

SCOPE OF SERVICES

**MICKEY LELAND INTERNATIONAL TERMINAL (MLIT)
ARCHITECT ENGINEER (A/E) DESIGN CONSULTANT SERVICES**

MLIT DESIGN CONSULTANT SCOPE OF SERVICES

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SECTION 1 - GENERAL

1.01 INTRODUCTION

- A. The Houston Airport System (HAS) has identified a significant need for the development of additional facilities at George Bush Intercontinental Airport (IAH) to handle aircraft, passengers, and cargo departing to and arriving from, domestic and international destinations on scheduled and chartered flights.
- B. To support the airlines' growth plans in Houston, HAS and airlines will complete a major Capital Improvement Program (CIP), known as the IAH Terminal Redevelopment Program (ITRP) and hereinafter referred as the "Program", that will include constructing a new 11-gate concourse (New Terminal C North currently under construction) undertaken by United Airlines (UA) and reconstructing and integrating the existing Terminal C North and Terminal D into a new single common-use international facility – the Mickey Leland International Terminal (MLIT), known as the "Project" undertaken by HAS. This Scope of Services is focused on the planning, programming, and design of the new MLIT including design coordination of airside, landside and roadway improvements, and utilities to serve the Project boundary.
- C. Capitalized terms used, but not otherwise defined, in this Exhibit shall have the same meaning as the terms defined in the body of the Agreement unless indicated otherwise.

1.02 MLIT VISION

- A. Key to this Project's success is to support the Houston Airport System's mission to connect the people, businesses, cultures and economies of the world to Houston. Design Consultant will embrace the following HAS core values as they relate to the MLIT planning, design, and construction:

Relationships	Service
<ul style="list-style-type: none">▪ We work together with integrity; treat every individual with courtesy and respect.	<ul style="list-style-type: none">▪ We WOW our customers through a "can do" attitude and respond quickly to meet and exceed their expectations.
<ul style="list-style-type: none">▪ We honor our commitments and behave in a manner that earns trust.	<ul style="list-style-type: none">▪ We find ways to bring fun and joy into our work and bring customers along for the ride.
<ul style="list-style-type: none">▪ We promote collaboration and teamwork across the organization.	<ul style="list-style-type: none">▪ We respond promptly and effectively.
<ul style="list-style-type: none">▪ We are reliable and trustworthy; we honor our promises and commitments.	<ul style="list-style-type: none">▪ We show respect, compassion and let people know we care.
<ul style="list-style-type: none">▪ We are open, positive and constructive in our feedback.	<ul style="list-style-type: none">▪ We willingly provide the necessary time and effort to meet the customer's needs.

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Relationships	Service
<ul style="list-style-type: none"> ▪ We treat people like they want to be treated. 	<ul style="list-style-type: none"> ▪ We are flexible and adaptive in a dynamically changing business environment.
<ul style="list-style-type: none"> ▪ We take responsibility for our actions. 	<ul style="list-style-type: none"> ▪ We display enthusiasm and passion for our work.
<ul style="list-style-type: none"> ▪ We lead by example. 	
Innovation	Excellence
<ul style="list-style-type: none"> ▪ We have the courage and willingness to consider new and unconventional ways of thinking. 	<ul style="list-style-type: none"> ▪ We strive for quality and skillful execution without compromise.
<ul style="list-style-type: none"> ▪ We assume responsibility for learning new things. 	<ul style="list-style-type: none"> ▪ We use the power of total employee involvement to achieve our organizational goals.
<ul style="list-style-type: none"> ▪ We embrace new ideas. 	<ul style="list-style-type: none"> ▪ We foster a culture of shared values that gets things done.
<ul style="list-style-type: none"> ▪ We listen with an open mind. 	<ul style="list-style-type: none"> ▪ We take calculated risks needed to achieve results.
<ul style="list-style-type: none"> ▪ We are future-focused; “I’ve always done it this way” does not exist in our vocabulary. 	<ul style="list-style-type: none"> ▪ We look for new and more effective ways to do business.
<ul style="list-style-type: none"> ▪ We recognize change as an opportunity. 	<ul style="list-style-type: none"> ▪ We encourage continuous improvement.

- B. To support the HAS mission and core values, the MLIT design will adhere to the following overarching themes:
1. **Convenient**, simple, functional, and intuitive for the entire passenger experience;
 2. **Flexible** design to safeguard for innovation and changes to technology, operations, and security;
 3. **Technology-enabled** for automated processing and customer convenience;
 4. Creating a **sense of place** reflective of the Houston community and environment;
 5. **Contemporary** and timeless design with use of natural light for an open, expansive feel;
 6. **Modular** features that enable off-site construction in controlled environments with on-site assembly to expedite construction, reduce material waste, control quality, and enable easier interior updates; and
 7. **Maintainable** facilities and systems that consider whole-life cycle costing.
 8. **Sustainable** and energy efficient.

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1.03 MLIT PLANNING OBJECTIVES

- A. The MLIT Program Definition Manual, dated December 2014, outlines the Program background, existing conditions, Program requirements, development plan, conceptual design criteria and Program phasing to be validated by the Design Consultant and Construction Manager-at-Risk (CMAR). During the Program definition process, the HAS planning team generated guidelines and objectives through several sources, including interviews with HAS staff, workshops, and discussions with airport stakeholders. These sources guided the planning and subsequent design efforts for the MLIT as documented in the MLIT Program Definition Manual.
- B. The MLIT design shall address the following key planning objectives as stated in the MLIT Program Definition Manual:
1. Provide additional international gate capacity within the Project boundary;
 2. Provide a high level of customer service;
 3. Meet airline requirements for contact gates and passenger processing facilities;
 4. Replace aging infrastructure, ensuring a focus on the maintainability and total cost of ownership of new assets;
 5. Develop a terminal facility that utilizes space efficiently;
 6. Develop a terminal facility that maximizes concession revenue opportunities;
 7. Increase opportunities for non-airline revenue sources;
 8. Maximize airside envelope to establish flexible and high gate utilization; and
 9. Maintain existing operations and number of wide-body gates during construction phasing.
- C. Additional considerations include, but are not limited to, the following:
1. Plan for the complete passenger experience from drop-off through customs and baggage collection with clear wayfinding and physical flow that enables a simple and clear operation;
 2. Address passenger needs for 24/7 operation that include available concessions, sleep pods, and comfortable lounge-type seating;
 3. Consider pay-per-use club with services that may include a spa with shower facility;
 4. Connection point between arrivals to the Federal Inspection Services facility must be seamless;
 5. Design the terminal facility with adequate and functional support for back-of-house operations including maintenance and equipment room space;
 6. Plan for concessions logistics – consider how materials and deliveries move through the facility from the loading dock to designated spaces, away from the

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- passengers and within a back of house environment; plan for centralized storage for concessions;
7. Consolidate operational spaces to support an efficient operation;
 8. Design the facility to both integrate art within the terminal design elements and to consider placement of art when planning facility interiors;
 9. Integrate advertising with the art program; plan for retail and commercial advertising to fit within the design;
 10. Plan for the modern passenger, including mobile device charging stations;
 11. Design for a tight building envelope that is properly sealed with energy efficient materials and glazing; and
 12. Consider the passenger's luggage needs to enable unencumbered shopping and relaxation.
- 1.04 INTERNATIONAL CUSTOMER RESEARCH
- A. To develop a deep understanding of the international customer hierarchy of needs in support of the Project, HAS conducted a series of focus groups to inform a conjoint analysis. Focus groups of business and leisure travelers were comprised of both US residents traveling internationally, as well as departing international travelers in the following regions: Mexico, Europe, Asia, and the Middle East.
 - B. The report describing a list of airport amenities and features to be considered as part of the Project design will be made available to the Design Consultant.

SECTION 2 - PROJECT DESCRIPTION

2.01 OVERVIEW

- A. The new MLIT will replace both existing Terminal C North Pier and the entire Terminal D facility with a new single consolidated terminal building planned to occupy four levels. The south face of the new MLIT will be constructed to the north of the current building location to accommodate landside roadway improvements. The proposed new MLIT will be planned for 15 wide-body gates including 4 gates for A380 aircraft, depending on the fleet mix, primarily on two double-loaded pier concourses. These gates will also be able to accommodate up to 30 narrow-body aircraft in alternative configurations.
- B. The new MLIT replaces all of the terminal processing functions of existing Terminal D, while expanding capacity and providing the desired passenger amenities and experience found in a world class international terminal. The Project includes all the work contained within the Project boundary as shown in **Attachment A** to this Scope of Services, such as the new MLIT and its associated landside and apron work and utilities; and connections to other airport facilities, such as terminal processor facilities at the Federal Inspection Services (FIS) located within Terminal E and connection to Terminal B (Terminal New C North). In addition, plan for connection with a future

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pedestrian bridge between the MLIT and an existing parking structure over North Terminal Road as well as direct access to a future hotel that may be constructed adjacent to the Project.

- C. Project construction phases are identified below:
1. Enabling Packages – Design Consultant and CMAR shall jointly develop Enabling Packages to be issued as early procurement (work) packages for Component Guaranteed Maximum Price (CGMP) proposals, such as a temporary sterile corridor, temporary baggage handling system, hydrant fuel main extension from NCN tie-in to the tie-in at the existing fuel main located at Taxiway SF, and other enabling projects identified during design services.
 2. D1 Pier and Western Terminal Processor and Frontal Gates
 3. D2 Pier and Eastern Frontal Gates
 4. D3 Pier and Eastern Terminal Processor – Note that the D3 (East) Pier has been removed and replaced with an eastern approach façade and site development. Connection to the FIS must be maintained and program requirements within the D3 Pier must be provided as needed within the D2 Pier. This requirement supersedes the D3 Pier requirements as stated in the MLIT PDM.
- D. The Project must be designed with constructability and passenger experience at its core. The Project must be designed and constructed in multiple phases to allow continuation of passenger services in the existing terminals, while the existing Terminal D is decommissioned and demolished in phases. Construction phasing as described within the MLIT Program Definition Manual is primarily a west to east flow of construction, where construction does not begin until United Airlines vacates the existing C North Pier at the completion of the new Terminal C North (NCN) Pier. The City is evaluating an option; however, to accelerate construction by advancing construction of the D2 pier and constructing the new terminal from east to west. For planning purposes, the intent is that a minimum of six (6) gates remain operational during the MLIT construction, including four (4) positions for wide-body and two (2) positions for A380 aircraft.
- E. Each phase of MLIT construction will require temporary interfaces to allow construction of the piers while protecting the passenger experience. Design Consultant will need to address the interfaces in each phased construction package to maintain passenger, landside, airside, airport wide work, utilities infrastructure, and Terminal E FIS access and control of sterile corridors. In addition, logistics management must be ensured within the MLIT and back-of-house corridors and building access during each phase of construction.
- F. Design Consultant is responsible for the following (refer to **Attachment A** for Project boundary graphical representation):
1. Full design of the apron pavement systems and associated infrastructure and utilities, including but not limited to, grading and storm water drainage, apron lighting, potable water, sanitary sewer, preconditioned air, ground power, power and communications, passenger boarding bridges and foundations, and hydrant fueling system from the terminal building curtain wall to the tail-of-stand-road

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(vehicle service road), including the vehicle service road and pavement markings.

2. Hydrant fueling system design from the aircraft fueling hydrants to the NCN connection point of the main hydrant fueling system located south of Taxiway NB and east of NJ. Remaining apron pavement and utilities system design will be under a related project.
3. Landside work, extension of the utilities conveyance corridor to the east end of the MLIT footprint, and roadway modifications. Landside work includes roadway modifications required for improved flow of vehicular traffic in and around the MLIT, additional curbside and bypass lanes in front of the terminal, and new signage and wayfinding. The landside project includes development on the landside, or public areas, along North Terminal Drive in front of the MLIT terminal and transition to the NCN terminal, and associated roadway utility work. The new MLIT curbside will be shifted slightly north from the existing Terminal D curbside to create space for new arrivals and departures lanes and curbsides, while reconstruction of the existing roadway will create bypass lanes through this congested area.

2.02 PROGRAMMATIC FUNCTIONS

- A. The Project includes international passenger services and support facilities including: ticketing check-in, holdrooms (departure lounges), baggage handling and claim areas, passenger and baggage screening, passenger amenities, customer service areas, and non-airline facility support space. The Project will include, but is not necessarily limited to, programmatic functions listed below:
 1. Ticket Counter and Support Areas
 2. Security Checkpoint lanes with safeguarded planning for growth plus a separate employee security checkpoint
 3. Baggage Handling Systems
 4. Federal Agency Facilities
 5. Checked Baggage Inspection System
 6. Concourses and Holdrooms
 7. Children's play areas
 8. Lactation Rooms (Mother's Nursing Stations)
 9. Airline Operations Area Shell Space
 10. Airline Clubs Shell Space – plan for minimum 70,000 square feet (total of 7 clubs) with vertical circulation at the club level and provision for direct club level boarding access for two A380 and one wide-body aircraft parking positions. NOTE: This space requirement supersedes requirements stated in the MLIT PDM.

