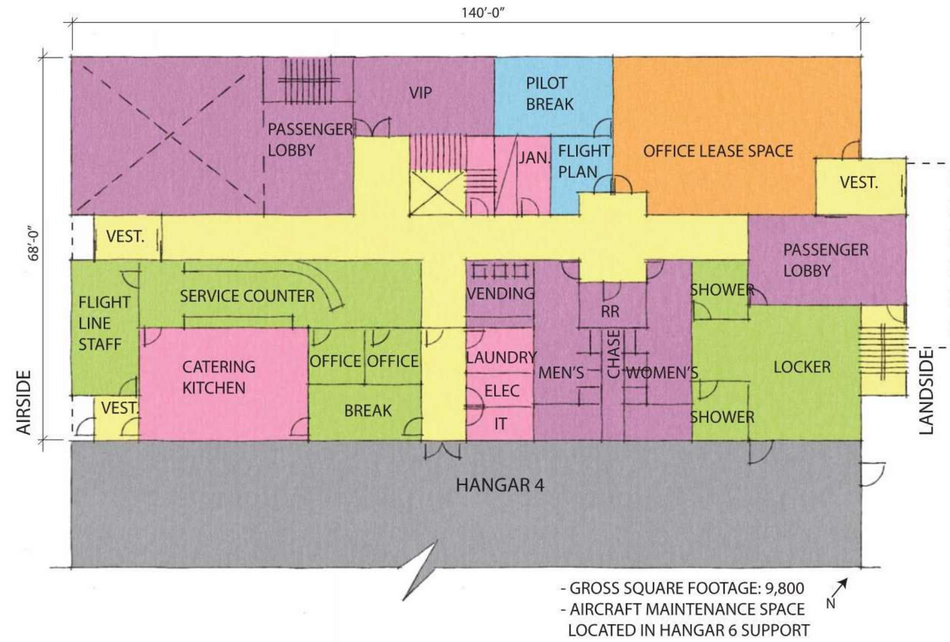


Figure 7. Preferred Concept – FBO Terminal First Floor Plan

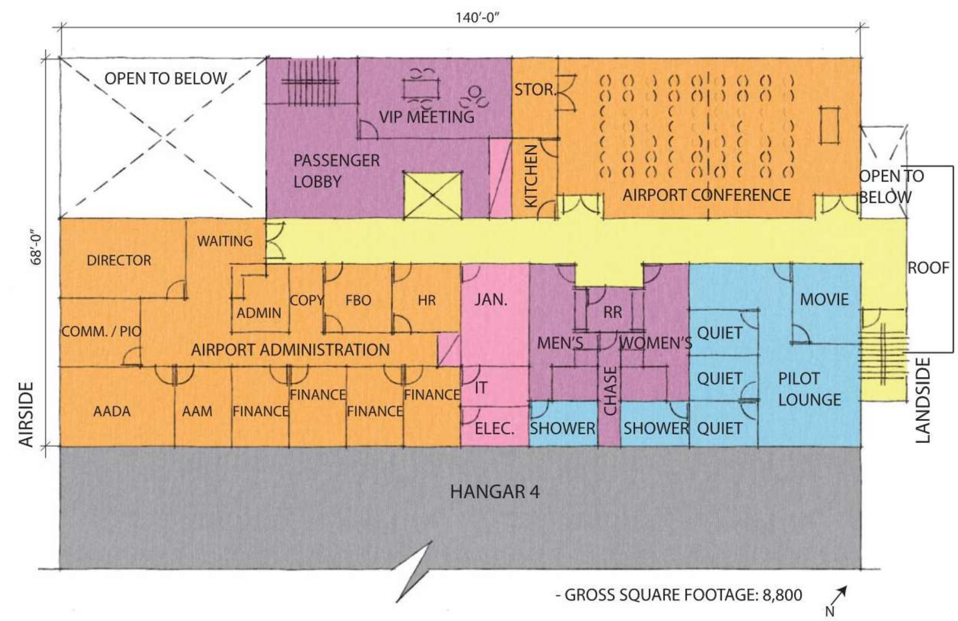


Figure 8. Preferred Concept – FBO Terminal Second Floor Plan

3.1.2.3. FBO Terminal Massing

Terminal massing is included with the overall site massing. Refer to the Appendix C for site massing.

3.2. GA Hangar Complex

At the beginning of the concept design, locations for the hangars and various configurations were studied. Due to the necessary adjacency to the aircraft apron and flight line, all hangars were oriented in the same manner with aircraft doors to the west and aligned with the east edge of the existing apron. All options assumed that Hangar 6 would be located as far south near the airport boundary as possible to maximize use of the limited site. The Agreement with the Department of the Interior restricts the height of the airport facilities resulting in a maximum height for the hangars of approx. 31'-6" above existing grade. Due to the rise in the apron to the north the depth of the bays for Hangar 3 is less than the rest of the Hangars. Hangars were sized to maximize capacity and to accommodate all sizes of GA aircraft based on Jackson Hole Airport trends and regional comparisons. See the Site Plan for more details on hangar programming.

3.2.1. Hangar 3

Hangar 3 is a 3-bay medium sized hangar with a 23-feet clear door height and a footprint of 100-feet x 300-feet. Hangar 3 is shifted 80-feet east of Hangars 4, 5 and 6 allowing additional apron space for aircraft parking. Similar to Hangars 4, 5 and 6 a 16-feet x 30-feet structure is added on the east of Hangar 3 for fire protection, mechanical and electrical systems support spaces. This allows the full utilization of the hangar floor for aircraft parking. Requirements for restrooms and offices will be determined during Schematic Design.

3.2.2. Hangars 4, 5, & 6

Hangars 4, 5, and 6 are larger hangars with a 26-feet clear door height and a footprint or bay size of 140-feet x 140-feet. This is the largest practical size allowed due to the height restrictions noted above. The concept design initially looked at incorporating existing Hangars 4 and 5 into the overall hangar complex, but it was determined that the existing Hangar 4 needs considerable refurbishment and would require structural upgrades to meet current code requirements and fire protection system. It was also determined through the design and planning exercises that the existing locations of Hangars 4 and 5 significantly restricted the possible re-configuration of the FBO Campus and limited the potential hangar capacity. To accommodate fire protection, mechanical and electrical systems, 16-feet x 30-feet structures are added on the east of Hangars 4 and 5. This allows the floor of the hangars to be open without any support spaces or equipment. On the east side of Hangar 6 a similar 16-feet deep building is added for the entire length of the hangar to accommodate Aircraft Maintenance facilities with a mezzanine level for storage.

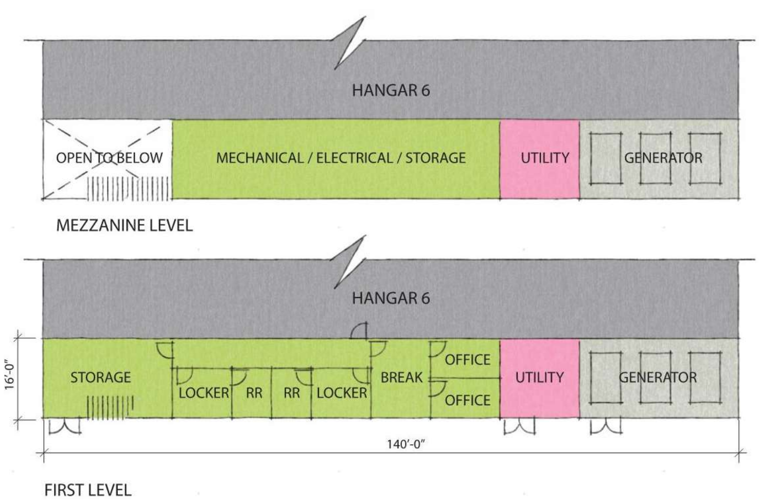


Figure 9. Hangar 6 Aircraft Maintenance (First Floor & Mezzanine Level Floor Plans)

3.2.3. Preferred Concept Design Layout - Hangar

The final size and location of the hangars is consistent with the early concept designs. The decision to replace existing Hangars 4 and 5 allows the highest utilization of the GA area.

3.2.3.1. Hangar Layout Advantages

- Hangars 4, 5 and 6 are all connected as well as having a connection to the FBO Terminal
- New buildings create new identity for general aviation complex
- Increased aircraft storage space
- Increased aircraft tail height
- Layout allows phased implementation

3.2.3.2. Hangar Layout Disadvantages

- No connection from Hangar 3 to the FBO Terminal

3.2.3.3. Site Integration

As dictated by the Airport, Hangar 3 is located at the north of the FBO Campus. The three-bay hangar aligns with the existing apron. The apron steps to the west south of Hangar 3. Hangars 4, 5, and 6 align with the step in the existing apron at the west and continue to the southernmost buildable point of the airport. Parking will be located to the east of the hangars and will be more fully developed in the design phase.

3.2.3.4. Hangar Floor Plan(s)

Refer to Appendix C for Hangar floor plans.

3.2.3.5. Massing

All hangar massing is included with the overall site massing. Refer to the Appendix C for site massing.

3.3. Ground Service Equipment (GSE) Building

The existing GSE Building is located at Hangar 4. With the removal of Hangar 4 there is an opportunity to improve the facility, update the layout, and relocate it to meet the needs of general aviation.

3.3.1. Concept Design Options

The GSE building had two main design options. Option 1 provides a center aisle pull through building with overhead doors on landside and airside end walls. Option 2 provides a smaller footprint with multiple overhead doors on the long (south) wall and one to two overhead doors on the narrower (west) airside end wall.

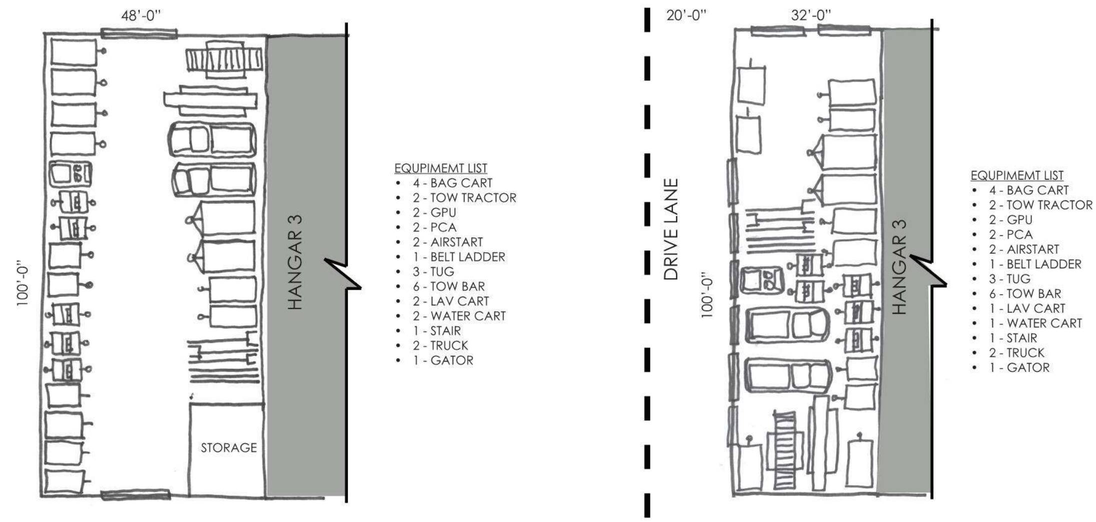


Figure 10. GSE Building Level - Option 1 (left), Option 2 (right)

3.3.1.1. OPTION 1 - Advantages

- Doors on east and west allow building to be placed between hangars or as a standalone building

3.3.1.2. OPTION 1 - Disadvantages

- Increased footprint
- Columns required to support structure for mezzanine storage

3.3.1.3. OPTION 2 - Advantages

- Smaller footprint
- More exterior doors increase access to frequently used equipment

3.3.1.4. OPTION 2 - Disadvantages

- Requires drive lane for side access that is wide enough to allow for turning radius of equipment.
- Will not facilitate pull through traffic, instead overhead doors would be used for those pieces of equipment used most frequently.

3.3.2. Preferred Concept Design Layout – Ground Service Equipment (GSE) Building

The preferred floor plan is Option 2 as it allows more flexibility in both storage of equipment and access to the facility.

3.3.2.1. Site Integration

Multiple locations for the GSE Building were studied but all locations were adjacent to Hangar 3. Locations at the south, north, and between bays of Hangar 3 were studied. Option 1 would be the only floor plan to fit between hangar bays. The south option would make the GSE building directly in the view-shed of the FBO Terminal, which was not desired. Siting the GSE at the north of Hangar 3 allowed it to be directly adjacent to the fuel farm yet access the rest of the general aviation complex.

3.3.2.2. GSE Building Floor Plan

The preferred GSE Building floor plan incorporates multiple overhead doors at the south and two overhead doors on the west. There is ample room on the first level for the storage of equipment. Along the entire north portion of the building is a storage mezzanine that can be utilized for seasonal or other long-term storage. Refer to Appendix C for floor plans.

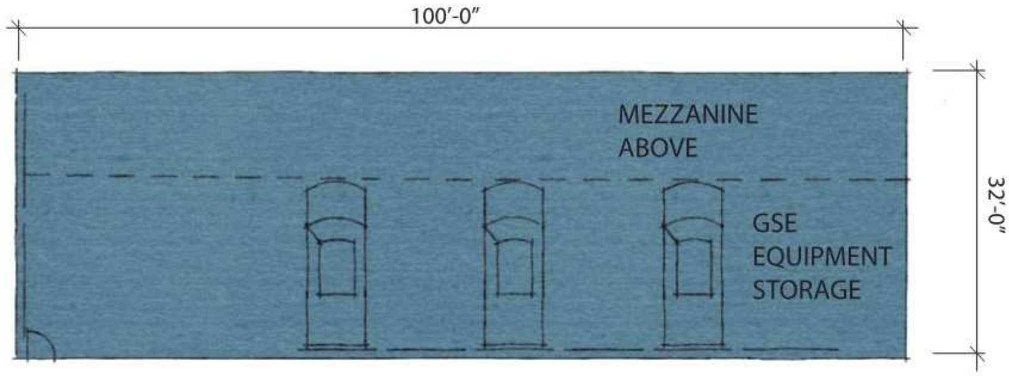


Figure 11. GSE Building Floor Plan

3.3.2.3. GSE Building Massing

GSE Building massing is included with the overall site massing. Refer to Appendix C for site massing.

End of Section

4. DESCRIPTION OF THE FACILITIES

The general aviation facility is comprised of (going from north to south): The Ground Support Equipment (GSE) Building located immediately south of the Fuel Farm. South of the GSE is Hangar 3 with three bays (A-C). The FBO Terminal is south of Hangar 3, separated by an airfield access drive, and is connected to Hangar 4. Hangar 5 with two bays (A-B) and Hangar 6 complete the campus to the south.

Figure 12. FBO Terminal & GA Hangar Campus Plan

4.1. General Facility Information

The FBO operation is housed in the existing FBO Terminal and existing Hangars 4 and 5 with ground support storage incorporated into Hangar 4. To accommodate increased GA activity, and provide additional aircraft storage capacity, the general aviation space will be expanded.

4.2. Site Plan

Site development information regarding the FBO & GA Hangars is contained in a separate report. The JAC FBO Site Plan Report has been coordinated with this document and contains detailed information including aviation planning metrics and projections, site development options, access roads, utilities, and parking.

4.3. Architectural

4.3.1. General

The south portion of the Jackson Hole Airport will now be occupied with the FBO Campus General Aviation facilities. Instead of the General Aviation campus structures having their own palette, these structures will use much of the same materials that are currently being used at the Jackson Hole Airport. Incorporating these buildings into the overall campus will further define the image of the Airport.

4.3.2. Building Exterior

4.3.2.1. Building Envelope

4.3.2.1.1. FBO Terminal

The FBO Terminal walls will have a steel frame construction including masonry unit or poured in place concrete exterior wall construction with cavity insulation and a variety of masonry and metal panel rain screen cladding. The floors will be pre-cast concrete or steel and concrete composite deck, and the roof will be steel framing with steel deck.

Exterior window and door assemblies will provide access, views, and daylight utilizing aluminum storefront/curtainwall glazing systems at the entrances and public spaces. Aluminum punched window openings will be used for smaller spaces that require daylight but need privacy and window coverings. The storefront and punched window openings will also give users of the building views of the airfield, aircraft operations, and the national park. All exterior doors will be an integral part of the storefront/curtainwall system with glazing.

The roof system will be a fully adhered membrane over rigid insulation and thermal board. A baseline R-Value of R-35 will be planned for the roof as outlined by code.

Flashing systems for exterior wall and roof will be pre-finished metal.

4.3.2.1.2. Hangars

The hangar walls will be precast concrete wall panels. Translucent sandwich panels will be incorporated into the exterior walls to bring daylight into the hangars. Further investigation will be needed with the structural system to verify the size and location of the translucent sandwich panels.

Hangar aircraft doors will be painted hollow metal door and frames. To allow the most flexibility on Hangars 3 and 5 a floating door system will be used. Three continuous tracks will extend the length of the hangar allowing all doors to be pushed to one end or the other of the hangar. This will create the largest opening and the most flexibility without utilizing space at the head of the door needed for structure. Hangars 4 and 6 will utilize a 90-degree door system, where the bi-parting doors move on tracks perpendicular to the opening to allow access to the entire opening. Again, this system requires minimal room at the head of the door. Translucent sandwich panels will be incorporated into the hangar doors to provide daylight into hangar spaces. Personnel doors will be hollow metal or aluminum storefront.

The roof system will be a fully adhered membrane over rigid insulation and thermal board. A baseline R-Value of R-35 will be planned for the roof as outlined by code. Flashing systems for exterior wall and roof will be pre-finished metal.

The Hangar Support Building will have precast concrete walls with painted hollow metal doors and frames. The roof system will match the hangars.

4.3.2.1.3. Ground Support Equipment (GSE) Building

The GSE will have precast concrete wall panels. Doors will be painted hollow metal door and frames with overhead doors. The roof system will be a fully adhered membrane roof.

4.3.2.2. Exterior Cladding

Pursuant to the Department of the Interior Agreement, all structures at the Airport must be “compatible in architectural style and appearance with existing structures.” Accordingly, the existing context of the region as well as of the Airport campus itself will be taken into consideration when addressing the exterior language of these buildings (reference Appendix C). The local vernacular includes natural materials that feel native to the area and to the history of the place. Wood, stone, concrete, glass, blackened steel, and rusted steel all comprise the material palette at the Jackson Hole Airport main terminal building. To maintain a sense of cohesion, the new QTA Facility has incorporated precast concrete panels, steel, and patinaed perforated metal panels.

The footprint of the proposed General Aviation campus places the buildings in-line north to south. Special consideration will be given to the treatment of the facades in order to break up their long expanse. Depth and relief in the perceived wall of building front can be achieved by using layers of exterior screening as well as indentations in the architectural massing. Variations in the materiality itself can also contribute to a dynamic elevation (refer to Appendix C).

The Terminal will be attached to the end of Hangar 4 and will appear as a transparent and inviting destination in the midst of a solid FBO edifice. The expression of structural elements will complement the material composition. The building skin will be durable and long-lasting as the backdrop to the open and exposed airport grounds. Preliminary concepts for the building exteriors shall include the following:

Exterior Façade Materials (refer to Appendix C)

- Precast concrete panels with board-formed finish for the exterior walls of the Hangars.
- Exterior surface-mounted steel structure with metal screen panels that stand off the concrete face. Metal screen panels could include a variety of patinaed to anodized to painted finishes.
- The Terminal façade shall include large glass expanses (consider electrochromic glass at western exposure). Specifically, the northwest corner will be a double-height transparent expression using triple pane glazing in a curtain wall system.
- Concrete will be a re-occurring material consistent with the adjacent hangars.
- Metal screen panels will carry across the Terminal in a smaller capacity.
- The screen gesture will appear to dissipate and undulate across the entire length of the newly developed apron front. Warmth and depth will be perceived at differing intervals behind the layered metal veil.

4.3.3. Building Interior

4.3.3.1. FBO Terminal Building

A contiguous theme will blend the material palettes between the interior and exterior architecture. The exterior façade will translate to the interior at specific moments, creating a sense of bringing the outside in. The textures and color schemes found within the Terminal will take cues from the natural surroundings of Jackson Hole and will illustrate a fresh rendition of mountain vernacular. The driving intent will be to ensure that the spaces are functional, durable, and that they will perform well for their purposes while simultaneously creating a sophisticated, inviting, and warm environment. The high-end public spaces will ultimately act as a backdrop complementing the stunning views to the west. (Refer to Appendix C).

The rooms are broken out into 3 Tiers which represent the level and quality of finishes. Tier 1 represents the high-end finishes that will be in the public spaces. Tier 2 represents the mid-level finishes for the secondary spaces. Tier 3 represents the more economical finishes for locker rooms and secondary bathrooms.

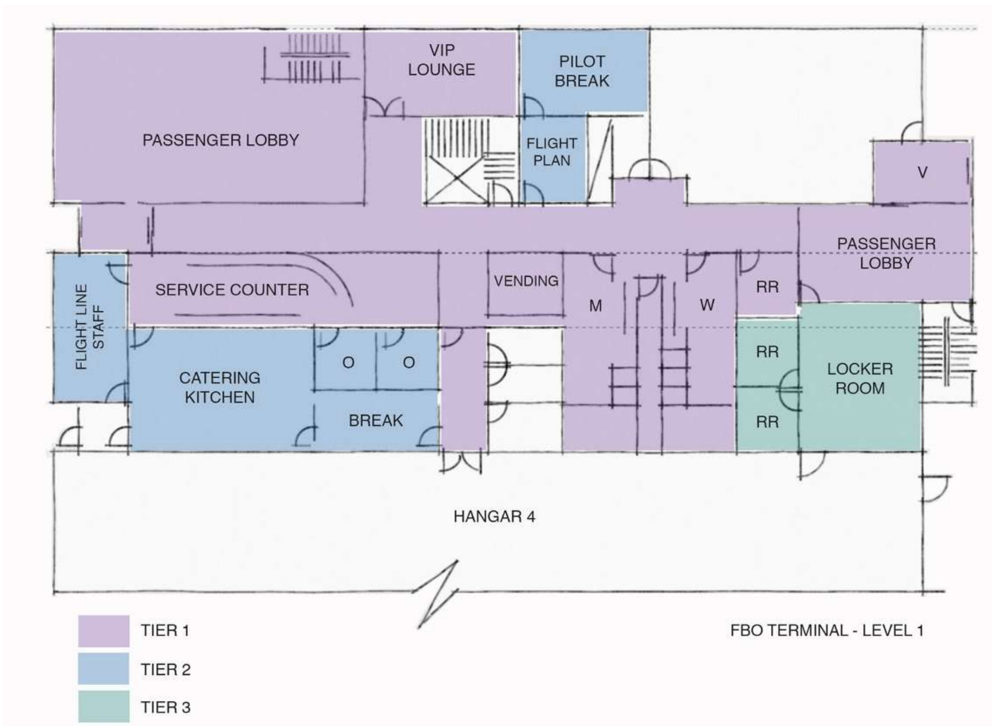


Figure 13. *Building Interior Tier Plan – First Floor*

Figure 14. Building Interior Tier Plan – Second Floor

4.3.3.2. Tier 1 Building Interiors

- **Floor Finishes**: Stained Concrete
- **Ceiling Finishes:**
  - Public Areas: Acoustic Wood Ceiling
  - Bathrooms: Level 5 Drywall
- **Wall Finishes:**
  - Public Areas: Level 5 Drywall
  - Restrooms: Natural Stone - Large-format Tiles or Slabs
- **Accent Wall Finish:** Blackened Steel, Board-form Concrete, Wood Paneling, and Leather. (Account for adequate accent walls throughout all of the public spaces).
- **Millwork Finish:** Custom Wood to Match Ceiling Finish
- Refer to Appendix C
- Pricing Reference:
  - Tile
    - Arizona Tile
    - Daltile