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11. Friends, Family and Relatives Center (FFRC) that may also be planned as part of Airline Club space
12. Airside Systems, Paving, and Utilities into and out of the building as coordinated with the related projects
13. Governmental VIP Suite (Diplomatic Room) for visiting dignitaries located on the departure level
14. Performance stage on departure level in high traffic area
15. Furniture, Fixtures and Equipment (FF&E)
16. Art Program Coordination and Provisions
17. Tenant/Concessionaire Shell Spaces for Food, Retail, Convenience, and Ancillary Services (to be built-out under separate contracts per phased construction) including Concessionaire Storage. Concessionaire space to be planned at the central core area and at the gates. Include consolidated vending areas planned as part of Concessionaire space.
18. Customer Service Areas
19. Loading Dock
20. Ground Transportation Facilities
21. Interior/Exterior Dynamic and Static Wayfinding Devices, including Airside Gate Signs
22. Passenger Boarding Bridges (PBB) - plan for two PBB at all wide-body and three PBB at all A380 capable gates
23. Aircraft Pre-Conditioned Air (PCA) Systems
24. Aircraft Ground Power 400 Hz Systems
25. Passenger Conveying Systems (vertical/horizontal circulation)
26. Passenger Information Communications Systems, Flight Information Display Systems (FIDS)
27. Baggage Information Display System (BIDS), Ramp Information Display System (RIDS), and Gate Information Display Systems (GIDS)
28. Aircraft Potable Water
29. Aircraft Sanitary Waste
30. Aircraft Guidance Parking System
31. Ground Service Equipment Battery Charging System
32. Building Systems (Structural, Curtainwall, Plumbing, Fire Protection, Mechanical, Electrical, Utility, Communications, and Security)

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33. Modifications to existing Terminal B-D connector to allow connection to the new facility
34. Extension and modifications to existing tunnel connecting the FIS in Terminal E to the Project
35. Flexibility for direct connection to a future hotel
36. Hydrant Fueling System for identified aircraft layout

2.03 DESIGN SERVICES SCOPE

- A. Design Consultant's Basic Services shall include services for all disciplines required to complete design of the Project and construction administration. Basic Services shall include, but not be limited to, the following:
1. Architectural Programming and Design
 2. Interior Design
 3. Structural Engineering
 4. Blast Protection/ Resistance Evaluation
 5. Conveying Systems including Elevators, Escalators, and Moving Walkways
 6. Plumbing Engineering
 7. Fire Protection Systems Design including design of deluge system for protection of curtainwall
 8. Mechanical Engineering
 9. Building Automation and Controls System
 10. Electrical Engineering
 11. Lighting Design
 12. Technology Integration Services – To include coordination of all systems and equipment with a communications component including, but not limited to: building automation and controls, supervisory control and data acquisition (SCADA), information technology, signage, baggage handling, jet bridges
 13. Technology and Communications
 14. Security Systems
 15. Acoustical Design
 16. Vibration Analysis
 17. Civil Engineering

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18. Specialty Services including Baggage Handling Systems, PCA Systems, and other systems as described within this Scope of Services
19. Traffic Design
20. BIM / GIS Design
21. Sustainability and Energy Efficiency Design
22. Visual Communications including Signage, Graphics and Wayfinding
23. Artwork Program
24. Furniture, Fixtures and Equipment (FF&E)
25. Life Safety Code Compliance
26. Commissioning Coordination
27. Operational Readiness and Airport Transfer (ORAT) Coordination
28. Construction Cost Estimating
29. Landscape Design
30. Hydrant Fueling System Design
31. Building Envelope System Testing Coordination
32. Other Basic Services as mutually agreed to by the Director and Design Consultant.

2.04 RELATED PROJECTS

- A. Design Consultant shall coordinate the MLIT design and recommended phasing approach with other design teams, the PMT, airline representatives, project stakeholders, and other tenants and contractors executing concurrent capital improvement and tenant improvement projects. The following projects are either in construction or are planned to be awarded under separate procurement packages for separate project delivery.

2.04.1 UNITED NEW TERMINAL C NORTH (NCN) PIER

- A. This project's design and construction is being managed separately by United Airlines with expected final completion by second quarter 2017. The project will construct a new concourse pier on the north ramp in between the existing Terminal B North gates and the existing Terminal C North Pier. At completion of the NCN (referred to as Terminal B in the PDM) project, United Airlines will vacate the existing Terminal C North pier and relocate operations to the NCN. This will allow demolition to begin on the existing Terminal C North pier, which is required for the construction of the Project.
- B. Project scopes included in the NCN project besides the terminal include:

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1. Terminal B to D Connector: This is the small linear pier running parallel to the terminal roadway west of the existing Terminal C North Pier, containing existing Gates C24-C27 and a United Club lounge. This area and two bays of concessions is the only portion of the Terminal C North Pier that will remain when the pier portion of the concourse is demolished to make way for the new MLIT D1 pier. The west end of this facility will be modified to integrate with the NCN Pier. After demolition of the existing Terminal C North pier, the east end will integrate with the new MLIT.
2. Renovation of Gates C24-C27 and the United Club lounge is United Airlines' responsibility. Renovation of the two bays of concessions is the responsibility of this Project. The purpose of maintaining the two bays of concessions area is to provide access for United Airlines to and from the NCN to the existing C Processor, and to provide vertical circulation service to the apron level. Phased construction of the MLIT will demolish the existing Terminal C North Pier, which serves as the connection between the existing C Processor, APM Station and the B-D Connector. For the B-D Connector to have continued access to the C Processor and APM station, a temporary pedestrian bridge will need to be constructed. The MLIT Design Consultant and CMAR teams will be responsible for maintaining this connection.
3. NCN Roadways and Drainage: There will be no new passenger ticketing, baggage claim, or curbsides associated with the NCN project; however, there will be phased landside demolition and construction associated with the new Utilidor and to maintain acceptable vehicle access for terminal and airside support services operations. Landside North Terminal roadways will be completely rebuilt at the end of the program.
4. NCN Apron and Utilities: NCN apron and utilities consist of all the supporting apron and underground utilities associated with the NCN pier concourse. Utilities include the high voltage system, sanitary sewer, storm sewer, domestic water, fire protection, natural gas, and jet fuel. Design and construction of these facilities are the responsibility of United Airlines. The jet fuel main line system which is conflict with the NCN project site will be demolished and rerouted to the north around the NCN and extended along the north side of the project and capped with a new vault for future connection to the MLIT. A new hydrant loop system will be installed around the entire NCN, tapping off the new lines and connecting to the existing system near the east end of the B-D Connector.

2.04.2 ITRP ENABLING UTILITIES - LANDSIDE

- A. This project is being procured under a separate progressive design-build project, expected to commence fourth quarter 2016 with construction start no later than third quarter 2017. Project scope includes the design and construction of water storage tanks and distribution pumping for domestic and fire protection water service to IAH terminal facilities; reclaimed water (treated at the City of Houston wastewater treatment plant) that is planned for use at IAH facilities for cooling tower make-up, irrigation, and flushing toilets; chilled and heating hot water distribution from the IAH central utility plant; 12.5kV site power distribution from a new electrical receiving station; a new 2MW standby power generator to serve the Project on a prioritized load basis; and

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information technology, communications, and fiber optic (FO) trunk lines including new SCADA system, to be constructed within an underground concrete utility conveyance corridor (Utilidor) below the north side of the vehicle service road to serve this Project. The Utilidor and services will be terminated at the west end of the Project boundary. This Project includes design of utilities services to the MLIT from the Utilidor connection point.

- B. The Utilidor will include installation of required utilities for NCN and MLIT. The Utilidor will be sized to accommodate installation, maintenance, replacement, and access for operations and maintenance staff to service piping, valves, fiber and cabling installed within the Utilidor. At designated points of service, the Utilidor will branch off and connect to the NCN and MLIT buildings, as well as provide for future service connections to other central terminal area facilities, for service connections to mechanical, electrical, and communications rooms.
- C. The Utilidor will be constructed in segments to align with the service needs of the MLIT construction phases. The design and phased construction approach will take into account the potential need for direct-buried temporary chilled and heated water supply lines which may be required outside the Utilidor.
- D. Refer to the IAH Utilities Master Plan, dated September 12, 2014, for additional detail related to utilities planned to serve the MLIT.

2.04.3 EAST AIRCRAFT PARKING HARDSTAND

- A. This project is being procured under a separate progressive design-build project, expected to commence fourth quarter 2016, with construction start no later than third quarter 2017. Project scope includes the design and construction of a new aircraft parking hardstand to be constructed northeast of the Project boundary and will enable construction of the proposed Project to facilitate boarding, deboarding, and parking of aircraft that may be displaced by the Project construction. The hardstand will provide gate support services (i.e., hydrant fueling, ground power, pre-conditioned air, etc.) to aircraft utilizing the parking positions.

2.04.4 MLIT APRON AND TAXILANES

- A. This project includes new apron pavement systems and associated infrastructure and utilities from the outer edge of the tail-of-stand road (vehicle service road) to the object free area of Taxiways NB and SF. Design and construction management services for this project is planned to be procured separately at a later date.

2.04.5 FEDERAL INSPECTION SERVICES (FIS) RENOVATION AND EXPANSION

- A. The FIS Renovation and Expansion project will enlarge the existing FIS to improve operations and provide increased capacity to meet growing demand. This project includes renovation of the existing FIS facilities for improved functionality, expansion eastward of the baggage handling system, and a new dedicated CBP parking structure. This project requires close coordination with the MLIT.

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- B. Design and construction management services for this project is planned to be procured separately at a later date. The Program Definition Manual for this project will be available for review prior to Project NTP.

2.04.6 AIRPORT-WIDE SYSTEMS

- A. Airport-wide Systems projects are associated with, and needed to properly develop and operate the facilities in the ITRP. Not all are required to be completed before the MLIT design is initiated. These projects range from additional off-site power distribution system improvements needed for service reliability, information technology backbone improvements, and inter-terminal train (ITT) system improvements.

2.04.7 TENANTS

- A. Tenant improvements are projects within the MLIT that third party tenants are responsible for designing and constructing the build-out. There are five major groups of tenants responsible for space build-out within the program: Airlines, concessionaires and third party service providers, Customs and Border Protection (CBP), Transportation Security Administration (TSA), and other federal agencies. Their construction and/or installation of equipment must be phased and coordinated with the each of the terminal phases so that tenant improvements are operational with the opening of that phase of the terminal. Primary tenants providing design and construction components of the ITRP are federal agencies related to safety, security and border protection, the airlines, and concessions. Some of these agencies provide their own design guidelines as referenced in the PDMs. Both airlines and concessions have public (customer) and back-of-house areas.

2.04.8 HAS INFRASTRUCTURE

- A. Additional projects either planned or in construction at IAH are identified within the HAS Capital Improvement Plan (CIP) and include taxiway rehabilitation and additional airfield projects, plus several utility infrastructure projects.

2.04.9 PROGRAM MANAGEMENT OFFICE (PMO) BUILDING

- A. To improve program management efficiency and interaction between HAS staff, stakeholder representatives, the PMT, plus the multiple consultant and contractor organizations, HAS is planning the construction of a centralized Program Management Office (PMO). The PMO as defined will provide a centralized facility for all designated HAS staff members, designated stakeholder representatives, the PMT's key staff members, PMSS teams, principal consultant and contractor staff members, and other designated personnel. In addition, the PMO will provide conference and training facilities to support the ITRP and a consolidated location for all ITRP-related document control, records management, reproduction, and CAD/GIS functions. This office building will be located at 115 Standifer Road.
- B. The Design Consultant may be required to house key management personnel during design and construction in this location with the Project Team. To facilitate work planning, HAS may provide laptop computers, monitors, and project management-

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related software for Design Consultant’s personnel that may office at the PMO building. Adjacent to this site, there will be a worker parking and transportation staging area, for transportation of workers to the Project site.

- C. Prior to relocating to the PMO building, HAS may provide office space within or near IAH boundaries in which to perform Services, subject to availability.

2.04.10 FUTURE PROJECTS

- A. In addition to the above reference projects, Design Consultant will be required to interface with projects planned for the future that may not yet be identified as part of the CIP.

SECTION 3 - PROJECT ADMINISTRATION

3.01 PROJECT ROLES AND RESPONSIBILITIES

- A. This section defines general roles and responsibilities for the entities involved in the Project.
- B. HAS, EPM and PMSS representatives comprise the PMT.

Entity	Responsibility
City of Houston (City)	<ul style="list-style-type: none">▪ The City of Houston is the owner and approver of all Contracts executed for work at Houston Airport system, including the Intercontinental Airport of Houston (IAH).▪ The Houston City Council approves all Contracts and changes to Contracts, unless otherwise delegated.▪ Delegated authority for work within the Houston Airport System is granted to the Director of the Department of Aviation.

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Entity	Responsibility
Houston Airport System (HAS)	<ul style="list-style-type: none"> ▪ HAS, through the Director (Department of Aviation) or their designee, represents the City of Houston with respect to management and operation of the Airport. ▪ Use of the terms City or HAS may be used interchangeably. ▪ Approves, makes decisions throughout all project phases ▪ Ensures that HAS-required decisions are made in a timely manner ▪ Facilitates communication with City of Houston, Department of Public Works and Engineering (PWE) to keep all parties informed of project progress and construction permit submittals ▪ Provides key input on owner requirements related to planning, art program, technology, finance, operations, maintenance, security, and safety
Executive Program Management (EPM) Team	<ul style="list-style-type: none"> ▪ Provides leadership to the ITRP and advises HAS on project status and key decisions affecting scope, schedule, budget, safety, and quality ▪ Develops policies, procedures, and execution plans to deliver the Program and Project ▪ Coordinates all work to be undertaken with HAS divisions, City departments and external stakeholders (such as airlines, concessionaires) as necessary for the timely and quality execution of the Program ▪ Engages and collaborates with airlines and other airport stakeholders to minimize disruption of operations and services throughout the duration of the Program
Program Management Support Services (PMSS) – Project Management	<ul style="list-style-type: none"> ▪ Led by Project Manager representative from Program Management Support Services (PMSS) staff to the Program; provides overall management for the Project ▪ Acts as interface between the Executive Program Management Team and Design Consultant and Construction Manager at Risk (CMAR) ▪ Ensures integration and execution of project-specific controls systems ▪ Ensures change management decision-making process is defined, documented, and understood

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Entity	Responsibility
Program Management Support Services (PMSS) Team - Construction Management	<ul style="list-style-type: none"> ▪ Led by Construction Manager representative from the Program Management Support Services (PMSS) staff to the Program; provides management specifically for cost, schedule, quality and safety ▪ Manages contracting and project management process through all phases of design and construction ▪ Manages the CMAR contract
Program Management Support Services (PMSS) Team - Design Management	<ul style="list-style-type: none"> ▪ Led by Design Manager representative from the Program Management Support Services (PMSS) staff to the Program; ▪ Provides management specifically for the design process, managing scope to budget, and safety in design ▪ Manages and tracks design from concept through construction permit packages and delivery of record close-out documents ▪ Manages the design review process through all phases of design ▪ Manages the Design Consultant contract
Design Consultant Project Manager	<ul style="list-style-type: none"> ▪ Design Consultant provides execution for all phases of design to produce a final design that achieves Project objectives, scope, schedule, safety in design, and budget ▪ As Prime Consultant, leads and coordinates sub-consultants and specialty consultant
Construction Manager at Risk (CMAR)	<ul style="list-style-type: none"> ▪ Provides management during pre-construction and construction phases for cost, schedule, work package planning and sequencing, quality, safety and constructability ▪ Performs design reviews and provides recommendations for design alternates to identify and resolve constructability issues and to assist in maintaining budget and schedule
Commissioning Authority (CxA)	<ul style="list-style-type: none"> ▪ Verifies testing and operational intent of all applicable elements of the Project scope ▪ Performs design phase reviews focused on 'commissionability', functionality, maintainability, sustainability and best practices ▪ Participates in concurrent design phase reviews with the PMT, other consultants and contractors, as applicable ▪ Develops Commissioning Plan to establish overall Commissioning requirements; CMAR will develop the technical commissioning plans

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3.02 DESIGN TO BUDGET

- A. Within forty-five (45) Calendar Days after the CMAR's NTP for Preconstruction services, the Design Consultant and CMAR will develop a cost component framework (template). The CMAR and Design Consultant will jointly use their experience, knowledge, and industry information from similar projects to develop an initial Probable Cost of the Work. The cost component framework, the Probable Cost of the Work, and the Agreed Cost of the Work must be approved by the Director prior to proceeding with Schematic Design.
- B. Design Consultant is responsible for producing Construction Documents that will result in a Probable Cost of the Work that will not exceed the Agreed Cost of the Work accepted by the Director.
- C. Cost Estimate Reconciliation
 - 1. Design Consultant will submit design options and deliverables throughout the Design Phases to the CMAR, through the PMT, in order for the CMAR to provide cost estimates. The Design Consultant will prepare and submit cost estimates based on their progressing design and participate in meetings with the PMT and CMAR to discuss the CMAR's cost estimates, provide clarification, and reconcile any differences that may exist. Following the cost estimate reconciliation, the Design Consultant in collaboration with the CMAR will prepare a technical memorandum describing the cost estimate resolution process and any remaining unresolved differences between the respective estimates in relation to the Agreed Cost of The Work.
- D. Cost Estimate Presentation
 - 1. The PMT will arrange a meeting between the Director, CMAR, and the Design Consultant to discuss the technical memorandum, the reconciled cost estimate and any outstanding differences. This meeting will include discussion of the unresolved differences in the estimates and if the estimate exceeds the Agreed Cost of the Work, identify areas where the progressed design can be modified to bring the Project within the Agreed Cost of the Work. The technical memorandum shall include an assessment of the impact of potential changes to the progressed design on aesthetics, function and impact to the maintainability or efficiency of the Project. The intent of the meeting is to obtain acceptance of any design modifications and the Agreed Cost of the Work from the Director.
- E. [Agreed Cost of the Work](#)
 - 1. The PMT will document decisions reached and any Agreed Cost of the Work adjustments resulting from the cost estimate presentation meeting.

3.03 BASIC SERVICES DELIVERY

- A. Basic Services for this Project will be phased as follows:
 - 1. Pre-Design
 - 2. Concept Design (15% Design Completion)

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3. Schematic Design (30% Design Completion)
 4. Design Development (60% Design Completion)
 5. Construction Documents (100% Design Completion)
 6. Construction Services
 7. Post-Construction Services
- B. Design Consultant shall provide a schedule for each Phase of the Project. The schedule shall be developed with the appropriate level of detail as the design progresses, for example, summary level during the Schematic Design Phase and more detail in the Design Development and Construction Documents Phases.
- C. Contract Document design deliverables will be issued in multiple procurement packages in accordance with procurement phasing strategies to be developed during Schematic Design.
- D. At appropriate times, Design Consultant will contact governmental agencies including but not limited to; the City, County, State and Federal agencies, that are required to approve the Contract Documents and the entities providing utility services to the Project. In designing the Project, Design Consultant will respond to applicable design requirements imposed by governmental agencies and by such entities providing utility services. Design Consultant will assist the PMT in connection with PMT's responsibility for filing documents required for the approval of governmental agencies.
- E. Design Consultant will be expected to present to and consult with stakeholders and HAS staff as required by the PMT.

3.04 DESIGN SCHEDULE

- A. Design Consultant will immediately commence work with the PMT upon receipt of the First Notice to Proceed for Basic Services to develop a detailed Design Schedule. The Design Schedule shall contain logic linked activities holding named resource types, estimated budgeted costs of those resource types and estimated durations of the tasks being performed in a measurable unit of either productive hours as otherwise agreed with the PMT. The Design Schedule shall include a section containing key milestones, identification of design phase workshops and timing of when key decisions must be made and by which party to maintain the Design Schedule, design review and approval durations, and target dates for design phase deliverables.
- B. Design Consultant shall, within fourteen (14) Calendar Days of the First NTP for Basic Services, submit the Design Schedule to the Project Management Team. Primavera P6 Professional V8.4 software or other software as may be approved by the City and PMT, shall be utilized for all schedule submittals required by this Contract.
- C. The City will implement the Project in multiple Procurement packages for permit and construction in order to expedite construction. To achieve construction delivery dates, Design Consultant, working with the CMAR, will submit the design for the PMT's review in several procurement packages that may encompass multiple building components.

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- D. Design Phase deliverables for each procurement package will be identified within the Design Consultant Design Schedule.

3.04.1 SCHEDULE CONTENT AND FORMAT

- A. The Design Schedule once accepted shall be baselined. The Design Schedule will be incorporated into the CMAR's Project Schedule which will be baselined per the PMT published project procedures.
- A. The Design Schedule shall show progress to-date, durations, and dependencies including tasks and key decision milestones that are the responsibility of the City. It shall show total project float and portray the complete and continuous critical path, throughout the Project.
- B. The Design Schedule shall allow for the direct linking of design deliverables to be produced by the Design Consultant to the PMT's Document Management System wherein the full register of design deliverables shall be listed and mastered.
- C. All activities in the Design Schedule shall have a predecessor and successor except for the contract start and finish milestones. Constraints are not allowed on activities. Each activity shall contain the resource/s executing that activity, the estimated hours budgeted to do so, and the resultant estimated budgeted cost. The total budgeted cost of all activities within the schedule shall equal the fee amount.
- D. The PMT will continually monitor the Design Schedule, and as part of invoice reviews, to check Design Consultant's progress against cost and schedule goals.
- E. Design Consultant shall develop the Design Schedule in accordance with the current version of the PMT Schedule Process, to be furnished upon Notice to Proceed with Services.

3.04.2 SCHEDULE APPROVAL

- A. The Design Schedule initial submission shall be made without showing progress. The PMT will review the Design Schedule and will issue a letter to Design Consultant stating approval or disapproval. If the Design Schedule is deemed unacceptable, the letter will detail areas of concern. Design Consultant shall address the areas of concern, correct the Design Schedule to the satisfaction of the PMT and resubmit. Once the Design Schedule is approved, it will become the Design Consultant's Schedule. The initial Design Consultant's Schedule shall not be changed during the design work without written approval by the PMT. All changes, progress updates, and revisions shall be made based on the Design Schedule.

3.04.3 SCHEDULE REVISIONS

- A. No changes shall be made to the Design Consultant's Schedule without written approval from the PMT. This includes, but is not limited to: logic changes, duration changes, and addition or deletion of activities. In accordance with the PMT published project procedures, the Design Consultant shall submit all Change Orders or scope

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change schedules to the PMT in writing for approval before incorporation into the Design Consultant's Schedule.

3.04.4 FLOAT TIME AND TIME EXTENSIONS

- A. The Design Schedule shall show total project float and portray the complete and continuous critical path throughout the Project. Float shall not be considered to be for the exclusive benefit of either City or Design Consultant. Time extensions for Contract performance will be granted only to the extent that the delays extend the critical path of the current monthly schedule update beyond the Contract Milestone(s) or completion dates. In order to obtain a time extension, the critical path delay must be beyond the control and without fault or negligence of the Design Consultant.
- B. In the event that Design Consultant created delays that impact an already negative float path on the current Design Schedule, Design Consultant will not receive any time extension unless and until the negative float is increased for the activity with the highest negative float on the current monthly schedule update.

3.04.5 RECOVERY SCHEDULE

- A. If, at any time during Design Consultant's performance of the Services, the PMT determines, based on its assessment of Design Consultant's current Design Consultant's Schedule and actual progress that Design Consultant is fourteen (14) or more Calendar Days behind schedule and the delay is impacting any specified design Milestone, Design Consultant shall prepare a recovery schedule at no additional cost to the City (unless a party other than Design Consultant is solely responsible for the event or occurrence which has caused the schedule slippage) explaining and displaying how Design Consultant intends to reschedule its Services in order to regain compliance with the Design Consultant's Schedule. Design Consultant shall submit the recovery schedule within seven (7) Calendar Days of a written notification by the PMT.

3.04.6 ACTIVITY CODING

- A. Basic Services under this Contract shall be coded into separate Project Phases. Design Consultant shall provide a breakdown of the tasks to be accomplished in each Project Phase. The Project Phases, as a minimum, shall include:
 - 1. Pre-Design
 - 2. Concept Design (15% Design Completion)
 - 3. Schematic Design (30% Design Completion)
 - 4. Design Development (60% Design Completion)
 - 5. Construction Documents (100% Design Completion)
 - 6. Construction Services
 - 7. Post-Construction Services

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- B. Each Project Phase summary shall have a start and completion date derived from the early start and early finish dates of the detailed activities included in the Design Schedule. All schedule activities are to be coded by Project Phase.
- C. Upon receipt of the First Notice to Proceed for Basic Services, the PMT will issue to the Design Consultant the Work Breakdown Structure (WBS) for all schedule activities to be coded against. This WBS will be mastered and change controlled by the PMT.

3.05 PROJECT MONITORING

3.05.1 DESIGN MANAGEMENT PLAN

- A. The Design Consultant shall submit a Design Management Plan that includes, but is not limited to the following: the proposed organization structure and roles, staffing plan, work plan, and deliverables, schedule milestones, quality management, and document control within thirty (30) days of the First Notice to Proceed.

3.05.2 DOCUMENT MANAGEMENT SOFTWARE

- A. The City will acquire document management software to be accessible by all Project team members and will be used as a repository for all Project documents and for issue management, risk management, tracking actions, requests for information (RFI's), and workflow processes. Working with the Project team, Design Consultant will recommend modifications to the software to refine functionality for tracking and reviewing design progress.

3.05.3 DESIGN DOCUMENT UPLOADS

- A. Design Consultant will upload design documents for all disciplines via the program management software, for collaboration with the Project Team.
- B. Design Consultant will maintain a log of changes and/or deviations from the PDMs and other baseline document requirements.
- C. Design Consultant shall provide forecast dates for the publication of design documents on a weekly basis via the document management software.

3.05.4 DESIGN FOR SAFETY

- A. Design Consultant will be required to demonstrate how construction safety has been factored/ mitigated within the design.

3.06 PROJECT MEETINGS

- A. All Project meetings that include participation with the PMT will be located at the PMO building or interim PMO offices.

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3.07 PROJECT PROGRESS MEETINGS

3.07.1 PROJECT STATUS MEETINGS

- A. Design Consultant will attend regularly scheduled Project status meetings for the duration of the Services with the purpose of describing the progress of design efforts in relation to the Design Schedule, scope of services, and design fees. Primary focus will be on issues that may affect the schedule, budget, or scope of work. The meetings are intended to last only as long as necessary to convey necessary information and reach agreement on issue resolution. Other supplemental meetings or design review meetings will be scheduled to address specific design or management issues. Frequency of Project status meetings will be agreed to by the PMT and Design Consultant and may be scheduled on a weekly basis.

3.07.2 PROJECT STATUS MEETING AGENDA AND SCHEDULING

- A. The PMT will be responsible for creating the meeting agenda in advance of all Project status and supplemental meetings. The PMT will also be responsible for scheduling the meetings at a convenient time and location for key stakeholders. The meeting agenda will include:
1. Comments and questions on Design Consultant's monthly status report.
 2. Unresolved issues that may affect the schedule, scope of Services, Work or budget.
 3. Upcoming work efforts, dates when key decisions are required to maintain the Project Schedule, and input or coordination required by the City, PMT, CMAR, or other Project stakeholders.
- B. Meeting Minutes
1. Design Consultant is responsible for documentation of Project status meetings in which Design Consultant is the facilitator and shall submit meeting minutes to the PMT within five (5) Calendar Days of the conclusion of the meeting. Meeting minutes will not record all discussions, but rather will be a summary of appropriate discussions, decisions, and action items. Design Consultant will prepare a template for the meeting minutes for discussion at the first Project Status meeting.

3.07.3 SUPPLEMENTAL STATUS MEETINGS

- A. Design Consultant will attend supplemental project management meetings with the purpose of dealing with more specific management issues as they arise. Supplemental meetings can only be called by the City or PMT and recorded as such in the meeting minutes. The meetings are intended to last only as long as necessary to convey necessary information and reach agreement on issue resolution. Meetings required to address Design Consultant deficiencies shall be held at no cost to the City.

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3.07.4 DESIGN PROGRESS MEETINGS

- A. Design Consultant shall participate in design conference calls and face-to-face progress meetings as needed, arranged by the PMT's Design Manager, to discuss the progress of Services and coordination issues. Design Consultant shall report to the Design Manager on the status of the following: design level of completion, adherence with the Design Schedule, issues affecting the quality of Services and coordination issues within the Design Consultant team and with other projects impacting or impacted by the Project.
- B. Design Consultant is responsible for documentation of all meetings in which Design Consultant participates, and shall submit to the Design Manager minutes of meetings within five (5) Calendar Days of the conclusion of the meeting. Design Consultant's attendees at the meetings will include the Design Consultant Project Manager, the Design Consultant Design Manager, and other senior staff as needed who will have direct knowledge of the progress of all aspects of the design.