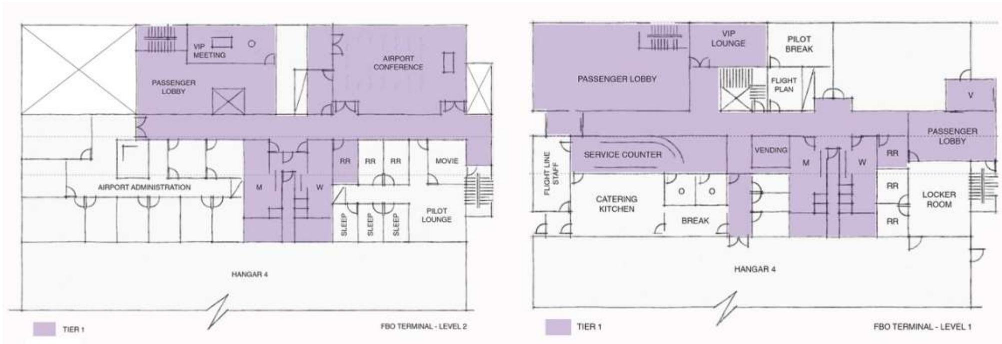


Figure 15. *Tier 1 Key Plan (First Floor & Second Floor)*

4.3.3.3. Tier 2 Building Interiors

- **Floor Finish: Main Level** – Stained Concrete; Upper Level - Modular Carpet Tiles
- **Ceiling Finish:** Level 5 Drywall
- **Wall Finish:**
  - **Public Areas:** Level 5 Drywall; (Account for some accent walls in wood and/or steel).
  - Restrooms: Porcelain Tiles
  - Kitchen: Stainless Steel Wall Panels
- **Millwork Finish:** Hayworth Modular Systems (Designed with CCG in Salt Lake City, UT)
- Refer to Appendix C
- Pricing Reference:
  - Tile
    - Arizona Tile
    - Daltile

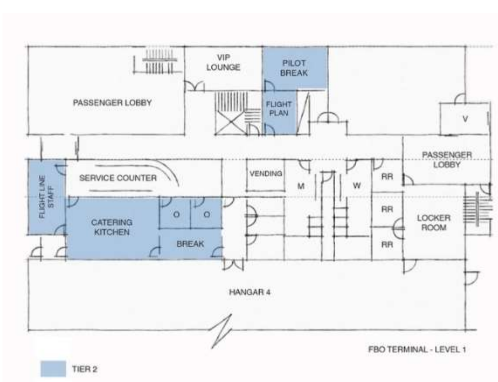
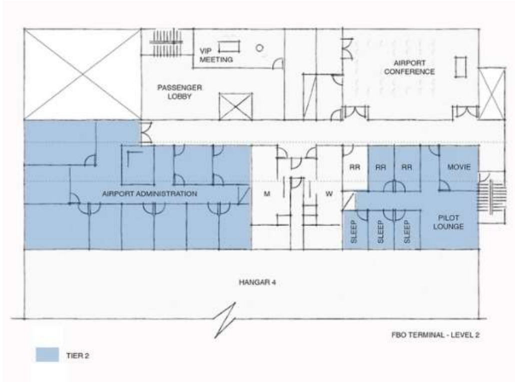


Figure 16. *Tier 2 Key Plan (First Floor)*



4.3.3.4. Tier 3 Building Interiors

- **Floor Finish**: Rubber Tiles
- **Ceiling Finish:** Level 4 Drywall
- **Wall Finish:**
    - Public Areas: Level 4 Drywall
    - Restrooms: Ceramic Subway Tiles
- **Millwork Finish:** Laminate Veneer
- Refer to Appendix C
- Pricing Reference:
    - Tile
        - Arizona Tile
        - Daltile

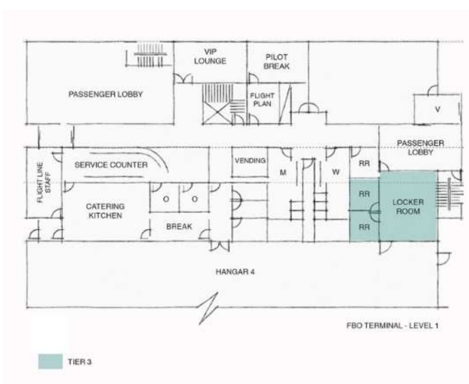


Figure 17. Tier 3 Key Plan (First Floor)

4.3.3.5. Hangars

The concrete slab will be covered with an epoxy floor system. Walls and ceiling including structural steel and mechanical equipment will be painted.

4.3.3.6. Hangar Support Buildings

The flooring in all areas including office spaces and mechanical spaces will be an epoxy floor system. Interior partition walls will be masonry with epoxy paint. Metal grate stairs will access the mezzanine. The mezzanine floor system will be precast plank with an epoxy topping.

4.3.3.7. Ground Support Equipment (GSE) Building

The exterior precast wall system will be exposed at the interior. The concrete floor slab on the main level will be sealed and the precast concrete floor of the mezzanine will also be sealed. Metal grate stairs will lead to the mezzanine.

4.3.4. Furniture, Fixtures, and Equipment

The rooms are broken out into three tiers, which represent the level and quality of furniture, fixtures, and equipment (FF&E). Tier 1 represents the high-end FF&E that will be in the public spaces. Tier 2 represents the mid-level FF&E for the secondary spaces. Tier 3 represents the more economical FF&E for locker rooms and secondary bathrooms.

4.3.4.1. Tier 1 FF&E

The Tier 1 furnishings and fittings will feel inviting, timeless, and be inspired by the architecture as well as the natural surroundings of Jackson Hole. The lines of the furniture will be refined, and the finishes will have varied textures with rustic elements; steel, walnut, oak, and stone, as well as high performance but comfortable rugs and upholstery materials; leather, faux leather, and woven fabrics. The color palette will consist of warm wood finishes, chocolate and saddle leather, and earth tone fabrics. The spaces will be multifunctional with flexible furniture layouts and arrangements, so they are user friendly for multiple parties, and private for travelers and staff. The decorative lighting will be sculptural and help define each space. In addition to the decorative lighting, there will be oversized art in multiple locations which will be commissioned by local artist(s). The goal is to create an environment that is highly functional as well as attractive and is harmonious with the exterior.

- Locations:
  - Main Level and Upper Level Lobby
  - Service Counter
  - Main and Upper Level Circulation
  - Main and Upper Level VIP Meeting
  - Area: 6,154 square feet
  - **Furniture Description:** Lounge Seating to include Rugs, Sofas, Lounge Chairs, Coffee Tables, Side Tables, Benches, Counter Stools.
  - Refer to Appendix C
- Locations:
  - Conference Room

- Area: 1,400 square feet
- **Furniture Description:** Conference Room Furniture includes Conference Table(s), Seating, Moveable Partition Walls.
- Refer to Appendix C

- Locations:
  - Main Level Bathrooms
  - Refer to Appendix C
  - Pricing Reference:
  - Furnishings
    - Haworth – Heather Howells at CCG, Salt Lake City, UT
    - Knoll Contract
    - B and B Italia Contract
  - Lighting
    - Roll and Hill
    - Flos
    - Hammerton
    - Modern Forms
    - Sonneman
  - Fixtures
    - Sloan
    - Delta
    - Kohler Commercial

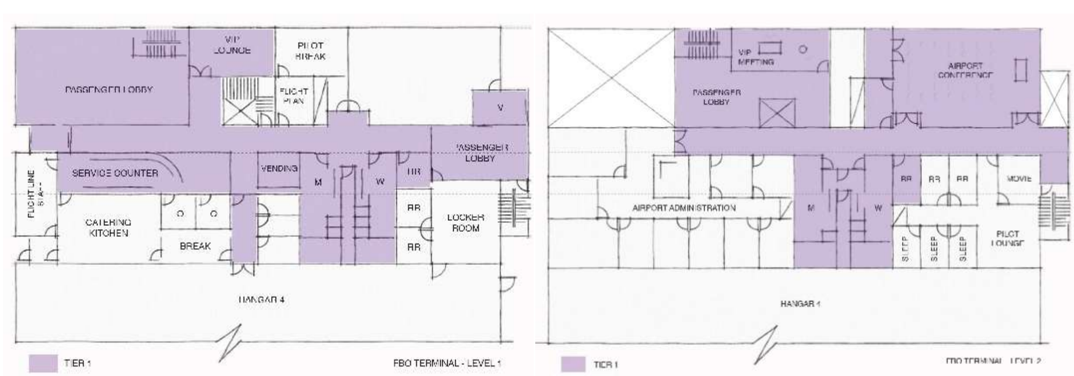


Figure 18. Tier 1 Key Plan (First Floor & Second Floor)

4.3.4.2. Tier 2 FF&E

The Tier 2 furnishing and fittings will be a continuation of the Tier 1 furnishings but with more of a casual feel. The furniture will be designed to support every day needs by having practical work areas for individuals and teams. In addition, there will be multipurpose seating areas that feel relaxing and comfortable. The decorative lighting will be more refined, task oriented, and help define each work zone. The kitchen will be a preparation space for catered food. It will have prep surfaces, commercial freezers and refrigerators for storage, commercial warming drawers, commercial dishwashers, and cleaning zones with oversized sinks.

- Locations:
  - Flight Plan Room
  - Pilot Break Room
  - Flight Line Staff Room
  - Area: 736 square feet
  - **Furniture Description:** Lounge Furniture includes Lounge Chairs, Coffee Tables, Cafe Tables, Dining Chairs. Office Furniture includes Office Desk, Desk Chairs.
  - Refer to Appendix C
- Locations:
  - Lower Level Offices
  - Lower Level Break Room
  - Upper Level Break Room
  - Upper Level Airport Administration Offices
  - Area: 2,928 square feet
  - **Furniture Description**: Office Furniture includes Desk, Desk Chairs, Office Storage, Conference Table(s), Conference Chairs, and Moveable Partition Walls. Lounge Furniture includes Lounge Chairs, Coffee Tables, Side Tables, Cafe Tables, and Dining Chairs.
  - Refer to Appendix C
- Locations:
  - Upper Level Pilot Lounge
  - Upper Level Pilot Movie Room
  - Upper Level Pilot Quiet Room
  - Area: 984 square feet

- **Furniture Description**: Lounge Furniture includes Sofas, Lounge Chairs, Chaises, Coffee Tables, Side Tables, Cafe Tables, and Dining Chairs.
- Refer to Appendix C
- Pricing Reference:
  - Furnishings
    - Haworth – Heather Howells at CCG, Salt Lake City, UT
    - Knoll
  - Lighting
    - Hammerton
    - Modern Forms
    - Sonneman
  - Fixtures
    - Sloan
    - Delta
    - Kohler Commercial

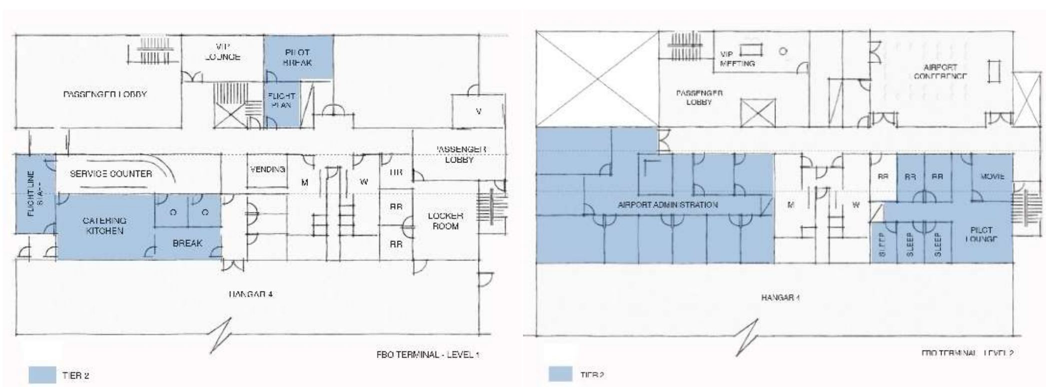


Figure 19. Tier 2 Key Plans (First Floor & Second Floor)

4.3.4.3. Tier 3 FF&E

The Tier 3 furnishings and fixtures will have reminiscent cues of Tiers 1 and 2 but the primary focus will be durable function.