3.08 DESIGN PHASE WORKSHOPS

3.08.1 PROGRAMMING WORKSHOPS

- A. Programming workshops with the PMT, City, and airline stakeholders shall address area requirements as well as overall site and construction phasing requirements for the design of the Project. These workshops will confirm and refine program assumptions for square footages and efficiencies. Separate workshops to address detailed program studies shall be conducted prior to the initiation of design. The intent is to provide an efficient building design with adjacencies, square footages and efficiencies that include sufficient circulation space and infrastructure system and utilities space. At completion of Design Development, no changes should occur to the MLIT program of requirements.

3.08.2 DESIGN REVIEW COMMITTEE (DRC) MEETINGS

- A. Design Consultant will prepare presentation materials for DRC meetings with the PMT, City, and airline stakeholders as required by the PMT. Design Consultant shall prepare an informative presentation addressing the current status of the design and required decisions that must be resolved. Design Consultant will collect data, present drawings and documentation, and/or receive input and feedback.

3.08.3 DESIGN PROGRESS WORKSHOPS

- A. The purpose of progress workshops is to bring Project issues requiring action or direction to the PMT, City, and airline stakeholders and subject matter experts related to the Project component, in an effort to establish requirements, directions, solutions, advice and knowledge with respect to specific Project needs and activities. Led by the Design Consultant, progress workshops will occur as required during the design phases. In order to ensure the correct level of participation, Design Consultant shall establish the schedule and purpose of progress workshops within the Design Consultant's Schedule. Each workshop shall be controlled by a facilitator.

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3.08.4 FORMAL DESIGN REVIEW WORKSHOPS

- A. Formal design reviews will take place as defined under Design Quality Management of this Scope of Services. Design Consultant will facilitate formal design reviews with the PMT, airline stakeholders and HAS subject matter experts including but not limited to, representatives from Planning, Operations, Maintenance, Technology, Security, and Safety. In addition, design assurance will be provided on a technical review level during Schematic Design, Design Development and Construction Document phases. Separately from the technical review, a Commissioning Authority will perform design phase reviews of systems/assemblies.
- B. The formal design reviews examine the facility's ability to meet operational, functional, structural, and aesthetic expectations. Design Consultant shall prepare meeting minutes of these workshops and incorporate design review comments into the Construction Documents for tracking completion and compliance with the City's requirements.
- C. It is essential that Design Consultant representatives who attend the workshops are able to present specific building component schemes to the PMT to promote meaningful dialogue. For example, if the exterior material choices of the building are the topic of discussion, the life cycle cost of the proposed materials, the energy savings potential, the cost implications, the structural implications, the interior lighting impact, and any other topic necessary to enable an informed decision must be included to finalize exterior materials and their configuration.
- D. The formal design review will incorporate all of the items discussed and resolved in previous progress workshops and to cumulatively develop and track categories essential to the Project, which are:
 - 1. Operations - concerns issues related to maintaining airport operations during construction phasing, sensitivity to IAH master planning, access, adjacencies, and maximum utilization of spaces.
 - 2. Building Elements - concerns the building enclosure, the building systems and the general quality and efficiency of construction.
 - 3. Schedules - concerns all scheduling associated with design and construction, and any occupancy impacts.
 - 4. Comprehensive Cost Factors - concerns the presentation and investigation of value analysis/ engineering practices and alternatives that may impact the building and operation costs, and ultimately the final cost of the Project when all factors are included.

3.09 PROJECT REPORTING

3.09.1 PROGRESS REPORT TEMPLATE

- A. Design Consultant shall prepare a template for the progress reports for discussion and approval at the first Project status meeting. The intent of the progress report is to quickly convey the current Project status as compared to the Design Consultant's

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Schedule, Scope of Services, and design fee; as well as identify issues that may impact Design Consultant's ability to meet the scope, schedule or budget in the future.

3.09.2 PROGRESS REPORT CONTENTS

- A. Design Consultant shall prepare and submit to the PMT a Progress Report by the date stipulated in the monthly reporting calendar as published by the PMT. The report shall address all items outlined below:
1. A brief narrative of the Services performed (including a status list of all contract deliverables) including level of completion of the design.
 2. Identification of areas of concern and actions, decisions, or approvals needed that affect or impact the design intent, scope or progress. The list shall include a proposed course of action for the resolution of each issue.
 3. Monthly status of the Project in relation to the approved Design Consultant's Schedule in electronic format. Design Consultant shall evaluate and determine the percent complete for each activity and Project Phase of the Services and incorporate these values into the updated status schedule.
 4. A schedule of all scope changes to the contracted Services. The schedule must contain the status of the change; whether it is approved, pending approval, under impact assessment etc.; the originating source of the change, the predicted impact of the change in cost, time and other impacts and dates highlighting when the change is to progress in status.
 5. An output taken directly from the approved Design Consultant's Design Schedule comparing:
 - a. Scheduled budget value of Services (in US Dollars) per agreed phase or WBS element for the measurement period and cumulatively to date.
 - b. Progressed value of Services (in US Dollars) done for the measurement period and cumulatively to date.
 - c. Actual cost of fees and other incurred reimbursable costs (in US Dollars) for the measurement period and cumulatively to date.
 - d. A fee forecast of remaining amount to be billed (in US Dollars), per month, based on the remaining design deliverables required.
 - e. The total expected cost of the Design Consultant's Services, to conclude all work under this Contract.
 6. A budget assessment that will compare fees expended to the estimated percent complete and to the expenditure rate expected for the period up to this point.
 7. Proposed changes in personnel, updated organization chart (if required).
 8. A list of activities taken directly from the Design Schedule to be conducted through the succeeding month.

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9. An update on the level of Minority and Women Business Enterprise (MWBE) participation achieved compared to contracted goals, and actions proposed to remediate the level of participation should forecasted target levels not be reached.
10. Recovery plan for all tasks over budget or schedule constraints (if required).
11. Key performance indicators (KPIs) that clearly illustrate the performance achieved to-date by the Design Consultant.
12. Actual costs for prior month and forecasted costs for the next month.
13. Forecast through end of each Services Phase.
14. Key decisions and status associated with those key decisions.

3.09.3 PROGRESS REPORT APPROVAL

- A. The PMT Project Manager will provide a memorandum to the Design Consultant within five (5) Calendar Days following each Project Status meeting indicating acceptance or rejection of the Progress Report. In the event the Progress Report is rejected, the PMT Project Manager will identify those items requiring additional efforts to make the Progress Report acceptable and the Design Consultant will modify it, as required, to be resubmitted to the PMT Project Manager for approval.

3.10 ISSUE MANAGEMENT

- A. Design Consultant shall develop a document template for tracking design-related issues, discuss that template with the PMT, and agree upon the final format. The issue management tool will be web-based to allow approved members of the Design Consultant, the City, PMT, and CMAR the ability to review issues identified, their status, and the resolution. The template shall, at a minimum, include: the person identifying the issue, the person with whom the issue was discussed, what discipline is involved, whether the issue was resolved or further action was required, the date the issue was raised and resolved, and how the issue was resolved.
- B. The person identifying the issue will be responsible for managing the issue to its completion and that person can be a member of the Design Consultant (and Design Consultant's Subconsultants), PMT, HAS or CMAR. Upon identifying an issue, the responsible person will immediately create an issue record on the website, make appropriate contacts, obtain consensus on the issue, and file the resolution.
- C. An issue is defined as either a question or a concern of any nature related to the planning, design, or management of any project and any discipline.

3.11 PERFORMANCE METRICS

- A. KPIs will be reviewed monthly between the PMT and Design Consultant and any KPIs that are deviating from the goal will be explained and if necessary require a mitigation plan from the Design Consultant to implement and correct the deviating KPI before the

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next monthly review. The KPIs will be developed by PMT and mutually agreed with Design Consultant. KPIs may include the following areas, at a minimum:

1. Work Planning/ Scheduling/ Accuracy of Forecasted Design Deliverables
2. Work Documentation and Reporting
3. Quality of Design Deliverables
4. Design to Budget
5. Responsiveness

SECTION 4 - DESIGN AND CONSTRUCTION PHASE SERVICES

4.01 GENERAL

- A. Design Consultant shall provide a cost-effective design and present the PMT with design options that consider construction cost, schedule, and life cycle cost (total cost of ownership) analyses for informed decision-making.
- B. Design Consultant shall furnish documentation and supporting data to support presentation of design options.
- C. Design Consultant will consider the value of alternative materials, modular building components, building systems and equipment, together with considerations based on the MLIT Program Definition Manual and MLIT Planning Objectives as described within this Scope of Services, in developing a design for the Project that is consistent with the schedule and budget.
- D. The scope consists of the following phases with estimated overall percentage completion of design, under a Construction-Manager at Risk (CMAR) project delivery method:
 1. Pre-Design
 2. Concept Design (15% Design Completion)
 3. Schematic Design (30% Design Completion)
 4. Design Development (60% Design Completion)
 5. Construction Documents (100% Design Completion)
 6. Construction Services
 7. Post-Construction Services

4.02 PROJECT VISION STATEMENT

- A. Design Consultant will collaborate with the PMT and other Project stakeholders to develop a written set of design principles and publish a Project Vision Statement for all stakeholders and Design Consultant team members to execute.

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4.02.1 PROJECT VISIONING WORKSHOP

- A. Design Consultant shall within thirty (30) Calendar Days of the First Notice to Proceed for Basic Services, arrange for and facilitate a meeting of Project stakeholders, at a time mutually agreed between the City and Design Consultant, to develop the basis for the Project Vision Statement. Design Consultant will prepare the Project Vision Statement summarizing the overall goals for the Project and publish and sign-off by all Project stakeholders.

4.02.2 VISION STATEMENT

- A. Design Consultant will graphically prepare the Project Vision Statement within five (5) Calendar Days of the workshop for execution by the major stakeholders. Following preparation of the Project Vision Statement, Design Consultant will facilitate a meeting with stakeholders to sign and finalize the Statement.
- B. The Vision Statement will be approved by the HAS Director for alignment with Project objectives.

4.03 PRE-DESIGN

4.03.1 PROGRAM DOCUMENT VALIDATION

- A. Within thirty (30) Calendar Days of the First Notice to Proceed for the initial Phase of Services, Design Consultant shall review and assist in validating program areas for development of the Project Concept Design:
 - 1. IAH Utilities Master Plan; September 12, 2014
 - 2. Mickey Leland International Terminal Program Definition Manual; December 2014
 - 3. Project Definition Documents and Project Definition Manuals for enabling and related projects
 - 4. All planned projects in the areas anticipated to be studied that would enable the Design Consultant to describe the future conditions that will exist before and during construction of the proposed facilities.

4.03.2 DATA COLLECTION

- A. Design Consultant shall take reasonable precautions to verify the accuracy and suitability of any drawings, plans, sketches, instructions, information, requirements, procedures, requests for action, and other data supplied to Design Consultant (by the City, PMT or any other party) that Design Consultant uses for the Project. Design Consultant shall identify to PMT in writing any such documents or data which, in Design Consultant's professional opinion, are unsuitable, improper, or inaccurate in connection with the purposes for which such documents or data are furnished.
 - 1. The City does not warrant the accuracy or suitability of such documents or data as are furnished unless Design Consultant advises the City in writing within five

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(5) Calendar Days of uncovering the unforeseen condition, that in Design Consultant's professional opinion, such documents or data are unsuitable, improper, or inaccurate and the City confirms in writing that it wishes Design Consultant to proceed in accordance with the documents or data as originally given.

- B. Design Consultant shall make reasonable efforts to investigate any documents provided by the City and the visible existing conditions at the Project site to identify existing systems and construction which must be modified to accommodate Design Consultant's design for the Project and construction of the Project.
 - 1. Design Consultant shall identify to the PMT in writing within five (5) Calendar Days, any discrepancies between the documents and visible conditions, and shall consult with the PMT on any special measures, services or further investigations required for Design Consultant to perform its services free from material errors and omissions and to properly coordinate with existing systems and construction. This investigation shall be accomplished by registered, professional architects and engineers, as appropriate.

4.03.3 DATA COLLECTION REPORT

- A. Design Consultant will prepare a report summarizing all of the data presented to Design Consultant prior to and as part of the data collection efforts. The report will describe the impact of the data on the design efforts and will point out key decisions that are required to move the project forward.
- B. Design Consultant will attend one meeting to discuss the results of the data collection efforts and City's comments. Based on the results of the meeting, Design Consultant will prepare and deliver meeting notes related to substantive discussions, action items and documenting decisions and will update the data collection report.

4.04 CONCEPT DESIGN

- A. Concept Design establishes the scope, assesses the cost, the overall conceptual direction, and scale and relationships among the Project components. The primary objective of this design phase is to arrive at a clearly defined, feasible concept while exploring the most promising alternative design solutions.
- B. Design Consultant will prepare three (3) distinct alternative concepts in a series of drawings and models that show the general arrangement and proportions of the facility and components on the site. Design Consultant shall prepare working models and/or illustrations to help visualize the Project.
- C. At the completion of concept refinement workshops and following the selection of a preferred concept, Design Consultant will prepare further refined conceptual development drawings and indicative illustrations of spatial arrangements and functions in the overall context of the main terminal and concourse. These drawings will account for all major functional spaces, define vertical circulation, verify its feasibility, establish controlling vertical dimensions, and define quantities of space (e.g., circulation).

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- D. For the Concept Design to be complete, the recommended concept described in this Phase will include the following items at the noted level of detail:
1. Block concept drawings of major terminal spaces, by each level, and color coded by type of space.
 2. Flow diagrams which indicate the flow of inbound and outbound passengers and baggage, ITT (APM) access, aircraft movement to/from gates, and landside vehicle ground movement, and movement to /from affected adjacent terminal facilities and parking structures.
 3. Concepts to modify existing site work, structures, roads, parking, or other displaced landside elements to allow for facility construction in phases.
 4. Broad conceptual phasing drawings to illustrate major phases required to implement the concept.
 5. Primary baggage system components/routes and conceptual baggage system layout.
- E. In addition, a technical concept report will be completed and will include the following:
1. Summary of the concept refinement workshops.
 2. Identification of the concept development process including the evaluation of three (3) alternative concepts and supporting logic for selecting the recommended concept.
 3. Identification of the recommended concept with description of the major functional areas and spatial relationships.
 4. Identification of existing site preparation work to be abandoned or modified and cost justification for doing so.
 5. Description of key systems components including mechanical, electrical, plumbing, fire protection, and structural systems.
 6. Unresolved issues with recommendations for resolution.
- F. Design Consultant will consider implementation of the concept while developing it, thereby assessing the impacts that demolition of existing facilities and new construction will have on airport operations, which may vary according to construction method. Horizontal alignment to connect Terminal B-D Connector and Terminal E FIS with the Project may affect cost and future flexibility.

4.04.1 CONCEPT REFINEMENT WORKSHOPS

- A. Conduct Workshop Number 1
1. Design Consultant will facilitate a technical workshop intended to provide three (3) concept layouts, aesthetics and operational parameters to be developed further including development of block level floor plans, flow diagrams, apron layouts, parking layouts, and any layouts to demonstrate required connectivity

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with the existing Terminal B-D connector and the FIS. This task will include a detailed presentation to the City of programming that has been conducted to date and will form the basis of the design.

2. At the completion of the first workshop, Design Consultant will prepare more detailed drawings and a brief report describing in greater detail the concepts identified. The report will include assumptions made and any issues that need to be resolved to complete the concept development. Design Consultant will submit the information to the PMT Design Manager for review, will revise as requested, and then resubmit to the PMT Project Manager for distribution.

B. Conduct Workshop Number 2

1. Design Consultant will conduct the second workshop with the intent to review results of the first concept refinement workshop and to select the recommended concept. This workshop will focus on evaluating the concepts, addressing issues, and reaching consensus on the best alternative to move forward.
2. Design Consultant will use evaluation factors and criteria provided by the City in a matrix format. This scoring matrix will provide specific places to record program-based measurement of order-of-magnitude costs, program requirements, constructability/ phasing, impact to other projects, airline operations, environmental consequences, ability to meet user's needs, function and form, and factors beyond the comparative cost and functional performance of the concepts, including, but not limited to: impacts to international passengers, acceptance by Federal agencies, etc.
3. During the workshop, Design Consultant will endeavor to remedy any noted shortcomings of either concept to make each as compliant with program objectives as possible. Upon reaching consensus, additional discussions on the recommended concept may occur.

C. Workshop Summary

1. Design Consultant will present the concepts, cost estimate, evaluation, rankings, and narrative on the process in a report and presentation and will support the City and the PMT in an executive work session/briefing of the conceptual development, refinement, and selection process, with the purpose of continuing with a preferred concept as the solution.

4.04.2 DRAFT CONCEPT DESIGN REPORT

- A. Design Consultant will combine all of the information gathered during the workshops and create a draft concept design report that will support development of cost estimates. Design Consultant will present the report to the City for review and comment.

4.04.3 CONCEPT DESIGN REPORT REVIEW MEETING

- A. Design Consultant will be responsible for arranging and facilitating a meeting within fourteen (14) Calendar Days of submitting the draft concept design report to obtain

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comments on the report. The primary purpose of this meeting is to address any major comments or questions from the Design Consultant's cost estimator, the City, PMT, and the CMAR.

4.04.4 FINAL CONCEPT DESIGN REPORT

- A. Based on comments received during the concept design report review meeting, Design Consultant will update the draft report. Design Consultant will present the updated report to the Design Manager for review and will address comments leading to the development of the final concept design report. Design Consultant will submit the final concept design report to the PMT Project Manager for distribution.

4.04.5 CONCEPT DESIGN REPORT – BASIS OF DESIGN

A. General

- 1. Provide documentation related to:
 - a. Design charrettes/ workshops/ information data collection sessions
 - b. Information exchange/ team meetings/ design and decision registers
 - c. Partnering and team building sessions; and
 - d. Quality management process followed by the Design Team
 - e. Summary of program of requirements

B. Basis of Design

- 1. The Basis of Design (BOD) is a preliminary narrative that is intended to provide a summary of the Concept Design and enable development of the construction cost estimate. The BOD documents thought processes and assumptions behind design decisions to meet the City's project requirements. Design Consultant shall update the BOD at completion of each design phase for City review. The BOD includes, but is not limited to, the following:
 - a. Project Definition
 - b. Project Scope Description
 - c. Total Building Square Footage (SF) – Block Plan
 - d. Functional Space Requirements – SF
 - e. Building Superstructure, Foundation, and Exterior Closure Description
 - f. Finishes Descriptions
 - g. Building Code or Standards Requirement - Summary code outline
 - h. Plumbing, Fire Protection, and Mechanical Systems - system type and total capacity, narrative and quantities, general sizes and number of systems

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- i. Electrical Systems - electrical system capacity and general system concept
 - j. Communication Systems
 - k. Life Safety Requirements
 - l. Security System - Confirm HAS requirements
 - m. Soils and Hydrology Report - Provide assumed foundation strategy
 - n. Vertical and Horizontal Conveying System Narratives - Consultant narrative to be included
 - o. Wind Impact - Consultant narrative to be included
 - p. Energy and Sustainability concepts
- C. Drawings and Models
- 1. Site Zoning Diagram, indicating:
 - a. General size and location of elements
 - b. Existing Site Plan
 - c. Demolition Diagram
 - 2. Site Plan, indicating:
 - a. Outline of all structures
 - b. Dimensions for each building component
 - 3. Construction Phasing and Sequencing Diagrams
 - 4. Utility Plan and/or Diagrams
 - a. Provide diagram and narrative of utilities location to the construction boundary
 - b. Identify utilities connection points
 - c. Confirm sufficient capacity at site boundary
 - 5. Building:
 - a. Architectural floor and roof plans
 - b. Life safety diagrams
 - c. Preliminary Section/Elevation Drawings with Overall Dimensions
 - d. Foundation and Superstructure diagrams

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- e. Plumbing, Fire Protection, Mechanical, and Electrical Conceptual Floor Plans and Single-line diagrams.
 - f. Communications Conceptual Floor Plans and Single-line diagrams
- D. Budget, Schedule and Risk Analysis
- 1. Design Consultant's cost estimate and technical memorandum on cost estimate reconciliation
 - 2. Schedule: Identify key project dates
 - 3. Risk Implications and Mitigation Strategies: Identify the various risks associated with the conceptual design and initial mitigation strategies
- E. Terminal Design Guidelines
- 1. Prepare design guidelines based on the HAS draft terminal building design guidelines to be provided to Design Consultant at issuance of the First NTP for Basic Services. Design Consultant shall prepare the terminal design guidelines for new terminal building construction based on the MLIT design concepts. HAS intends to adopt the terminal design guidelines for use on future new building construction.

4.04.6 PREPARATION OF GRAPHICS FOR CITY PUBLIC PRESENTATIONS

- A. Design Consultant will assist the PMT in developing display materials for use in public meetings which may include the Houston City Council and other forums. Design Consultant will assist with developing materials for public meetings consisting primarily of presentation boards and use of presentation software such as PowerPoint if requested by the PMT. Design Consultant will also assist in the development of graphics for distribution to local news organizations.

4.04.7 QUALITY CONTROL

- A. Design Consultant shall perform internal quality control reviews at the end of the each Phase. The results of these interdisciplinary, peer, and independent reviews shall be submitted to the PMT.

4.05 SCHEMATIC DESIGN

- A. Based on the mutually agreed upon Concept Design, the Agreed Cost of the Work, and Design Consultant's schedule, Design Consultant shall prepare sufficient alternative approaches to design and construction of the Project to satisfy the City's requirements and shall, at completion of this phase, submit Schematic Design Documents in accordance with the Contract. Design Consultant must obtain written approval from the PMT before proceeding with Phase 3 – Schematic Design Services.
- B. Design Consultant shall review alternative approaches to design and construction for the Project and the Schematic Design Documents as they are being prepared at intervals appropriate to the progress of the Project with the PMT and CMAR. The

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Schematic Design Documents shall establish the design for all components of the Project. Design Consultant's scope during this Project Phase is based on the Concept Design Report (program, Basis of Design, concept design), construction schedule, and Agreed Cost of the Work.

- C. Schematic Design Documents shall further develop the conceptual design established in Phase 2 - Concept Design and confirm that functional relationships for all components are adequate for the Project. Deliverables shall include drawings, lists of assumptions, updated programmatic criteria, Basis of Design report, preliminary design calculations, preliminary cost estimates, project schedules and investigative surveys.
- D. The Schematic Design Phase is completed upon the PMT's approval of the Schematic Design Basis of Design Report.

4.05.1 PROGRAM COMPARATIVE ANALYSIS

Design Consultant shall develop a comparison to the Program document based on the recommended Concept Design that will serve as the basis for tracking further Program requirements through Design Development.

4.05.2 SCHEMATIC DESIGN DELIVERABLES

- A. Deliverables shall include:
 - 1. Design Consultant's letter of transmittal,
 - 2. Certification that the lead design professional in each discipline has coordinated deliverables with those of the other disciplines involved in the Project,
 - 3. Certification of compliance with Program, budget and schedule requirements,
 - 4. Drawings and outline specifications to communicate decisions and design developed to a Schematic Design level,
 - 5. Schematic Design Report
 - 6. Models, renderings, and BIM model
 - 7. Material and finishes boards
 - 8. Schematic level estimate of the probable Cost of the Work
 - 9. Electronic files of all deliverable items in their native language/format and PDF format.

4.05.3 SCHEMATIC DESIGN REPORT

- A. Design Consultant shall prepare a final report to assemble the Schematic Design information prepared under this Phase. The Schematic Design Report shall also include outstanding issues, identification of additional studies, if required, and recommendations of long-lead purchase items. The document will be prepared in draft, final draft, and final report form, 11 x 17 format, and will be issued in electronic format

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(including a PDF and native-format versions of the final report and full-resolution files of all included images).

B. The Schematic Design Report will include, but not limited to, the following sections:

1. Basis of Design – Updated from Concept Design for approved Owner changes
2. Terminal Building Operations Report
3. Models and Renderings
4. Materials and Finishes Report
5. Geotechnical Report (if required)
6. Terminal Structural Systems Report
7. MEP/FP Systems Report
8. Code Analysis Report
9. Security Assessment Report
10. Baggage Handling System Report
11. Signage and Graphics Report
12. Concessions Report
13. Aircraft Parking Layout Plans
14. Aircraft Maneuvering Plans
15. Ramp Equipment Maneuvering Plans
16. Art Integration Report
17. Technology and Special Systems Report
18. Other Terminal Building Systems Report
19. Energy and Sustainability Design Report
20. Phasing and Implementation Plan
21. Outline Specifications

C. Basis of Design

1. The Basis of Design (BOD) is a critical element of the Schematic Design Report. It shall provide a comprehensive, detailed, technical, narrative description of the complete Project scopes of work and all components of the design in each discipline, to ensure that Design Consultant possesses a thorough understanding of the Project's scope (which may not be fully evident based on preliminary drawings submitted for phase review). It shall demonstrate that each discipline has sufficiently anticipated the requirements and features of the design through

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to completion. Failure to submit a comprehensive, detailed Basis of Design will cause the entire Schematic Design submittal to be rejected. Design Consultant shall update the BOD at subsequent submittals. (Please note: should there be any changes made from the BOD, those changes must be approved by HAS.

2. The BOD shall primarily be a full narrative description of the Project as it will ultimately appear on the construction documents, summarizing the investigation findings and supported by the analyses and calculations from each design discipline. The BOD shall assemble all design information prepared under this Phase. It shall also include: a list of assumptions, a summary of the evolution of Schematic Design, beginning with the concept planning criteria documents, and comparative analysis of the design to the concept facility space program; a discussion of the overall design concept and massing and the specific concept for the terminal building; major design decisions with regards to systems, form, size, quantity, materials, appearance and quality; explanation of impacts on or by other projects; outstanding issues; identification of additional studies, if required; recommendations for long-lead purchase items, and identification of any outstanding issues and considerations to be resolved prior to beginning the next Phase of design.
3. The BOD shall include a detailed Design Schedule for the remaining phases of design and a preliminary construction schedule developed through coordination with the CMAR.
4. The BOD shall be included in the Schematic Design Report and shall be updated from Concept Design.

D. Terminal Building Operations Report

1. Design Consultant shall prepare a Terminal Building Functions Report including a narrative detailing how the building functions operationally.
2. The report shall also include passenger flow diagrams displaying the path of originating, connecting, and terminating passengers from their point of entry into the international terminal complex through their point of exit.
3. The report shall include emergency exit flow of occupants for all levels of the facility.
4. Additionally, the report shall include a listing of terminal tenants by type (e.g. airline, federal agency, commercial) and the building level(s) they will occupy.
5. Finally, the report shall include a narrative describing how goods and services will move into and through the building.
6. The Terminal Building Functions Report will be included in the Schematic Design Report.

E. Models and Renderings

1. Design Consultant shall prepare massing model(s) as required to illustrate the recommended Schematic Design. Massing model(s) shall extend to include

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structures and areas that are in direct contextual relationship with the proposed structure. The model shall be delivered to the PMT.

2. Design Consultant shall prepare study models of the Schematic Design, illustrating a three-dimensional representation of the entire project site. The number of models will be appropriate to show the design of the facility at this Phase of design. The building and structures may be shown in simple detail showing the schematic forms, initial material considerations, and with only major openings indicated. The models shall be built at a scale suitable to be transported.
3. Design Consultant shall prepare a 3-dimensional animation depicting movement through the major interior spaces and a “flyover” around the exterior of the entire project using BIM tools. Full-resolution electronic files of the animation in a format suitable for use in a PowerPoint presentation shall be delivered with the other electronic information.
4. Prepare full-color renderings (exterior and interior), suitable for public display (including matting, cover glass and framing); quantity of renderings and sizes to be confirmed during design.
5. Photographs of the massing and study models, renderings, and key stills from the model shall comprise the Models and Renderings to be included in the Schematic Design Report. Full-resolution electronic files of all included illustrations and renderings in their native format shall be delivered with the other electronic information.