- Locations:
  - Lower Level Locker Room
  - Lower Level Bathroom
  - Area: 480 square feet
  - Furniture Description: Benches
  - Refer to Appendix C

- Pricing Reference:
  - Furnishings
    - Haworth
    - Knoll Contract
  - Lighting
    - Modern Forms
    - Sonneman
  - Fixtures
    - Sloan
    - Delta
    - Kohler Commercial

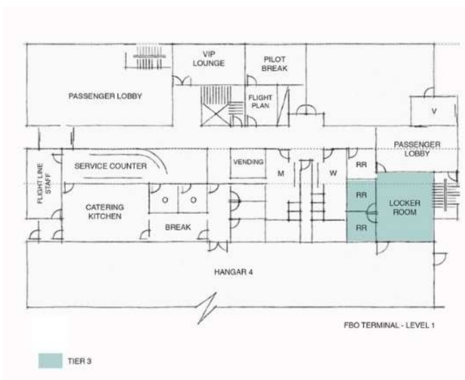


Figure 20. Tier 3 Key Plan (First Floor)

4.4. Structural

4.4.1. General

This project has significant area and height limitations per the Department of the Interior Agreement; combined with Jackson Hole Airport program goals to maximize general aviation facilities for all aircraft sizes. These design parameters require maximum door hangar heights, long structural spans, minimum overall assembly depth, and seismic design standards. During the Conceptual Design phase, it was important to investigate a range of structures for the hangars to determine efficiency and effectiveness of the structural system and its integration with other building assemblies and systems.

4.4.2. Design Codes and Loads

The project will be designed using applicable codes in effect at the time of design and construction of each project element. The following design parameters were used in the generation of the schematic design phase following the 2015 International Building Code with State of Wyoming and Teton County Amendments:

4.4.2.1. Risk Category II

4.4.2.2. Dead Loads:

- Building Metal Roof System 20 psf (superimposed load)

4.4.2.3. Live Loads:

- Roof 20 psf

4.4.2.4. Snow Loads:

- Ground Snow Load 120 psf
- Building Flat Roof 76 psf

4.4.2.5. Wind Loads:

- Ultimate Wind Speed 115 mph
- Exposure Category C

4.4.2.6. Seismic Parameters:

- Seismic Design Category D
- Site Class D
- Analysis Procedure: Equivalent Lateral Force
- Seismic Resisting System: Special Reinforced Concrete Shear Walls and/or Steel Special Moment Frames

4.4.2.7. Rain Loads:

- Rain Load on Flat Roof 78 psf

4.4.2.8. Soil Parameters:

- Allowable Soil Bearing Pressure 4,000 psf (Nelson Eng. Report No. 18-172-01)

4.4.3. Sub-grade Structure

The foundation will be constructed of cast-in-place concrete frost walls, spread footings and slab on grade floor. Per the geotechnical report prepared by Nelson Engineering (Report No. 18-172-01), the anticipated differential settlement for this type of foundation system is 1/2 inch. Due to the height limitations and interior clearance requirements for the hangar buildings, the potential for settlement may not be acceptable. If this is the case, a more robust, deep foundation system may be warranted. This will continue to be evaluated as the design progresses. For the various options presented herein, the anticipated ASD factored column and wall loads are as follows:

4.4.3.1. Hangar 3

4.4.3.1.1. Option A1:

- Interior Columns: 365 kips/-125 kips
- Exterior Columns: 230 kips/-40 kips

4.4.3.1.2. Option A2:

- Interior Columns: 365 kips/-125 kips
- Exterior Columns: 215 kips/-70 kips

4.4.3.1.3. Option A3:

- Interior Columns: 300 kips/-90 kips
- Exterior Columns: 140 kips/-45 kips

4.4.3.1.4. Option B1

- Interior Columns: 480 kips/-0 kips
- Exterior Columns: 290 kips/-10 kips

4.4.3.1.5. Option B2

- Interior Columns: 480 kips/-0 kips
- Exterior Columns: 250 kips/-10 kips
- Load Bearing Walls: 11 kips/ft

4.4.3.2. Hangar 4 & 6

4.4.3.2.1. Option A:

- Load Bearing Walls: 20 kips/ft

4.4.3.2.2. Option B:

- Columns: 40 kips/-0 kips

4.4.3.2.3. Option C:

- Columns: 100 kips/-5 kips

4.4.3.2.4. Hangar 5

- Option A:
  - Interior Columns: 1365 kips/-0 kips
  - Exterior Columns: 730 kips/-0 kips
- Option A with PC Bearing Walls:
  - Interior Columns: 1365 kips/-0 kips
  - Load Bearing Walls: 20 kips/ft

The concrete slabs inside the hangar buildings are anticipated to be 8-inch thick and reinforced with rebar in each direction to control cracking. The slab on grade will be placed on a compacted granular material.

4.4.4. Super Structure

4.4.4.1. Hangar 3

Hangar 3 consists of three 100-feet x 100-feet bays. The design constraints for this hangar include a door height and interior clearance of 23’-0”, maximum building height of 28’-0”, and minimum allowance of 13 inches for roofing material. Two options were found to be feasible: structural steel frames with steel bar joists and structural steel frames with long-span steel wide flange joists. Variations of these options are presented below. These options will continue to evolve as the design progresses.

4.4.4.1.1. Option A – Steel Bar Joists with Steel Wide Flange Moment Frames

Option A1: This option utilizes light gage metal stud walls for the exterior wall system to reduce the seismic weight of the building. In this option, the exterior walls do not participate in the lateral resisting system. The roof is anticipated to be constructed with 28-inch bar joists with 1-1/2-inch metal roof deck. The roof is supported by steel moment frames in both directions. To minimize the footprint utilized by the steel columns, a built-up column is recommended to provide the required resistance and stiffness in both directions. The spacing of the frames is approximately 30'-0" on center. This option is the lightest weight option and utilizes the least amount of structural steel. The minimum vertical clearance provided by this option is 23'-7 5/8" which allows for deflection of the roof system and the potential for differential settlement of the building. A preliminary representation of the structural framing for this option is presented in Appendix C.

Option A2: This option utilizes a combination of insulated precast walls and light gage metal stud walls (front wall of the hangar only) for the exterior wall system. In this option, the precast exterior walls participate in the lateral resisting system and support the roof along the back wall of the hangar (i.e. wall opposite the hangar doors). The roof is anticipated to be constructed with 28-inch bar joists with 1-1/2-inch metal roof deck. The roof is supported by steel moment frames in both directions to minimize the lateral force induced on the exterior precast walls. The longitudinal frames are spaced at approximately 30'-0" on center. To minimize the footprint utilized by the steel columns at the interior of the building, a built-up column is recommended to provide the required resistance and stiffness in both directions. The minimum vertical clearance for this option is 23'-7 5/8", which will provide the tolerance need to accommodate the vertical deflection of the roof system as well as the potential for differential settlement. Preliminary drawings for this option are provided in Appendix C.

Option A3: This option is a slight variation from Option A2 such that the longitudinal moment frames are spaced at 22'-9" on center. In addition to the change in the spacing of the longitudinal moment frames, the bar joists sizes may be reduced to 24 inches to accommodate the shorter spans. However, the minimum vertical clearance remains the same as the headers above the hangar doors do not change. Although this option has more steel frames, it allows for additional height clearance on the interior of the building to accommodate equipment and systems to be hung from the ceiling. This option is slightly lighter (steel weight) than Option A2. However, there are more steel components which will require additional labor. Preliminary drawings for this option are provided in Appendix C.

4.4.4.1.2. Option B – Steel Wide Flange Joists with Steel Wide Flange Moment Frames

Option B1: This option utilizes wide flange beams/joists spanning in the longitudinal direction (98'-0" span) spaced at 5'-0" on center with 1-1/2" metal deck. These joists are supported by wide flange moment frames in both directions. The minimum vertical clearance for this option is 23'-6 1/4" which provides the least vertical clearance of all the options. In addition, it is the heaviest of the options presented. The exterior walls are assumed to be insulated precast walls, excluding the front wall of the hangar which will be light gage metal studs. The exterior walls will be non-load bearing and do not participate in the lateral resisting system. Preliminary drawings for this option are provided in Appendix C.

Option B2: This option is similar to Option B1. The only change is the exterior precast walls are utilized as bearing walls and are integrated into the lateral resisting system. By utilizing the precast walls in the structural systems, it reduces the amount of structural steel required. Preliminary drawings for this option are provided in Appendix C.

4.4.4.2. Hangars 4 & 6

The controlling factors associated with Hangars 4 and 6 include accommodations for a 26-foot door opening and interior height clearance, maximum building height of 31'-3", and minimum allowance of 13 inches for roofing material. Given these constraints and the desire to have a 140'-0" clear span building, the options associated with these two hangars are limited. Preliminary drawings for the options presented below can be found in Appendix C. As the design progresses, the options will be further evaluated.

4.4.4.2.1. Option A - Load Bearing PC Walls with Long-Span Steel Roof Trusses

The roof is anticipated to be framed with structural steel roof trusses spaced at 3-feet on center which will be supported by the exterior precast walls. The precast walls will be utilized for both bearing and lateral resistance. The truss span will be parallel to the large hangar door. The typical roof deck is 1-1/2" type B, 16 gage metal decking spanning across the roof trusses. The trusses are anticipated to be constructed with WT top and bottom chords with double angle web members. The total depth of the trusses is 3'-8" resulting in a maximum deflection at mid-span of 6-inch or less.

4.4.4.2.2. Option B – Non-Load Bearing PC Walls with Long-Span Steel Roof Truss Rigid Frames

The roof is anticipated to be framed with structural steel roof trusses spaced at 3-feet on center which will be supported by structural steel columns. The steel roof trusses and columns will be designed as a rigid frame system that will resist gravity and lateral loads. The frames will be orientated parallel to the large hangar door. The typical roof deck is 1-1/2" type B, 16 gage metal decking spanning across the roof trusses. The trusses are anticipated to be constructed with WT top and bottom chords with double angle web members. The total depth of the trusses is 3'-8" resulting in a maximum deflection at mid-span of 6-inch or less. The exterior walls are anticipated to be constructed of non-load bearing, insulated precast walls. The walls will be utilized as part of the lateral resisting system.