F. Material and Finishes Report

1. Definitions of general levels of finishes to be provided within public areas will be specified. The level of finishes of each tenant space will be based regarding the leasing policy for various IAH tenants.
2. A narrative and photograph of the material and finishes board shall comprise the Material and Finishes Report to be included in the Schematic Design Report. Full-resolution electronic files of all included pictures in their native format shall be delivered with the other electronic information.

G. Geotechnical Engineering Report

1. If, based on the evolution of the design, additional geotechnical analysis is required beyond that performed by the City, Design Consultant may be required to hire and direct a geotechnical engineering company to perform soil investigations and prepare reports appropriate for the Project. The geotechnical scope of work will include, at a minimum:
 - a. Borings and other soil sampling necessary to provide adequate design criteria for the subgrade and/or foundation types envisioned for the projects and to establish construction requirements for the projects.
 - b. Laboratory and office analysis of the soil and/or rock samples, including rock quality and bearing capacity. In the case of embankments, settlement, consolidation and slope stability will be included in the analysis.

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2. Preparation of a geotechnical report shall be based on the loads provided by the Design Consultant. In addition to design criteria for proposed structures, this report will consider impacts, if any, on adjacent existing or proposed structures. Sufficient data will be provided such that the Design Consultant and CMAR can prepare reasonable quantity and cost estimates for the proposed Work. The Geotechnical Report shall be included in the Schematic Design Report.

H. Terminal Structural Systems Report

1. The Terminal Structural Systems Report shall include a narrative indicating the building code under which the building structure is being designed and descriptions of the foundation system and roof structure, the approach to blast protection, and identification of any structural members that may require long lead times for procurement.
2. The report shall also include a design criteria table identifying live loads, dead loads, wind loads, and special loads (e.g. aircraft, aircraft pushback tractors, baggage tugs). A material properties table shall be included to identify required concrete strengths and ASTM standards for reinforcing and structural steel.
3. The Terminal Structural Systems Report shall be included in the Schematic Design Report.

I. MEP/FP Systems Report

1. The mechanical, electrical, plumbing, and fire protection (MEP/FP) report shall include an assessment of the existing MEP/FP systems in and around the Project site and describe the method by which those services will be incorporated into the Project.
2. The plan for providing MEP/FP services to the Project site shall include design criteria for the heating, ventilating, and air conditioning system including air distribution (including tenant areas), natural gas distribution, a discussion of building automation and controls systems, fire alarm and protection systems, electrical systems to provide power to all systems (provide list) including allowances for tenant areas, emergency power systems, grounding system, airline equipment battery charging systems, plumbing systems including aircraft potable water system and type/quantity of plumbing fixtures, the 400 Hz aircraft power system, the aircraft preconditioned air system, interior, exterior, and apron lighting systems, and lighting control systems.
3. The MEP/FP Report shall be included in the Schematic Design Report.

J. Code Analysis Report

1. A code summary report shall be published summarizing applicable requirements for all disciplines, based on review of applicable codes and regulations of government agencies and underwriters having jurisdiction. Design Consultant shall directly contact each agency to confirm Design Consultant's understanding of applicable codes and criteria.

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2. Documentation of regulatory agency requirements and Authority-Having-Jurisdiction requirements, and possible impacts of these requirements on project cost, scope and schedule shall be included in the report.
 3. The report shall address fire protection and life safety codes and will include tables and drawings depicting the occupancy and loading factors for each level of the building.
 4. The report shall also list all applicable Americans with Disabilities Act (ADA) requirements, identify key issues, and present the plan to comply with the requirements.
 5. The Code Analysis Report shall address primary requirements of applicable regulations. The analysis shall be submitted to the PMT in the Schematic Design Report.
- K. Security Assessment Report
1. The Security Assessment Report shall provide a narrative discussing the design approach to address all security codes, standards, and guidelines. It will identify facility operational requirements and address the physical security provisions to be included in the design.
 2. The report will also include demarcation plans by level depicting boundaries between public, FIS sterile, security sterile, and SIDA/secured areas.
 3. The Security Assessment Report shall be included in the Schematic Design Report.
- L. Baggage Handling System Report
1. The Baggage Handling System (BHS) Report will include a narrative and line drawings with critical dimensions established for coordination.
 2. The narrative will include a summary of the proposed BHS and system description. It will also include a discussion of alternatives considered during evolution of design as well as a description of proposed BHS equipment components including control systems, system functionality and environmental requirements. System operational noise levels, structural loading, clearances, elevations, electrical loads, and other miscellaneous coordination issues shall also be included.
 3. The report shall address the paths for normal and oversized baggage as well as non-conveyable items (e.g. pets) from the main and recheck check-in counters to all gates served by the terminal.
 4. While a baggage handling system simulation is not required at this stage, Design Consultant shall prepare a math model indicating transit times for inbound, outbound, and connecting baggage.
 5. The Baggage Handling System Report shall be included in the Schematic Design Report.

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M. Signage and Graphics Report

1. The Signage and Graphics report shall include a narrative discussion of the methodology, location plans indicating types and locations of signs for the new terminal and connecting concourse and pedestrian walkways, passenger path of travel plans, exterior sign location plans, signage concepts, type and color studies, symbols, and a list of messages.
2. The Signage and Graphics Report shall be included in the Schematic Design Report.

N. Concessions/ Tenants Report

1. Design Consultant shall review previous concessions reports prepared for the PMT and information provided in the MLIT Program Definition Manual. Once familiar with these materials, the Design Consultant shall meet with PMT and stakeholders designated by PMT to discuss concessions requirements for the Project.
2. Design Consultant shall prepare a Concessions Report as part of the Schematic Design Report that shall include goals and objectives of the MLIT concessions program, a concessions space program with a quantitative assessment of concessions space requirements and locations identified, and a schematic-design level outline and discussion of concessions design criteria and standards.
3. The Concessions/ Tenants Report shall be included in the Schematic Design Report.

O. Aircraft Parking Layout Plans

1. Design Consultant shall prepare schematic aircraft parking layout plans for all scenarios pursuant to the MLIT Program Definition Manual under which the new terminal building will operate. Schematic layout will locate lead-in lines, taxi lanes, ground service equipment staging areas, and airside vehicle parking spaces. Drawings will display templates for all authorized aircraft types at each lead-in line.
2. The Aircraft Parking Layout Plans shall be included in the Schematic Design Report.

P. Aircraft Maneuvering Plans

1. Design Consultant shall prepare aircraft maneuvering plans, coordinated with the airlines, airport operations the FAA control towers and the ARFF stations, for all aircraft expected to use the gates for all scenarios pursuant to the program document under which the concourse will operate. The plans will indicate taxi-in, pushback, and taxi-out paths to/from all gates from/to all adjacent taxiways via taxilanes. Aircraft holding positions and de-icing positions on the apron(s) will also be shown.
2. The Aircraft Maneuvering Plans shall be included in the Schematic Design Report and be updated as required to produce documents that follow the direction of the FAA Advisory Circulars and airport operations.

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Q. Ramp Equipment Maneuvering Plans

1. Design Consultant shall prepare ramp equipment maneuvering plans, coordinated with the airlines and airport operations, the FAA control towers and the ARFF stations, for all scenarios under which the new terminal building will operate. Schematic layout will locate pre-arrival ground service equipment staging for all equipment to be stored on the apron and post-arrival positions for all equipment that will service the aircraft. Equipment travel paths for all services and equipment will be indicated on the plans.
2. The Ramp Equipment Maneuvering Plans shall be included in the Schematic Design Report and be updated as required to produce documents that follow the direction of the FAA Advisory Circulars.

R. Art Integration Report

1. Design Consultant will meet with appropriate entities within the City, as identified by the City, to discuss objectives, budgets and requirements of the City's Art Program. Opportunities and options for integration of art into the Project will be presented and discussed at working sessions attended by the Design Consultant and the HAS Art Curator and Houston Arts Alliance stakeholders. Design Consultant will prepare a narrative describing the outcome of these meetings. The updated site and floor plans will identify locations of opportunities for art, to include both the incorporation of major permanent works and display areas for temporary exhibits.
2. Art installations will be incorporated into the MLIT in accordance with the City of Houston's 1999 Civic Art Ordinance stating that 1.75% of vertical construction monies in City-managed projects should be allocated to art beautification. Three types of art will be incorporated:
 - a. Integrated/Permanent Art which will be works generally of a large nature installed as part of the architecture, with a view of being permanent and lasting the life of the architecture. Suitable locations, centrally located at places of gathering or high traffic nodes, with double height spaces and significant natural or artificial light, will be determined during design.
 - b. Portable/Rotating Art locations will be able to accommodate rotating collections of general flat work (photography, paintings, etc.) and small 3D objects (sculptures or worked pieces of a moderate size), Locations could be a gallery space or display cases in public areas with high passenger flow. Free-standing display cases (acquired separately by HAS) would be installed in different areas of the terminal and relocated at will. These would have electrical power for internal lighting, and therefore secured power outlets would need to be built flush into the floor in locations identified for these portable displays. Locations would also be identified for integration of permanent cases built into the walls.
 - c. Multi-Media display locations should be identified. Large media walls would require computer interfaces to handle audio and visual aspects of digital works. Location should include high-speed internet connectivity, ample

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power supply and ventilation to handle operation of multiple large screen monitors, computer, audio and lighting systems. The space should be flexible to allow for future technological systems to be installed.

3. The Art Integration Report shall be included in the Schematic Design Report.

S. Special Systems Report

1. The Special Systems Report shall present an overview of all low-voltage systems including, but not limited to: Flight Information Display System (FIDS), Baggage Information Display Systems (BIDS), Common Use Terminal Equipment (CUTE), Common-Use Self-Service (CUSS) kiosks, Public Address (PA), Master Antenna Television (MATV), Building Management System, Dynamic Signage/Wayfinding Systems, Passenger tracking for checkpoint wait times, Premises Distribution Systems, voice/ data network system, access control system, telecommunications (IT) infrastructure, and WiFi system.
2. The Special Systems Report shall be included in the Schematic Design Report.

T. Other Terminal Building Systems Report

1. The Other Terminal Building Systems Report shall include design criteria for the passenger boarding bridges, gate support equipment (i.e., preconditioned air, ground power and potable water system), aircraft docking systems, passenger conveying systems (including elevators, escalators, and moving walkways), passenger and employee screening systems, building maintenance systems, and any other systems identified during design but not covered in another section of the Schematic Design Report.
2. The Other Terminal Building Systems Report shall be included in the Schematic Design Report.

U. Energy and Sustainability Design Report

1. The Energy and Sustainability Report shall describe the plan for incorporating sustainability procedures and practices in the Project's design, construction, and operation. Design Consultant shall during the course of design, strive to achieve a high-performance building standard that complies with the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) standards without submission for LEED certification.
2. The report shall include a narrative summarizing the results of a LEED audit to be performed by the Design Consultant and a table delineating each available LEED credit and whether it falls into the "yes" category (items for which the requirements for the credit were already included in the design or which could be incorporated with little or no additional effort), the "maybe" category (items for which credit is possible but which would require additional construction capital cost), or the "no" category (items for which the credit is not feasible, possible, or practical for this Project).

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3. The report shall include a presentation of the completed analysis of the maintainability aspects of the proposed schematic design and the total cost of ownership of building systems.
4. Design Consultant shall coordinate recommended energy and sustainability Project opportunities with the HAS Sustainable Management Plan.
5. The Energy and Sustainability Design Report shall be included in the Schematic Design Report.

V. Phasing and Implementation Plan

1. HAS must maintain operation of its existing facilities, including terminal buildings, airside ramps and associated taxiways, and landside roadways, during construction of this Project. Design Consultant in collaboration with the PMT and CMAR, shall perform a coordinated analysis of stakeholder needs, constructability issues, testing and Commissioning schedules, and integration with the Project Schedule, to form a basis of documentation of the phasing plans. Phasing studies shall include:
 - a. Preliminary phasing plans, illustrating a proposed sequence of construction, in block plan format. The focus will be on “soft” issues, such as maintenance of operations and gate capacity, clarity of public circulation, extent of temporary partitions, and options for temporary gates.
 - b. Review of these preliminary diagrams with the City, PMT and project stakeholders to assess their impact on the proposed construction schedule (and vice versa).
 - c. Revision of phasing diagrams to reflect results of the review with City, PMT and project stakeholders.
 - d. Presentation of phasing diagrams to airline and tenant representatives.
 - e. Identification of anticipated cost and schedule impacts related to the selected phasing approach.

W. Outline Specifications

1. An outline specification, including major materials and equipment for the Project will be prepared following the current edition of The Construction Specifications Institute (CSI) Manual of Practice and MasterFormat Master List of Titles and Numbers for the Construction Industry. The list will establish the appropriate overall character and level of quality, and will be properly reflected in the estimate of the probable Cost of the Work.
2. Design Consultant shall provide those specification sections for work typically described by MasterFormat Divisions 2-43. For Division 1, Design Consultant shall obtain from the PMT Project Manager the current version of the City Construction Contract General Conditions and Construction Contract Special Conditions and will develop, coordinating with the CMAR (to eliminate conflicts with the CMAR Contract) and the PMT, all applicable Division 1 specification

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sections, to include description of work restrictions, special access or security requirements, and a detailed Summary of Work. Design Consultant will provide a complete listing of all specification sections in the Schematic Design Report (the Outline Specification itself is a separate deliverable as part of the Schematic Design Drawings and Specifications).

X. Cost Estimate

1. Design Consultant's cost estimate and technical memorandum on cost estimate reconciliation.

Y. Quality Control

1. Design Consultant shall perform internal quality control reviews at the end of the each Phase. The results of these interdisciplinary, peer and independent reviews shall be submitted to the PMT.

4.06 DESIGN DEVELOPMENT

- A. Based on the approved Schematic Design Documents and any adjustments to the Basis of Design or agreed Cost of the Work authorized by HAS, Design Consultant shall prepare, for approval by the PMT, and review by the CMAR, Design Development Documents that illustrate and describe the components of the Project, establish scope, cost, relationships, forms, size, appearance and quality. Deliverables shall consist of Drawings, Specifications and other documents required to fix and describe the size and character of the entire Project as to civil, architectural, structural, plumbing, fire protection, mechanical, electrical, and communication systems, materials and such other elements as may be appropriate.
- B. Design Consultant shall review the Design Development Documents as they are being prepared at intervals appropriate to the progress of the Project with HAS, PMT and CMAR. Design Consultant must obtain written approval from the PMT before proceeding with this Phase of the Services.
- C. The CMAR will be expected to establish the Project Guaranteed Maximum Price at completion of this Phase.

4.06.1 DESIGN DEVELOPMENT REPORT

- A. Design Consultant shall prepare a final report to assemble the Design Development information prepared under this Phase. The Design Development Report shall also include outstanding issues, identification of additional studies, if required, and recommendations of long-lead purchase items. The document will be prepared in draft, final draft, and final report form, 11 x 17 format, and will be issued in electronic format (including a PDF and native-format versions of the final report and full-resolution files of all included images).
- B. The Design Development Report will include the following sections as submitted under the previous Schematic Design Phase of services developed to the Design Development level:

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1. Basis of Design – updated from Schematic Design
2. Terminal Building Operations Report
3. Models and Renderings
4. Materials and Finishes Report
5. Geotechnical Report – if required
6. Terminal Structural Systems Report
7. MEP/FP Systems Report
8. Code Analysis Report
9. Security Assessment Report
10. Baggage Handling System Report
11. Signage and Graphics Report
12. Concessions Report
13. Aircraft Parking Layout Plans
14. Aircraft Maneuvering Plans
15. Ramp Equipment Maneuvering Plans
16. Art Integration Report
17. Technology and Special Systems Report
18. Other Terminal Building Systems Report
19. Energy and Sustainability Design Report
20. Phasing and Implementation Plan
21. Specifications
22. Cost Estimate
 - a. Design Consultant's cost estimate and technical memorandum on cost estimate reconciliation.

4.06.2 PROCUREMENT PACKAGE DOCUMENTATION

- A. Design Consultant shall provide multiple procurement package documents in collaboration with the CMAR to support the construction schedule. The procurement packages will be released at different times, which will require Design Consultant to prioritize the work and provide separate design submittals for approval.

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4.06.3 SCHEMATIC DESIGN REVIEW COMMENTS

- A. Design Consultant shall respond in writing to the comments prepared by the Project Team for the previously submitted Schematic Design Documents.

4.06.4 DRAWINGS

- A. Design Consultant shall provide drawings for the separate design submittals in the format as described within Section 7 of this Scope of Services.

4.06.5 PROJECT MANUAL WITH TECHNICAL SPECIFICATIONS

- A. Design Consultant shall provide the project manual for the individual design submittals in the format as described within Section 7 of this Scope of Services.

4.06.6 MODELS AND VIDEOS

- A. If requested and approved by the City, Design Consultant shall construct models as described below:
 - 1. A finished architectural model of the approved Schematic Design illustrating a three-dimensional representation of the entire Project site, including a depiction of each construction phase and including new and existing buildings and structures, site improvements, topography, cars, people, roadways, and taxiways. The purpose of this model shall be to serve as a presentation tool for the approved Project design.
 - 2. A large scale cutaway model of the building, which shows spatial relationships of the major public spaces, including exterior and interior finishes.
- B. Design Consultant shall produce a minimum of two (2) videos at completion of design milestones to be determined by the City: one at completion of Concept or Schematic Design and one at completion of Construction Documents.

4.06.7 QUALITY CONTROL

- A. Design Consultant shall perform internal quality control reviews at the end of the each Phase. The results of these interdisciplinary, peer and independent reviews shall be submitted to the City.

4.07 CONSTRUCTION DOCUMENTS

- A. The purpose of this phase is to prepare completed construction Contract Documents, satisfying all previous design review comments and suitable for public bidding and construction. Based on the approved Design Development Documents and any further adjustments in the scope or quality of the Project or in the agreed Cost of the Work and Project Schedule authorized by HAS, Design Consultant shall prepare, for approval by the HAS, Construction Documents consisting of Drawings, Specifications, cost estimate and schedule setting forth in detail the requirements for construction of the Project.

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- B. Design Consultant must obtain a written Notice to Proceed (NTP) from HAS before proceeding with this Phase of the Services.

4.07.1 GENERAL REQUIREMENTS

- A. Based on the approved Design Development Documents and any further adjustments in the scope or quality of the Project or in the agreed Cost of the Work authorized by the PMT, Design Consultant shall prepare, for approval by the PMT and review by the CMAR, Construction Documents consisting of Drawings and Specifications in accordance with City's written requirements setting forth in detail the requirements for construction of the Project, including, without limitation, requirements contained in the Contract.
- B. Design Consultant will be responsible for managing the design to stay within the agreed Cost of the Work. Design Consultant shall review the Construction Documents as they are being prepared at intervals appropriate to the progress of the Project with HAS, the PMT and CMAR.
- C. Design Consultant shall advise HAS, the PMT and CMAR on matters such as construction phasing and scheduling, bid or proposal alternates, special cash allowances, liquidated damages, the construction contract time period, and other construction issues appropriate for the Project. Design consultant shall assist the PMT and CMAR in the preparation of the necessary bidding information, bidding forms, RFP information, and RFP forms, and the Conditions of the Contract.

4.07.2 DESIGN DEVELOPMENT REVIEW COMMENTS

- A. Design Consultant shall respond in writing to the comments prepared by the PMT for the previously submitted Design Development Documents.

4.07.3 CONSTRUCTION DOCUMENTS (PROGRESS)

- A. The purpose of this submittal is to determine that all major features of design are progressing in accordance with prior direction, that major architectural and engineering decisions have been made, that most drawings and other documents are well advanced, and that general plans and sections of the drawings and calculations are appropriately advanced. This submittal is also to demonstrate agreement with the practices, policies, criteria, directives and standards that have been adopted and approved by the PMT for the Project.

4.07.4 CONSTRUCTION DOCUMENTS (FINAL REVIEW)

- A. This submittal shall comprise completed construction Contract Documents, satisfying all previous review comments and suitable for public bidding and construction. Final quality control elements performed by Design Consultant such as inter-discipline coordination, peer reviews and document and calculation checking shall be completed and incorporated. Any work remaining at this stage shall be only minor corrections to resolve discrepancies discovered during the final review. Included as part of this design

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submittal will be a construction submittal schedule, which will list all items by specification section, that is to be submitted by the CMAR for review and approval.

4.07.5 PROCUREMENT PACKAGE DOCUMENTATION

- A. Design Consultant shall provide multiple procurement package documents in collaboration with HAS, the PMT and CMAR to support the construction schedule. The construction packages will be released at different times, which will require Design Consultant to prioritize the work and provide separate design submittals for approval.

4.07.6 QUALITY CONTROL

- A. Design Consultant shall perform internal quality control reviews at the end of the each Phase. The results of these interdisciplinary, peer and independent reviews shall be submitted to the PMT.

4.08 BID PACKAGING AND PERMITTING

- A. In conjunction with the development of the Guaranteed Maximum Price and at other times as appropriate to the Project, Design Consultant shall assist HAS, the PMT, and CMAR by answering inquiries from bidders and proposers at the City's request, and shall prepare and issue any necessary addenda to the bidding or proposal documents.
- B. Permitting
 - 1. Design Consultant is responsible for designing the Project in accordance with all applicable local, state, and federal codes and standards to enable permits to be obtained from the City of Houston and other governmental agencies for approval and/or construction.

4.09 CONSTRUCTION SERVICES

4.09.1 GENERAL

- A. Design Consultant must obtain a written Notice to Proceed (NTP) from the City before proceeding with this phase of the Services.

4.09.2 AUTHORITY

- A. Design Consultant will advise and consult with HAS and the PMT during Construction Services. Design Consultant will have authority to act on behalf of HAS only to the extent provided in Contract. Design Consultant will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, nor will Design Consultant be responsible for the CMAR's failure to perform the Work in accordance with the requirements of the Contract Documents.

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4.09.3 PROJECT SITE VISITS

- A. Design Consultant shall have responsible staff to observe and record in a report format on the Work while it is in progress. Staff will be expected to be onsite and will be provided space within the PMO Building, during any construction activity that is taking place for review of such work and consultation with HAS, the PMT team and the CMAR. Staff shall have requisite skills and experience that constitute the disciplines of work they are responsible for and representative of the key sub consultants utilized on the Project. They may be asked to participate in weekly construction meetings.
1. Staff will primarily be the interface and resolution coordinators for field issues encountered during construction and the home design team staff.
 2. Staff shall also report to the PMT immediately any and all observations of the CMAR to include but not limited to any;
 - a. safety concerns or hazards observed on the site;
 - b. work in progress or in place that deviates from the Contract Documents;
 - c. deviations from the most recent construction schedule submitted by the CMAR; and
 - d. any and all defects and deficiencies observed in the Work.
- B. Principals and or Project Managers will be required to periodically visit the Project site at regular intervals or as otherwise agreed to by the PMT and Design Consultant, to become familiar with progress and quality of the portion of the Work completed, and to determine if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. On the basis of the site visits, Design Consultant will keep HAS and the PMT informed about the progress and quality of the portion of the Work completed, and report to the PMT known:
1. deviations from the Contract Documents;
 2. deviations from the most recent construction schedule submitted by the CMAR; and
 3. defects and deficiencies observed in the Work.

4.09.4 NON-CONFORMING WORK

- A. Design Consultant will advise the PMT when it is necessary to reject Work that does not conform to the Contract Documents. Whenever Design Consultant considers it necessary or advisable, Design Consultant will have the authority to require inspection or testing of the Work in accordance with provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed. Neither this authority of Design Consultant nor a decision made in good faith either to exercise or not to exercise such authority will give rise to a duty or responsibility of Design Consultant to the CMAR, Subcontractors to the CMAR, material and equipment suppliers, their agents or employees or other persons or entities performing portions of the Work.

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4.09.5 INTERPRET CONTRACT DOCUMENTS

- A. Design Consultant will advise on matters concerning the requirements of the Contract Documents on written request of HAS or the PMT. Design Consultant's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. Interpretations and decisions of Design Consultant will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings.

4.09.6 CERTIFICATES FOR PAYMENT TO CMAR FOR CONSTRUCTION

- A. Design Consultant will be asked to consult with the PMT for the review of the CMAR progress payment applications. Based on observations, test reports and other collected and witnessed data, the Design Consultant may be asked to concur that the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to:
1. An evaluation of the Work for conformance with the Contract Documents upon Substantial Completion;
 2. Results of subsequent tests and inspections;
 3. Correction of minor deviations from the Contract Documents prior to completion; and
 4. Specific qualifications expressed by Design Consultant.

4.09.7 SUBMITTALS

- A. In accordance with the approved submittal schedule, Design Consultant will review and approve or take other appropriate action upon the CMAR's submittals such as Shop Drawings, Product Data and Samples (collectively "Submittals") as follows:
1. Design Consultant will review submittals and return comments to the PMT within twenty-one (21) Calendar Days or as mutually agreed upon by Design Consultant, CMAR and PMT. Design Consultant's action in reviewing submittals will be taken in accordance with the approved submittal schedule or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in Design Consultant's professional judgment to permit adequate review. Basic Services include no more than two (2) reviews per each submittal. Design Consultant will review each submittal after the CMAR provides written confirmation that it conforms to: (a) the requirements of the Contract Documents (or reflects approved deviations therefrom); (b) existing field conditions; and (c) other conditions that affect incorporation of the submittal into the Work.
 2. Design Consultant will review each submittal only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Review of a Submittal is not for the purpose of determining the accuracy and completeness of other information such

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as dimensions, quantities, and installation or performance of equipment or systems, which are the CMAR's responsibility. Design Consultant's review will not constitute approval of safety precautions or of any construction means, methods, techniques, sequences or procedures.

3. If the Contract Documents specifically require the CMAR to provide professional design services or certifications by a design professional related to systems, materials or equipment, Design Consultant will specify the appropriate performance and design criteria that such services must satisfy. Design Consultant will review shop drawings and other submittals related to the Work designed or certified by the design professional retained by the CMAR that bear such professional's seal and signature when submitted to Design Consultant. Design Consultant will be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by such design professionals.
4. Design Consultant will maintain a record of submittals and copies of submittals supplied by the CMAR in accordance with the requirements of the Contract Documents.

4.09.8 REQUESTS FOR INFORMATION

- A. Design Consultant will review properly prepared, timely requests by the CMAR or the PMT for additional information about the Contract Documents ("RFI"). A properly prepared RFI about the Contract Documents will be in a form prepared or approved by HAS and the PMT and will include a detailed written statement that indicates the specific drawings or specifications in need of clarification and the nature of the clarification requested. Design Consultant may provide additional requirements for RFIs in the Contract Documents and may return without response any request that does not reasonably comply with the requirements stated in the Contract Documents. Design Consultant's response to RFIs will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, Design Consultant will prepare and issue supplemental drawings and specifications in response to RFIs.

4.09.9 CHANGES IN THE WORK

- A. Design Consultant may authorize minor changes in the Work that are consistent with the intent of the Contract Documents and that do not involve an adjustment in the Cost of the Work or an extension of the time for performance of Work. If requested by the PMT, Design Consultant will prepare Change Orders and construction change directives for the PMT approval and execution in accordance with the Contract Documents. Design Consultant will maintain records relative to changes in the Work.

4.09.10 PROJECT COMPLETION

- A. Design Consultant will:
 1. Conduct inspections to determine the date or dates of Substantial Completion and the date of Final Completion;

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2. Review with HAS and the PMT Certificates of Substantial Completion;
 3. Review from the CMAR and forward to the PMT, for the City's review and records, written warranties and related documents required by the Contract Documents and assembled by the CMAR; and
 4. Review the final certificate for payment based upon a final inspection indicating the Work complies with the requirements of the Contract Documents. Design Consultant's inspections will be conducted with the PMT to check conformance of the Work with the requirements of the Contract Documents and to verify the accuracy and completeness of the list submitted by the CMAR for Work to be completed or corrected.
- B. When the Work is found to be substantially complete, Design Consultant will inform the PMT about the balance of the Cost of the Work remaining to be paid the CMAR, including the amount to be retained from the Cost of the Work, if any, for Final Completion or correction of the Work.