4.4.4.2.3. Option C – Non-Load Bearing PC Walls with Steel Plate Girder Rigid Frames

The roof is anticipated to be framed with built-up structural steel plate girders supported by structural steel columns. The rigid frames are anticipated to be spaced at 10-feet on center. The steel frames will be designed as a rigid frame system that will resist gravity and lateral loads. The frames will be orientated parallel to the large hangar door. Due to the larger spacing between the frames in this option, structural steel bar joists are anticipated to span between the frames with 1-1/2" type B, 16 gage metal decking spanning across the bar joists. The depth of the plate girders is anticipated to be 3’-8” or less with a maximum deflection at mid-span of 6-inch or less. This option provides for the largest vertical clearance, 26’-7 1/4”. The downside to this option is the size of the columns. The columns are anticipated to be 41 inches deep, which will impact the useable floor space within the hangar. The exterior walls are anticipated to be constructed of non-load bearing, insulated precast walls. The walls will be utilized as part of the lateral resisting system.

4.4.4.3. Hangar 5

Hangar 5 consists of two 140-feet x 140-feet bays. The controlling factors associated with Hangar 5 are the same as described above for Hangars 4 and 6. In addition, the vertical clearance between bays was requested to be 16’-0” or greater. Due to the long spans, high seismic region, heavy snow loads, and height limitations, the structural options for Hangar 5 are limited to a single option as presented in Appendix C. As additional information is made available, this concept will be revised.

The option presented accounts for long-span steel trusses spaced at 3’-0” on center with 1-1/2” metal deck spanning across the trusses. The trusses are anticipated to be fabricated with WT top and bottom chords and double angle web members. There are four moment frames provided in the longitudinal direction and three in the transverse direction. The frames in the transverse direction are constructed of WF steel trusses that are 10’-0” deep. To minimize the impacts to the usable space on the floor of the hangar, the columns supporting the moment frames are shown to be constructed with built-up columns to provide adequate support and resistance for loads in both directions. The minimum vertical clearance in the bays is 26’-6” which provides the necessary tolerance for the vertical deflection of the roof system and the potential for differential settlement. The vertical clearance provided for the frames separating the bays is 16’-6”.

An alternative to the option presented is to utilize the exterior precast walls for bearing and lateral resistance. This would reduce the amount of steel required as three of the exterior steel frames, all excluding the frame at the hangar doors, could be eliminated.

4.4.4.4. Walls and Lateral Resisting System

Excluding Hangar 3, Option A1, the exterior walls are assumed to be constructed of insulated precast concrete panels to match the new QTA building construction. For the hangar options with non-load bearing precast walls that are not integrated into the lateral resisting system, it is anticipated these walls may be constructed with 3-inch topping, 3-inch rigid insulation, and 6-inch structural section. Where the precast walls are not load bearing but do provide lateral resistance, it is anticipated a similar wall section may be utilized with limitations on the width of the panels. Per discussions with a local precast supplier, it is assumed the minimum width of these panels to be 11’-1” to provide adequate resistance for overturning. The exception to this is the back wall (wall opposite the hangar doors) for Hangar 4/6, Option A. For these hangars, the back walls are anticipated to be composed of 3-inch topping, 3-inch rigid insulation and 11-inch structural section and a minimal panel width of 10’-1”. For the precast walls that are providing both lateral resistance and bearing for the roof, it is assumed these walls will be composed of a 3-inch topping, 3-inch rigid insulation, and 11-inch structural section. The typical panel widths for these walls should be kept to 10’-0” to help resist overturning. Panel widths less than those described herein would result in a 24-inch structural wall section and would result in a significant increase in the seismic forces on the building which are not currently accounted for in our design. These options will continue to evolve as the design progresses.

The exterior wall system presented in Hangar 3, Option A1, integrates a light gage metal stud wall into the design. Given the height of the walls, it is anticipated the exterior walls will be either 8-inch, 12 gage, studs spaced at 16-inch on center or 10-inch, 14 gage, studs spaced at 16-inch on center. This is also the case for all of the walls adjacent to the hangar doors.

The lateral resisting systems for the various hangars and options are currently comprised of either precast shear walls, steel moment frames, or a combination of steel moment frames and precast shear walls. Preliminary sizes for the steel frames are shown on the plans included in Appendix C. Due to the high seismic zone, these elements will continue to evolve as the materials (and weights) are refined.

An alternate exterior wall system that has also been considered in lieu of precast concrete is a concrete masonry unit (CMU) block wall. Based on our preliminary analysis, it is anticipated a 16-inch CMU reinforced block wall fully grouted and reinforced at every core would be required to support the gravity and lateral loads induced on the building. We would also anticipate having reinforced horizontal bond beams at the top of the wall and every 4-feet on center along the height of the wall. Please note the preliminary framing options presented in Appendix C do not reflect the use of these walls. Depending on the option, utilization of CMU walls may increase the steel framing sizes to accommodate an increase in seismic weight.

4.4.5. Special Systems

4.4.5.1. Roof

Due to the building height constraints and the minimum clearance requirements inside the building, multiple structural systems have been considered and are described herein. Also included in the analysis was a sloped roof option. However, this option has been eliminated due to the additional height that is required to accommodate the roof slope.

4.5. Mechanical

The FBO Terminal, surrounding hangars, and GSE building will all need to be properly ventilated and heated throughout the year. The following information summarizes the types of systems needed to accomplish this for each space. These needs are unique to the building type, function and purpose. Reliability, redundancy and efficiency are taken into account in this recommendation. Also following the current industry standards for these types of spaces has been recommended.

4.5.1. General

All louvers are to be provided by the General Contractor.

Provide start-up for all equipment/systems. Provide Test and Balancing for all systems.

Mechanical contractor shall provide all Variable Frequency Drives (VFD) and motor starters. Mechanical equipment shall be provided with factory wired disconnect switch. All motors with VFD's shall have Aegis-shaft grounding rings installed.

Supply, return, general exhaust or transfer ductwork shall be constructed from galvanized G90 sheet metal unless otherwise noted. Duct shall be constructed in accordance with SMACNA 1995, Second Edition Standard. All supply, return, and exhaust ductwork shall be sealed in accordance with SMACNA Seal Class B. Supply duct system shall be pressure tested for leakage.

4.5.2. Ventilation

4.5.2.1. Variable Air Volume Air Handling Unit

This unit should have a heating water coil and chilled water coil. Provide both the relief fan and supply fan with a fan array. Supply and return air mains to be located in the shaft shown.

4.5.2.1.1. FBO Terminal Building (20,000 CFM)

Provide a modular variable air volume unit located in the basement of the FBO. Outside air should be located along the side of the Terminal, in a built-up plenum preventing snow from getting into the outside air intake. Relief air should be relieved into the adjacent hangar providing some tempered air to that space. Provide variable air volume boxes (VAV box) with hot water reheat coils throughout the facility. Assume one VAV box per room to allow for control to each space.

4.5.2.2. Indoor Direct Fired Make-Up Air Units

4.5.2.2.1. GSE Building

Provide an indoor direct fired natural gas make-up air unit interlocked with garage exhaust fan operation.

4.5.2.3. Packaged Pre-Manufactured Air Handling Unit

4.5.2.3.1. Hangar 6 Aircraft Maintenance Support Space

Provide a packaged premanufactured Air Handling unit to provide both heating and cooling to office and support spaces in the hangars. Unit to have DX cooling and hot water heating.

4.5.2.4. Toilet Room Exhaust

Provide an Inline Exhaust Fan serving the restroom, allow the exhaust fan to modulate between an occupied and unoccupied setting. The unoccupied setting will be code minimum, with the occupied setting to be 1.5x code minimum. Fans should be located in the restroom chases with a discharge through the exterior face of the wall.

4.5.2.5. Destratification Fans

Provide destratification fans to provide ventilation in the summer and prevent hot air from pooling along the ceiling in the winter. These are to be hung and located between the ceiling structure to allow for maximum ceiling clearance.

4.5.2.5.1. Hangars (Typical for Hangars 3, 4, 5, and 6)

Provide destratification fans to provide ventilation in the summer.

4.5.2.5.2. GSE Building

Provide destratification fans to provide ventilation in the summer.

Basis-of-Design Product: Zoo Fans

4.5.2.6. Exhaust Fans

4.5.2.6.1. GSE Building

Provide exhaust fans as required to meet the needs of the equipment running in the space. Control CO and NO2 in the space.

4.5.2.7. CO/NO2 Monitoring

Provide CO/NO2 monitoring system for GSE Building garage exhaust fan and make-up air unit control.

4.5.3. Heating

4.5.3.1. Condensing Hot Water Boiler

Provide boiler(s) with full redundancy and capacity to serve items including the AHUs, fin tube radiation, floor heat, snow melt and unit heater specific to each building. Provide one hot water heating pump per boiler.

4.5.3.1.1. FBO Terminal Building

Provide two boilers with full redundancy and capacity to serve both the AHUs and fin tube radiation. Provide hot water heating pumps as outlined above.

4.5.3.1.2. Hangars

Provide two boilers with full redundancy and capacity to serve in floor heat, snow melt and unit heaters. Provide hot water heating pumps as outlined above. Provide a separate heat exchanger for the snow melt system and in floor heat. Assume 60 BTU/ft2.

Also provide in-floor hydronic heating, hot water unit heaters and apron snowmelt system as outlined above to support the heating system in the building.

4.5.3.1.3. GSE Building

Provide two boilers with full redundancy and capacity to serve in floor heat, snow melt and unit heaters. Provide a separate heat exchanger for the snow melt system and in floor heat. Assume 60 BTU/ft2.

4.5.3.2. Fin Tube Radiation

Provide hot water Fin Tube Radiation along all exterior walls with windows.

4.5.3.2.1. FBO Terminal Building

Provide hot water Fin Tube Radiation along all exterior walls with windows; including the passenger lobby, VIP meeting rooms and administration offices.

4.5.3.3. In-floor Hydronic Heating

4.5.3.3.1. Hangars (Typical for Hangars 3, 4, 5, and 6)

Provide zoned in floor heating to serve the hangar spaces for space comfort in the winter.

4.5.3.3.1. Ground Service Equipment Building (GSE)

Provide in floor heating to serve the garage space for space comfort in the winter.

4.5.3.4. Hot Water Unit Heaters

Located around the perimeter of the buildings to allow for make-up heating from the doors opening and closing. Heat Source: Condensing hot water boiler.

4.5.3.5. Apron Snowmelt System

4.5.3.5.1. Hangars (Typical for Hangars 3, 4, 5, and 6)

Provide approximately 20' of snow melt on either side of the hangar doors and 10' on either side of garage overhead doors. Assume 60 BTU/ft2. Heat Source: Condensing hot water boiler.

4.5.3.5.2. Ground Service Equipment Building (GSE)

Provide approximately 10' on either side of garage overhead doors. Assume 60 BTU/ft2. Heat Source: Condensing hot water boiler.

4.5.4. Cooling

4.5.4.1. Air-cooled Chiller System

Provide air chilled chillers with heat exchangers.

Provide dedicated dx systems for communications rooms with heat producing equipment.

4.5.4.1.1. FBO Terminal Building

Locate air chilled chillers along Hangar 4 with heat exchangers located in the mechanical room in the FBO Terminal Building basement.

4.5.4.1.2. Hangars (Typical for Hangars 3, 4, 5, and 6)

No cooling will be provided in the hangars.

4.5.4.1.3. Ground Service Equipment Building (GSE)

No Cooling will be provided in the GSE Building.

4.6. Plumbing

Each of the spaces will require specific plumbing needs, all of which have been addressed. The FBO Terminal will function much like any standard terminal with restroom and kitchen functions. Each of the Hangars will have water, storm and waste to accomplish the drainage from aircraft, light maintenance where required and cleaning of the facility. The GSE will, in a lot of ways, be very similar to the Hangars with a bit more for maintenance needed.

4.6.1. General

Sanitary and vent piping to be no hub cast iron piping. All piping in plenum to have a flame spread rating per code requirements.

The buildings to receive a new water main service. Provide complete domestic water service assembly consisting of: Water meter, backflow preventer, shut-off valves on the upstream and downstream of the water meter, bypass piping and valve, thermal expansion tank, pressure gauge downstream of water meter.

Water piping 2-1/2" and smaller shall be type 'L' copper, press-fit fittings. Water piping 3-inch and larger shall be type 'L' copper or schedule 10 stainless steel with press-fit fittings.

The gas meter shall be supplied by gas company. The gas company shall supply 2 psi gas pressure after meter. Gas piping shall be schedule 40, ASTM A53, black steel, welded. Provide gas pressure regulator valves for emergency generator, water heaters, and unit heaters.

4.6.2. Compressed Air

Provide air compressor with a 120-gallon tank. Air compressor to have a two-stage pump and be ASME Code tank certified for 200 psi maximum working pressure. Provide a pressure switch for automatic start/stop operation. Unit to have industrial duty NEMA motors and a mounted and wired motor starter.

4.6.3. Fixtures

- Water Closets shall be white vitreous china siphon jet type with 1.6 gpf electronic solar flush valve.
- Urinals shall be white vitreous china siphon jet type with 1.0 gpf electronic solar flush valve.
- Lavatories shall be white vitreous china self rimming counter type with 0.5 gpm electronic 24-volt DC faucet.
- Stainless Steel Sinks shall be single compartment, 18-gauge type 304 stainless steel self rimming type with deck mounted, two lever faucets.
- Wall boxes for owner furnished appliances requiring water (coffee, ice, etc.) shall be metallic recessed type. Include an inline water filter.
- Mop sinks shall be made of structural fiberglass. The size shall be 24 inches x 24 inches x 10 inches high. Provide with wall mounted service sink faucet.
- Electric water coolers shall be two-station, non-recessed type with bottle filler.

4.6.4. Domestic Water

Provide a new domestic water service for each building. Provide hose bibs no more than 50' apart around the exterior of the building to allow for maintenance.

Provide one wall hydrant per building.

4.6.4.1. FBO Terminal Building

Provide a new 3-inch domestic water service for the building.

4.6.5. Soft Cold Water (SCW) System

4.6.5.1. FBO Terminal Building

Provide a duplex water softener with an electronic central control system, brine tank, fiberglass tank and 125 peak flow rates. The soft cold water is to serve all plumbing fixtures excluding any hose bibs, wall hydrants and irrigation systems.

4.6.6. Hot Water (HW) System

Provide hot water recirculation piping throughout the facility. Recirculation piping is to connect to the hot water lines within 8'-0" of end user on each hot water branch line. No hot water fixture to be more than 8'-0" from the recirculation piping. Provide a balancing valve located on each recirculation line set to 1gpm.

4.6.6.1. *FBO Terminal Building*

Water heater to have a thermal efficiency of 95% max. input and 98% min. input. Provide an air intake and vent. Provide with a natural gas fuel source, ASME certified, UL listed and include a thermal expansion tank.

4.6.6.2. *Hangars (Typical for Hangars 3, 4, 5, and 6)*

Water heater to have a thermal efficiency of 95% max. input and 98% min. input. Provide an air intake and vent. Provide with a natural gas fuel source, ASME certified, UL listed and include a thermal expansion tank.

4.6.6.3. *Ground Support Equipment (GSE) Building*

Water heater to have a thermal efficiency of 95% max. input and 98% min. input. Provide an air intake and vent. Provide with a natural gas fuel source, ASME certified, UL listed and include a thermal expansion tank.

4.6.7. Sanitary Waste Water

Provide a 6-inch sanitary waste main exiting each building to connect to the site utility 5’-0” from building foot print. Provide sanitary waste main exiting the building as needed to meet code and use requirements, provide cast iron floor drains in toilet rooms, mechanical rooms, and bathroom shafts.

4.6.7.1. *Hangars (Typical for Hangars 3abc, 4, 5ab, 6)*

Provide sanitary waste main exiting the building as outlined above. Provide heavy duty trench drains along the hangar doors track on both sides, interior side to have stainless steel grate, exterior to have galvanized cast iron. Throughout the hangar provide area drains placed to allow the space to be properly maintained and convenient for airplane parking, assume 8 per hangar. Provide a fuel oil separator and a sand separator to protect the sanitary system.

4.6.7.2. *Ground Support Equipment (GSE) Building*

Provide sanitary waste main exiting the building as outlined above. Provide heavy duty trench drains under vehicle parking locations to allow drainage below vehicles. Provide a fuel oil separator and a sand separator to protect the sanitary system.

4.6.8. Storm Water

Provide both a primary and overflow storm drainage solution. This will be piped separately and properly daylighted to meet code. All of this piping is to be contained above the structure to maximize clearance. Provide storm drains in both 4-inch and 3-inch coated cast iron. Provide a 10-inch rain water leader exiting the building and connect to the site utility 5’-0” from the building foot print. Storm water will be directed to the Airport’s storm water treatment system.

4.6.9. Compressed Air

4.6.9.1. *Hangars (Typical for Hangars 3abc, 4, 5ab, 6)*

Provide an air compressor with a 120-gallon tank in each hangar.

4.6.9.2. *Ground Service Equipment (GSE) Building*

Provide one air compressor with a 120-gallon tank.

4.7. Fire Protection

4.7.1. General

The fire protection and life safety strategy for the general aviation Campus will follow the prescriptive code requirements as adopted by Teton County, Wyoming. The primary codes currently of record are the 2015 Edition of the International Building Code (IBC), the 2011 Edition of NFPA 409 - Standard for Aircraft Hangars, the 2013 Edition of NFPA 13 - Standard for the Installation of Sprinkler systems, the 2013 Edition of NFPA 20 - Installation of Stationary Pumps for Fire Protection, and the 2013 Edition of NFPA 72 – National Fire Alarm and Signaling Code. Additional referenced standards can be found in the Conceptual Code Analysis Reports in Appendix B. In 2019, it is assumed that Teton County will adopt new codes. All future work will adhere to the then-current code.

Meetings were held with the code officials and Fire Marshal to introduce them to the project as well as outline the fire protection strategies. There were not any comments from the meetings that changed the outlined strategies, but future meetings will be conducted as design progresses to keep the code officials and Fire Marshal apprised to the project.

In addition to the active components of the fire protection and life safety systems mentioned in Sections 4.6.2, 4.6.3 and 4.6.4 of this report, a significant component of the fire protection and life safety strategy is comprised of passive fire protection features. The passive fire protection features include fire resistance rated construction complying with the IBC and NFPA 409. The fire resistance rated construction configuration will be as follows:

- 2-hour fire rated wall between the FBO Terminal and Hangar 4
- 3-hour fire rated wall between Hangar 4 and Hangar 5A
- 2-hour fire rated wall between Hangar 5B and Hangar 6

Additional fire resistance rated barriers and occupancy separations will be present in the general aviation Campus, but the aforementioned fire walls have the most stringent requirements and require special consideration. The fire walls will be constructed in accordance with IBC Section 706 and IBC Section 412.4.6.2. In accordance with IBC Table 412.4.6 Hangars 3, 4, 5 and 6 will each be individually classified as Group II Hangars.

This scenario has the fuel farm and the GSE on separate lots thus requiring a 40’-0” set back and the fire wall at the north side of the GSE. See Appendix C for campus diagram outlining this option. An additional option that is being considered puts the fuel farm and the GSE on the same lot requiring a 10’-0” separation between the two buildings. The fire wall then moves to the north wall of Hangar 3. This option allows additional space for vehicle movement between the GSE and Hangar 3 as well as between the FBO Terminal and Hangar 3. The site diagram for this option is in Appendix C.

Fire detection, alarm, and suppression systems will be installed per all applicable codes and the Owner’s insurance underwriter requirements.

All suppression system materials shall be U.L. Listed or FM Approved for use in fire protection systems.

4.7.2. Detection

The fire alarm detection and detection required for the fire suppression systems will be primarily driven by NFPA 409. The fire alarm and detection will be installed in accordance with NFPA 72, IBC and NFPA 409. The detectors installed for the actuation on foam systems will be rate-of-rise, fixed temperature, or rate-compensation type. The detection system will be provided with supervision as required by NFPA 72. A manual activation station will be located so that each system can be individually operated from both inside and outside the aircraft storage and servicing area. The manual stations will be installed so that they are unobstructed, readily accessible, and located in the normal paths of exit from the area.

Provide smoke detectors in electrical rooms, data/telecom rooms, elevator lobbies and elevator equipment rooms.

4.7.3. Alarm

The Alarm system will be installed in accordance with NFPA 72, IBC, NFPA 409, and NFPA 11. Audible alarms shall be installed to indicate the operation of the system, to alert personnel, and to indicate failure of any supervised device or equipment. Occupant notification is required to warn of pending discharge of the foam system. Where exposure to automatic extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal shall be provided to alert occupants once agent discharge has begun. Additional occupant notification is not required for the fire alarm system but is good practice to design and install due to the potential safety hazards associated with foam system discharge.

Provide an intelligent, addressable fire alarm supervisory system capable of monitoring all facilities on the general aviation campus. The main fire alarm panel (FACP) shall be located in the FBO Terminal main electrical room. All fire alarm and system devices shall meet ADA guidelines. Provide 120V power for control of fire alarm control relays for smoke dampers as required. Provide provisions to tie into the building fire alarm system for pre-action sprinkler systems areas as required. Provide addressable monitor modules for all the following:

- Sprinkler flow switches
- Sprinkler tamper switches

4.7.4. Suppression

IBC Section 412.4.6 identifies that the hangar fire suppression systems will be designed in accordance with NFPA 409. For Group II Hangars, NFPA 409 provides several code compliant options for the fire suppression system, as follows:

- A combination of automatic sprinkler protection and an automatic, low-level, low-expansion foam system. (recommended)
- A combination of automatic sprinkler protection and an automatic, high-expansion foam system.
- The provisions of Group I hangar protection. However, exceptions apply. See NFPA 409 Section 7.1.1(1) for full requirement.
- A closed-head foam-water sprinkler system.

Automatic closed-head sprinkler protection will be provided inside separate shop, office and storage areas located inside aircraft maintenance and servicing areas. Closed head sprinklers will also be installed throughout the FBO Terminal Building. The design will be in accordance with the hazard classifications specified in NFPA 13.

In addition to the provision for sprinkler and foam extinguishing systems required above, Hand Hose systems in accordance with NFPA 409 Section 6.2.9 and wheeled/portable fire extinguishers in accordance with NFPA 409 Section 6.3 are also required.

The potable water supply will be protected against backflow. The total water supply will be calculated to satisfy the combination of required fire suppression systems and hose stations. The water supply for closed-head sprinkler systems aircraft storage and service areas will have a minimum flow duration of 30 minutes. The water supply for low-expansion foam systems shall be capable of furnishing water at the rate specified in NFPA 409 for a period of time equal to at least twice the period of time used to calculate the quantity of foam–liquid concentrate. The water supply for the hand hoses will be in accordance with NFPA 409 Section 7.8.6 and 7.8.7. Provide proof of sufficient water flow from the Airport water system at the south end of the Development Sub-Zone during schematic design to satisfy the Fire Marshall.

Fire Pumps will be installed in accordance with NFPA 20. The total pumping capacity will be such that the maximum demand is met with the largest fire pump being out of service. To achieve this requirement a redundant pump is required to be installed. Fire pumps will be started automatically by either a drop-in water pressure or a signal from the detection control panel. Where two or more fire pumps are used, they shall be provided with automatic sequential starting. Once started, fire pumps shall be arranged to run continuously until they are stopped manually. There shall be an audible “pump running” alarm in a constantly attended area.

4.7.4.1. FBO Terminal

Provide a dedicated 8-inch fire protection water service with a backflow prevention device. Provide a wet sprinkler system throughout the building. Provide a separate control valve assembly for each level of the building. Each wet system riser shall include supervised shutoff valve, check valve, water flow alarm switch, and test and drain provisions.

Use a light hazard design density for office and breakroom areas: 0.10 gpm/sq. ft. over the most remote 1,500 sq. ft. with 100 gpm hose allowance. Use an ordinary hazard group 2 design density for storage areas: 0.20 gpm/sq. ft. over most remote 1,500 sq. ft. with 250 gpm hose allowance. Use only Schedule 10 and Schedule 40 piping, with threaded or grooved couplings. Sprinklers to be quick response; k-factor 5.6; 165-degree F brass uprights in areas without finished ceilings and 165-degree F concealed pendants with 135-degree F white cover plates in areas with finished ceilings.

4.7.4.2. Hangars

Provide a dedicated 8-inch fire protection water service with a backflow prevention device. Provide a wet sprinkler system throughout the building. Each wet system riser shall include supervised shutoff valve, check valve, water flow alarm switch, and test and drain provisions. Sprinklers to be located at the deck in accordance with NFPA Standard 13.

Design density for hangars: 0.17 gpm/sq. ft. over the most remote 5,000 sq. ft. with 500 gpm hose allowance. Use an ordinary hazard group 2 design density for mechanical, electrical, and storage areas: 0.20 gpm/sq. ft. over most remote 1,500 sq. ft. with 250 gpm hose allowance. Use only Schedule 10 and Schedule 40 piping, with threaded or grooved couplings. Sprinklers in hangars to be quick response; k-factor 8.0 or 11.5; 125-degree F brass uprights.

Sprinklers in mechanical, electrical, and storage areas to be quick response; 165-degree F brass uprights in areas without finished ceilings and 165-degree F concealed pendants with 135-degree F white cover plates in areas with finished ceilings.

In the hangars, provide an automatic, low-level, low-expansion AFFF foam system. Provide a separate system for each hangar. Use a minimum application rate of foam solution of 0.10 gpm/sq. ft. The discharge rate of the system is to be based on the rate of application multiplied by the entire aircraft storage and servicing floor area. Provide 10 minutes of foam discharge. Design the system to provide distribution of foam over the entire aircraft storage and service area to within 5-feet of the perimeter walls and doors within 3 minutes of system actuation. Foam concentrate pipe and fittings shall be brass. Provide a reserve supply of foam concentrate in accordance with NFPA Standard 11. Install electric-drive foam concentrate pumps in accordance with NFPA Standard 20. Provide a full-service controller for each foam concentrate pump

4.7.4.3. Ground Support Equipment (GSE) Building

Provide a dedicated 6-inch fire protection water service with backflow prevention device. Provide a dry sprinkler system throughout the building. Dry system riser shall include supervised shutoff valve, dry pipe valve with trim, water flow alarm pressure switch, air maintenance device, and test and drain provisions. Provide a nitrogen generator supply. Use a light hazard design density for office and breakroom areas: 0.10 gpm/sq. ft. over the most remote 1,500 sq. ft. with 100 gpm hose allowance. Use an ordinary hazard group 2 design density for storage and maintenance areas: 0.20 gpm/sq. ft. over the most remote 1,500 sq. ft. with 250 gpm hose allowance.

Use only Schedule 10 and Schedule 40 piping, with threaded or grooved couplings. Sprinklers to be quick response; k-factor 5.6; 165-degree F brass uprights in areas without finished ceilings and 165-degree F concealed pendants with 135-degree F white cover plates in areas with finished ceilings.

4.8. Electrical

The FBO Terminal, hangars, and GSE buildings need to be sufficiently powered for day to day normal operations as well as be provided with backup capability to maintain operations during an outage. Efficient equipment and controls will provide an energy conscious, reliable system. Along with power, telecommunications, lighting, and security all contribute to providing a safe, secure, well connected facility. These recommendations take all of this into consideration.

4.8.1. General

Training shall be provided on all electrical systems including: electrical distribution monitoring, emergency generators and transfer switches, lighting control systems, and fire alarm systems.

4.8.2. Power

4.8.2.1. General

4.8.2.1.1. Grounding Systems – Typical for all Buildings

Provide complete grounding systems for all buildings. Provide 250 kcmil conductor grounding ring with cadweld connections to the building's structural steel at the building columns. Provide 250 kcmil conductor with cadweld connection to water service. Bond all metal piping systems. Provide lightning conductor down leads. Provide 3/0 insulated copper grounding conductor for vertical riser in the electrical and telecom rooms.

Provide minimum 12" x 4" x 1/4" ground bus in each electrical and telecom room. Provide minimum 24" x 4" x 1/4" ground bus in main electrical room.

4.8.2.1.2. Lightning Protection System – Typical for all Buildings

Provide lightning protection systems for all buildings. System shall be a complete concealed system of lightning protection for the building structure in accordance with NFPA requirements. All material shall bear the label of the manufacturer of the Underwriters Laboratories, Inc. Installations shall carry a master label.

4.8.2.1.3. Electrical Distribution – Typical for all Buildings

Provide distributed 480/277 Volt and 208/120 Volt electrical infrastructure throughout all buildings. Provide electrical closets on each level. Provide a surge protective device (SPD) in the new service that is directly connected to the bussing within the main gear. Provide a power quality customer meter in the service that is capable of measuring Volts and Amps. Distribution overcurrent protection shall be circuit breaker type. Provide building automation monitoring of meters, ATS's, generators, and UPS's.

4.8.2.2. FBO Terminal

Provide primary utility feeders to the building. Service shall be (1) main 480/277 Volt, 3-phase, 4-wire 1600A service. Provide electrical distribution equipment, feeders and connections for mechanical equipment as required. Refer to mechanical equipment issued with Mechanical Schematic Documents. Equipment to include: toilet room exhaust, air volume air handling unit supply and return fan arrays, hot water boiler auxiliary loads, air-cooled chiller system auxiliary loads, hot water pumps, and air compressors. Provide electrical distribution equipment, feeders and connections to miscellaneous equipment including: kitchen equipment, soft water system, hot water heaters, power operated doors, and elevator.

4.8.2.3. Hangars 4, 5, and 6

Provide primary utility feeders to each hangar. Each service shall be 480/277 Volt, 3-phase, 4-wire 1000A. Provide electrical distribution equipment, feeders and connections for mechanical equipment as required. Refer to mechanical equipment issued with Mechanical Schematic Documents. Equipment shall include: hot water boiler auxiliary loads, in-floor hydronic heating auxiliary loads, hot water unit heater auxiliary loads, snow melt system auxiliary loads and destratification fans. Provide electrical distribution equipment, feeders and connections to miscellaneous equipment including: ground powering units and power operated doors.

4.8.2.4. Ground Support Equipment (GSE) Building

Provide primary utility feeders to building. Service shall be one (1) main 480/277 Volt, 3-phase, 4-wire 1000A service. Provide electrical distribution equipment, feeders and connections for mechanical equipment as required. Refer to mechanical equipment issued with Mechanical Schematic Documents. Equipment shall include: hot water boiler auxiliary loads, in-floor hydronic heating auxiliary loads, hot water unit heaters auxiliary loads, snowmelt system auxiliary loads, destratification fans, and make-up air units, exhaust fans.

4.8.2.5. Hangar 3

Provide primary utility feeders to each hangar. Each service shall be 480/277 Volt, 3-phase, 4-wire 1000A. Provide electrical distribution equipment, feeders and connections for mechanical equipment as required. Refer to mechanical equipment issued with Mechanical Schematic Documents. Equipment shall include: hot water boiler auxiliary loads, in-floor hydronic heating auxiliary loads, hot water unit heaters auxiliary loads, snowmelt system auxiliary loads, destratification fans, make-up air units, and exhaust fans. Provide electrical distribution equipment, feeders and connections to miscellaneous equipment including: ground powering units and power operated doors.

4.8.3. Backup Power

4.8.3.1. General

Generators to include “drop over” enclosure. Generators to be provided with provisions for portable load bank connection. Provide connections for temporary/portable generators for maintenance of permanent generators. Sound attenuators to be included for 77 db at 25-feet. Provide critical silence type mufflers. Provide closed transition transfer switches with bypass.

4.8.3.2. FBO Terminal Building

Provide (1) 750kW Diesel emergency/standby power generator with integral fuel tank capable of a 48-hour run time at full load. Provide (1) 40kVA Uninterruptible power supply.

4.8.3.3. Hangars 4, 5a, 5b, and 6

Provide (4) 750kW Diesel emergency/standby power generators with integral fuel tank capable of a 48-hour run time at full load, one generator per hangar or hangar bay. Provide (4) 40kVA Uninterruptible power supplies, one UPS per hangar or hangar bay.

An option to consolidate backup power to fewer (or a single) generator will be evaluated during Schematic Design.

4.8.3.4. Ground Support Equipment (GSE) Building

Provide (1) 500kW Diesel emergency/standby power generator with integral fuel tank capable of a 48-hour run time at full load. Provide (1) 40kVA Uninterruptible power supply.

An option for the GSE Building to use QTA excess generator capacity will be evaluated during Schematic Design.

4.8.3.5. Hangar 3

Provide (3) 500kW Diesel emergency/standby power generators with integral fuel tank capable of a 48 hour48-hour run time at full load, one generator per hangar bay. Provide (3) 40kVA Uninterruptible power supplies, one UPS per hangar bay.

An option for Hangar 3 to use QTA excess generator capacity will be evaluated during Schematic Design.

4.8.4. Lighting

4.8.4.1. General

Lighting shall be LED. Lighting levels throughout the project will be in accordance with the recommendations of the Illuminating Engineering Society (IES) or Airport standards.

4.8.4.1.1. Exit and Egress Lighting

Provide exit signs on life safety power, connected to standby generator. Provide LED type edge lit exit signs in public areas. Provide LED die cast aluminum exit signs in all other areas. Provide emergency and egress lighting on life safety power, connected to standby generator. Provide 100% of total building lighting on life safety power.

4.8.4.1.2. Lighting Control System

Provide a lighting control system that is controlled by the building automation system (BAS). Provide lighting controls with relay control to the BAS. Provide occupancy sensors with manual overrides in offices, conference rooms, storage rooms, loading dock, restrooms, and similar areas. Public areas shall be programmed as determined by the owner to turn off or reduce lighting levels during non-peak times. Photocells shall be installed to reduce lighting levels when adequate natural light exists. Provide local switching in mechanical rooms, electrical rooms, and telecom rooms. Provide low voltage switches in hangar spaces. Site lighting shall be controlled via photocell and astronomical time clock.

4.9. Low Voltage

4.9.1. Telecommunication

Provide low voltage data distribution throughout all buildings. Telecommunication room shall be provided on each level and include the following requirements: Provide (4) dedicated UPS power circuits in each telecom room for equipment racks. Provide an isolated telecommunication ground system including a telecommunications main grounding bus bar connected to the main building ground system. Lighting shall provide a minimum of 50-feet candles measured at 3-feet above floor. Provide conduit sleeves with plastic grommets to above ceiling basket tray. Provide plywood backboards within telecom rooms. Ceilings not required. Concrete surfaces shall be sealed to prevent permeation of moisture and reduce dust.

4.9.2. Audio-Visual

Provide power and data for conference room audio/visual system. Conference room audio/visual systems to include projector, screen, video conferencing equipment, source equipment, and computer interfaces. Provide local lighting control interface.

4.9.3. Security

The buildings will be monitored via internal security systems and CCTV cameras. Provide power provisions for pan-tilt-zoom type exterior/site CCTV cameras mounted at the parking lot poles and roof mounted CCTV cameras as required. Provide card reader/door monitoring system at exterior entrances and within the buildings as required.

End of Section

5. PHASING &SCHEDULE

The FBO Terminal and GA Hangar Development project must be developed in a logical sequence to allow continuous effective operation of the FBO functions to support General Aviation activity and to allow the JAC Board to develop the FBO facilities as demand requires and funding availability allows. During construction, each building will require significant dedicated landside and airside space for construction, material and equipment staging, and erection activities for precast walls and structural steel. Attempting to construct multiple project elements simultaneously would have an unacceptable effect on GA apron space availability and landside FBO activities. Consequently, the project should most likely be constructed in four discrete phases:

5.1. Phasing

Phases 1 and 2 are interchangeable, but they cannot be constructed simultaneously because too much of the GA apron would be needed to support construction activities. The reduced aircraft apron availability would significantly and unacceptably affect GA operations.

5.1.1. Phase 1

Hangar 6 will be constructed at the far south end of the Development Subzone facing the runway with the west wall in line with the existing Hangars 4 & 5. This 140’ x 140’ hangar will have 26-foot vertical clearance from the existing apron (elevation 6410-feet). A two-level addition on the east wall will house the emergency generator for Hangars 4, 5 & 6 and the FBO Terminal; fire suppression equipment; mechanics’ space; and dry storage on the second level. A 20,000 SF apron expansion will be added to the south end of the GA apron, and FBO parking will be expanded on the east side of the hangar. Construction activity will impact a portion of the apron in front of Hangar 5 and FBO vehicle parking east of Hangar 5.

5.1.2. Phase 2

Hangar 3/GSE Building will be constructed at the north end of the FBO area, just south of the new Fuel Farm. The 100’ x 300’ hangar will have 3 bays and 23-foot vertical clearance. The GSE Building will be constructed north of Hangar 3, abutting the Fuel Farm site. There is limited space between Hangar 3 and the QTA and a fire lane must be maintained. Consequently, construction staging will require the entire new GA ramp on the old Hangar 3 site. Theoretically, Hangar 3 and the GSE Building could be constructed separately, but the construction staging impact would be almost the same for both buildings. Constructing them simultaneously will reduce the duration that the GA apron on the old Hangar 3 site is unavailable for FBO operations.

5.1.3. Phase 3

Hangar 4 and the FBO Terminal will be a contiguous building with code-required fire separation between the components – 140’ x 140’ hangar with 26-foot vertical clearance and two-story 20,000 SF FBO Terminal. This phase starts with the demolition of the existing Hangar 4. Construction staging will require a good portion of the GA apron west of Hangar 4 and the landside area east to the Access Road. If the final configuration impacts the existing FBO Terminal, a temporary modular terminal may need to be installed between the existing Hangar 5 and Hangar 6 during this construction phase. Landside paving will be replaced and expanded to serve the new parking and access plan.

5.1.4. Phase 4

Hangar 5 will be constructed in the gap between Hangar 6 and Hangar 4 after demolition of the existing Hangar 5 and FBO Terminal. The new Hangar 5 will have two bays, each 140' x 140' with 26-foot vertical clearance. The north and south hangar walls will abut the adjacent Hangar 4 and Hangar 6 walls with minimal penetrations and code-required fire separation. Construction staging will require the apron west of this site and the landside area east of the site to the Access Road. Paving will connect the Hangars 4 and 6 parking lots to complete the FBO parking and access plan.

5.1.5. Phasing Note

The first two phases are functionally interchangeable within the development plan; the Board will determine whether a 19,600 SF hangar with 26-foot vertical clearance is more advantageous in the short term that a multi-bay 30,000 SF hangar with 23-foot vertical clearance. For preliminary schedule analysis, the Design Team assumes that Hangar 6 will be developed as the first phase. The schedule detailed below and presented in Appendix E is based on the four-phase construction approach.

Figure 21. Construction Phasing Plans

5.1.6. Construction Delivery

Although each phase could be separately designed, competitively bid, and awarded to the low-bid contractor; the Construction Manager at Risk (CMAR) alternate construction delivery method is ideally suited to execute this project. The Concept Plan envisions a consistent exterior aesthetic and similar materials, equipment, and operating characteristics for all buildings on the FBO campus; these objectives are more easily achieved with a single contractor executing the entire construction program. The project will benefit from consistent management and coordination across all four phases, and construction "lessons learned" can more easily be applied in subsequent phases when the same contractor manages all phases. The CMAR can assist during each design phase with cost estimating, scheduling, materials selection, constructability reviews, etc. The schedule prepared for this report assumes the CMAR construction method will be used.

5.2. Schedule

The schedule approach assumes the Design and Construction Team can move seamlessly from one phase to the next, keeping the team intact, employing the synergy of repetitive design elements, and applying lessons learned from the previous phases. The CMAR would also achieve efficiencies by moving from one phase to the next without having to demobilize and remobilize between phases. Backward planning is required to create a schedule for design, procurement, preconstruction, and construction for each project phase that will support seamless progress on this project.

5.2.1. Construction

The construction phases, with the exception of Phase 3, can be completed in a single construction season if on-site construction of each phase starts April 1st of the construction year. The buildings in Phases 1, 2, and 4 could be enclosed before winter weather precludes some exterior construction activities, and the interior work could be completed by the end of the year. However, some building systems testing, e.g. fire suppression, could be delayed by adverse winter weather and push final completion and acceptance of the building to the following spring. The size and complexity of Phase 3 combined with the requirement to demolish the existing Hangar 4 before construction can begin will likely make Phase 3 a two-year construction event.

5.2.2. Preconstruction

Preconstruction activities for each phase will occur between the award of the CMAR GMP contract for that phase and the start of on-site construction. They include administrative submittals, technical design of some building components and systems, shop drawing submittal and review, materials procurement, fabrication, and delivery activities. Major preconstruction elements include:

- CMAR completion of subcontracts and purchase orders
- Bonds, insurance, administrative submittals, and permitting
- Shop drawings and materials submittals preparation, review, revision, and approval – For major building components (structural steel, precast wall panels, HVAC, fire suppression, etc.) the shop drawing process usually requires 8 weeks preparation, 2 weeks review, 4 weeks revision, and 2 weeks approval before material procurement and fabrication can begin.
- Procurement, fabrication, and delivery of components to the job site.

To assure that preconstruction tasks are completed to allow an April 1st on-site construction start, the JAC Board should target award of the CMAR GMP contract for each phase at the October Board meeting the year before construction starts.

5.2.3. Procurement

Wyoming statutes require that the CMAR must conduct an open bidding process for all subcontracts with the required public advertisements. 70% of CMAR subcontracts must be awarded to Wyoming-resident subcontractors unless one of four waiver conditions apply; waivers must be approved by the JAC Board. Although subcontracts may be bid after award of the CMAR GMP contract, the preferred method is to bid the subcontracts first and use those bid prices in negotiating the GMP amount. Subcontract bidding, bid opening, bid tabulation, and waiver analysis require a minimum of 30 days after the Construction Documents are available.

After subcontract bidding, the CMAR must prepare the GMP Proposal which includes detailed pricing for subcontracts, unit price items, and purchases; cost of self-performed work; CMAR fee, bonds, and insurance; clarifications and assumptions; allowances; contingencies; and proposed completion dates. Two weeks is a reasonable period to prepare a GMP Proposal for each phase of construction on this project.

Another two weeks should be allocated to review the CMAR's proposal, negotiate the final GMP amount, prepare the GMP Amendment and any required waiver resolutions, and prepare the award recommendation for each phase. In order to complete review by Board members tasked with this Conceptual Focus in time to place the GMP Amendment on the October Board meeting agenda, the Construction Documents must be available for bidding by August 1st of the year before construction starts.

5.2.4. Design

The Concept Design has identified the location, size, major components, and configuration of each phase. Each design phase in this project should include three distinct sub-phases – Schematic Design, Design Development, and Preparation of Construction Documents – with a rigorous quality control review and a JAC staff/Conceptual Focus review toward the end of each design sub-phase. The Design Team will conduct additional reviews with the Teton County Building Official and the Fire Marshal, and Teton County will likely require an independent structural analysis of the final design before issuing a building permit. Approximately 12 months should be allowed for the design process. The design scope, fee, and contract must be prepared, negotiated, and ready for Conceptual Focus review by August 1st of the year before Construction Documents are required in order to get the Design Contract awarded at the August Board meeting. Scope and fee discussions between JAC staff and the Design Team should begin by July 1st to have a design contract ready for review by August 1st.

In summary, the design contract terms must be agreed by August 1st of year one to allow construction GMP Amendment award in October of year 2 and construction completion at the end of year 3; e.g. if the Phase 1 design contract is awarded in August of a given year, the construction GMP Amendment could be awarded in October of the following year, and the building could be occupied at the end of December of the year after that. A delay in awarding either the design or construction authorization will result in a considerably longer delay of construction completion because critical construction tasks would have to be completed in winter weather conditions or delayed several months for better weather.

The conceptual schedule at Appendix E assumes a smooth and steady transition between construction phases. It assumes the Phase 1 design contract will be awarded at an August Board meeting, which results in project completion at the end of December in the sixth year thereafter. Though the Appendix E chart is based on an August award, it may be easily adjusted to accommodate later start dates. This schedule shows the optimal plan to complete the FBO facilities redevelopment as quickly as possible without significantly affecting airport operations. The Board may choose to delay one or more phases based on GA demand or funding availability. Delays could result in extended duration for subsequent phases and increased costs due to both construction cost escalation and Design Team inefficiencies.

5.3. Budget Considerations

The final cost of the project will be highly dependent on the start date, the pace and continuity of the design, and the construction phasing schedule. A smooth progression from phase to phase will lower costs for both design and construction. The Owner has decided to defer preparing a budget estimate based on the Concept Design until the start date and pace of construction are clarified. Budget estimates for each construction phase will be developed during the design process and finalized based on the Construction Documents for each phase.

Figure 22. Cost Estimate Summary

The construction industry forecasts a 5% - 9% annual cost escalation factor for construction in the Jackson Hole area. Construction cost growth is difficult to predict, but it's even more uncertain in the current national and geopolitical environment. Currently, construction activity is high nationally, but very high in the Jackson Hole area; making local subcontractors, tradesmen, and laborers expensive and often unavailable. Commodity and component prices may fluctuate significantly as international trade negotiations ripple the markets. A Congressional compromise and enactment of a large federal infrastructure bill could significantly increase construction activity nationally making both labor and materials more expensive, reducing subcontractor availability and competitiveness, and likely delaying project schedules. Conversely, a slow down in local construction activity and/or a reduction in anticipated national infrastructure development could reduce construction cost escalation for this project.

End of Section

End of Report

6. APPENDIX SUMMARY

- Appendix A – Programming Documents
- Appendix B – Code Analysis
- Appendix C – Drawings
- Appendix D – Utility Access
- Appendix E – Schedule

6.1. Appendix A – Programming Documents

- A.01 Terminal Space Allocation

6.2. Appendix B – Code Analysis

- B.01-B.04 FBO Terminal and GSE Facility Conceptual Code Analysis
- B.05-B.11 GA Hangars Conceptual Code Analysis

6.3. Appendix C – Drawings

- C.01 Campus Plan
- C.02 Axonometric / Massing
- C.03-C.07 Terminal Floor Plans
- C.08-C.15 Hangar Floor Plans and Details
- C.16 Hangar Support Building Floor Plan
- C.17 Ground Support Equipment (GSE) Floor Plans
- C.18-C.23 Building Exterior Precedent Imagery
- C.24-C.32 Building Interior and FF&E Precedent Imagery
- C.33-C.46 Hangar Structural Floor Plans and Details
- C.47-C.48 Campus Fire Setback Plans

6.4. Appendix D – Utility Access

- D.01-D.02 Utility Access Narrative

6.5. Appendix E - Schedule

- E.01 Campus Phasing Plans
- E.02 Summary Schedule
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