4.10 POST - CONSTRUCTION SERVICES

- A. Refer to the Contract for the Scope of Services.

SECTION 5 - DESIGN QUALITY MANAGEMENT

5.01 OVERVIEW

- A. Quality management of the Construction Documents is the overall responsibility of the Design Consultant. Other parties including HAS, the PMT and CMAR; however, are integral to the success of this Project and also have a role in the quality management process.

5.02 DESIGN QUALITY MANAGEMENT WORKSHOP

- A. Design Consultant will hold a quality management workshop at the beginning of the Project to describe quality expectations and procedures to be used throughout the Project. Workshop participants will include HAS, the PMT and CMAR representatives; and Design Consultant team representatives from architecture, interior design, structural and MEP/FP. Design Consultant will prepare an agenda, presentation and handout materials in advance of the workshop, conduct the entire workshop, and then prepare and distribute a summary of the workshop to all participants.

5.03 DESIGN QUALITY MANAGEMENT COORDINATION MEETINGS

- A. Design Consultant will hold quality management coordination meetings that will include the Design Consultant Project Manager and other key management personnel, the PMT quality management lead, the PMT Design Manager, and PMT participants to communicate changes to the design or other documents as a result of the design review process, and to describe upcoming reviews.

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- B. Schedule and frequency of quality management coordination meetings will be outlined during the quality management workshop and may be scheduled to occur on a quarterly basis, depending upon the design review schedule.
- C. Design Consultant will prepare and present to the Project Team the current status of the design efforts and assure design issues are well documented with associated required resolution dates.

5.04 PROJECT ADMINISTRATION INITIAL REVIEW

- A. Design Consultant will hold a project administration review meeting after the Project Team develops the initial project administration submittals as described in Section 3 of this Scope of Services. The Project Team will create drafts of the project organization chart, baseline schedule, monthly progress report template, data collection plans, and project coordination procedures for review by the PMT. Following this meeting, Design Consultant will update these deliverables as necessary and submit to the PMT for review.

5.05 DESIGN REVIEW PROCESS

5.05.1 IN-PROGRESS DESIGN REVIEWS

- A. Design Consultant will upload design progress documents and project issues as required for weekly progress meetings. The CMAR and PMT will be responsible for downloading those documents for routine review of the design progress at appropriate intervals for each discipline.
- B. It is the intent of this activity to identify, as early as possible, potential design issues and bring those issues to Design Consultant's attention. It is Design Consultant's responsibility to address issues either through discussion or through the design review process.
- C. All comments and questions from in-progress reviews will be transmitted to the PMT for assessment. The PMT will determine whether the issue has been previously addressed or will be addressed in subsequent Phases and thus does not warrant Design Consultant involvement; or that the comment should be passed on to the Design Consultant to be addressed.
- D. If a comment is deemed to require response by the Design Consultant, the commenter will be responsible for entering the comment on a project issues database under the appropriate discipline. Design Consultant will either immediately address the issue, notifying the Design Consultant Project Manager of the change, convene an internal meeting to discuss the issue followed by a follow-up discussion with the commenter, or work with the commenter to convene a design meeting with appropriate PMT and/or CMAR staff members. Resolution of the issue will be entered by the commenter on the project issues database, and the PMT shall ensure that this entry has occurred.
- E. Design Consultant will submit draft design Documents and specifications to the PMT for review and distribution to respective reviewing teams at each Phase of design as described in the following tables.

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1. Reviews are defined as either Functional or Technical:

Component	Functional Review	Technical (Design Assurance) Review
Purpose	A review to confirm that the design functions as intended	An audit of the project at end-of-phase
Reviewer	Program Management Team, Airlines, and other ITRP Stakeholders	External resources, conducted through contracted PMSS or third-party reviewer(s)
Timing	As noted in the Table below	End of Schematic, Design Development and Construction Documents
Response Expectations	Design Consultant must respond to review comments in writing within 21 Calendar Days	Design Consultant must respond to comments in writing within 21 Calendar Days

2. Review Requirements by Phase:

Phase	Progress*	End of Phase
Pre-Design	Not Applicable	Functional Review
Concept Design	Not Applicable	Functional Review
Schematic Design	Functional Review	Functional Review, Technical Review
Design Development	Functional Review	Functional Review, Technical Review
Construction Documents	Functional Review	Functional Review, Technical Review

*The number of reviews per Phase will be determined by the PMT.

5.05.2 COORDINATION MEETINGS

- A. Design Consultant will hold design coordination meetings near the end of each design Phase, bringing all major disciplines together to review the design Documents and coordinate design to remove potential conflicts and resolve design issues.
- B. Upon completion of the coordination meetings, Design Consultant will update the design for a quality assurance design review by the PMT.

5.05.3 QUALITY ASSURANCE DESIGN REVIEWS

- A. Design Consultant will submit the design and specifications to the PMT quality assurance team for review and comment prior to formal interim and end of phase reviews. Design Consultant will conduct a pre-review meeting with the quality assurance team to describe design progress, what has been done to address

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comments on previous design phase, and any major decisions that have been made during the course of the current design phase.

- B. The PMT quality assurance team will then conduct a quality review of the design Documents with notes on the drawings and specifications in preparation for design review meetings.

5.05.4 DESIGN REVIEW MEETINGS

- A. Design Consultant will conduct a design review meeting after completion of PMT quality assurance design reviews to discuss all design concerns and to make sure there are no conflicting comments and there is general agreement on changes that the Design Consultant will implement.

5.05.5 REVISED DRAFT DESIGN AND COMMENT TRACKING

- A. Design Consultant will then update the design based on agreed-upon changes from the PMT quality assurance team and then submit that design to the PMT. Every comment from the PMT quality assurance team will be noted in a review matrix and notations will be provided as to the status of changes related to that design. The matrix will be supplied to the PMT quality assurance team for review when the documents are submitted to the PMT.

5.05.6 DESIGN SUBMITTAL PRELIMINARY REVIEW MEETING

- A. Upon completion of each design Phase and following the quality assurance design review procedures, Design Consultant will submit the design deliverables to the PMT for review and comment. Design Consultant will conduct a pre-review meeting with HAS and the PMT to describe the progress of the design, what has been done to address comments on previous design phases and any major decisions that have been made during the course of the current design Phase. Design Consultant will then submit the design and specifications to the PMT for review and comment.
- B. Each design Phase will have an end of phase formal review. Schematic Design, Design Development and Construction Document Phases will each have at a minimum, one (1) additional formal review at 50% completion. Design Consultant shall incorporate comments prepared by reviewers into the next design Phase and shall provide a response with a report indicating action taken on all comments and comment location in the next Phase.

5.05.7 DESIGN SUBMITTAL REVIEWS

- A. The following design submittal review process applies to all design submittals, but the review periods vary.
- B. General
 - 1. Design Consultant will submit a draft of the submittal to the Project Management Team upon completion of an internal quality review and quality assurance review. The PMT will be responsible for developing one set of review comments,

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resolving conflicts within HAS and the PMT, and delivering that review set to the Design Consultant. Design Consultant will evaluate the review comments, contact the PMT for clarification or to discuss comments that the Design Consultant disagrees with, update the deliverable, and resubmit the final document to the PMT.

2. It is the intent of all parties to conduct only one (1) review session for each deliverable. It is the responsibility of the Design Consultant to provide the most complete draft deliverable possible, and to effectively and openly address the review comments. It is the responsibility of the PMT to ensure that there is only one (1) set of review comments delivered to the Design Consultant, and that those comments represent consensus within both parties.

C. Review Comments

1. It will be the PMT Design Manager's responsibility to combine all comments from all reviewers, address and resolve conflicting comments, and deliver one (1) set of comments to the Design Consultant for response. Design Consultant will only address the combined set of review comments and will be responsible for tracking only those comments to their conclusion.
2. Review comments will be submitted in a matrix format that allows Design Consultant the ability to respond to comments on a single form. On the form, the Design Consultant will note either one of the following:
 - a. The comment has been accepted as is and addressed immediately in the current design phase with a notation that allows the PMT to immediately see the change
 - b. The comment requires some further discussion to determine the best course of action
 - c. Design Consultant recommends the comment not be incorporated with a notation for the reason for the recommendation, or
 - d. The comment will be addressed in subsequent phases and specifically how it will be addressed.

5.05.8 DESIGN REVIEW MEETING

- A. Design Consultant will facilitate and participate in one review meeting per design submittal to clarify review comments, to discuss comments that are expected to be rejected, and to resolve discrepancies.
- B. The PMT will develop the agenda working with HAS and the CMAR to identify critical issues that require discussion at the meeting.
- C. Design Consultant will prepare a summary of the meeting describing decisions reached on issues identified in the agenda including any immediate action items, and will update the review comment matrix. Design Consultant will submit the meeting summary and updated review comment matrix to the Program Management Team within five (5) Calendar Days of the meeting.

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5.05.9 RESOLUTION AND TRACKING

- A. Design Consultant will be responsible for updating the review comment matrix prepared for each design submittal review to be included in subsequent design submittals. The matrix will clearly show how each comment has been addressed and will note the drawing sheet and specification number where the change(s) have been made.
- B. It is the intent of all parties to resolve review comments as quickly and efficiently as possible and not carry those review comments past the subsequent design submittal. Comments that cannot be resolved quickly because certain data may be required or some clarification meeting is necessary will be included in a project issues database. Design Consultant will be responsible for entering that issue into the database and tracking that issue through until it is resolved.

SECTION 6 - CMAR COORDINATION

6.01 OVERVIEW

- A. The City will retain the services of a Construction Manager at Risk (CMAR) in parallel with the Design Consultant. The CMAR will provide independent construction cost estimating services as well as constructability guidance.
- B. Design Consultant will be expected to collaborate and jointly develop a buildable design concept that achieves the Design to Budget expectations throughout the entire design and construction process.

6.02 CMAR KICKOFF MEETING

- A. PMT will arrange for and conduct a meeting between the Design Consultant, CMAR, and Subconsultants to confirm roles and responsibilities and other issues pertinent to effective coordination.
- B. Design Consultant will present the overall approach to the design process including the team organization and interface with the CMAR, Design Schedule and important coordination requirements.
- C. CMAR will present a detailed description of their organization, how they plan to sequence the construction, and information that they would like to see on an ongoing or periodic basis.
- D. PMT will develop an agenda in discussions with all parties and distribute that agenda at least five (5) Calendar Days prior to the meeting. Design Consultant will also develop meeting notes focusing on action items and agreed upon coordination procedures, and distribute to all attendees within five (5) Calendar Days of the meeting. Design Consultant will update the notes based on comments received, distribute to attendees, and make available on the Project website.

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6.03 CMAR COORDINATION PROCEDURES

- A. Design Consultant, working with the PMT, will coordinate with the CMAR as follows:
1. Project Management Meetings – The CMAR will be invited to attend all Project Status meetings to understand how the Project is progressing. The CMAR will receive agenda and meeting notes from the Design Consultant.
 2. Design Review Meetings - The CMAR will be invited to attend all design review meetings to provide input on design, constructability, and cost issues.
 3. Supplemental Meetings – The CMAR may be invited to supplemental Project Status meetings depending on the agenda.
 4. Access to the Project Website – The CMAR will be given access to the Project website to allow continual review of design progress, monitor adherence to the schedule, and view issues.
 5. CMAR Coordination Meetings –Design Consultant will arrange for and conduct CMAR coordination meetings as needed that will focus on issues specifically related to construction, cost estimates, and coordination.
 6. Other Topic-Specific Meetings –Design Consultant and PMT will be available to attend additional project meetings requested by the CMAR to discuss issues of concern. These meetings may be held in conjunction with regularly scheduled or supplemental project status meetings.

6.04 CONSTRUCTABILITY AND COST ASSESSMENTS

- A. The CMAR will periodically, but at a minimum of once per month, review the progress of design as discussed and provide comments to the Design Consultant. The primary intent of this effort is to evaluate the design for potential cost savings, improved construction methods, and additional information that may be useful to improve the completeness of the design.
- B. These comments will be placed in a section of the Project website and reviewed at a minimum monthly by the Design Consultant to assess the recommendations and determine which should be incorporated into the design.
- C. At the quality management coordination meetings, Design Consultant will identify those CMAR recommendations that have not and/or will not be addressed and provide documentation of the reasons for those decisions. If the CMAR disagrees with the decisions, they will then have the opportunity to post those issues on an issues management section of the website and discuss those issues with the PMT, in the presence of the Design Consultant. The final determination on whether to incorporate a CMAR recommendation will be made by the PMT. Design Consultant shall not incorporate CMAR-recommended changes to the design without PMT approval.

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6.05 CONSTRUCTION PHASING AND PROCUREMENT PACKAGE STRATEGY

6.05.1 CONSTRUCTION PHASING PLAN

- A. The CMAR is responsible for the construction phasing plan. Design Consultant's responsibility will be to provide input in the development of the plan, review the plan, identify issues of concern, and work with the CMAR to address critical phasing issues that may affect the design.
- B. Design Consultant will review the plan and conduct a meeting with the PMT and CMAR where issues will be identified, discussed and resolved. Impacts of the phasing plan on the design will be identified and any impacts on the Design Schedule, scope or budget will be identified and resolved at the next Project status meeting.

6.05.2 PROCUREMENT (BID) PACKAGE STRATEGY

- A. CMAR will make recommendations to the PMT regarding organization of the Construction Documents to facilitate the soliciting of offers and the awarding of construction subcontracts in a manner that expedites construction within a phased or staged construction approach. The recommendations will take into consideration such factors as maintaining airport operations, time of performance, type and scope of work, availability of labor and materials, overlapping trade jurisdictions, provisions for phased demolition of existing facilities, code restrictions, and other constraints.
- B. CMAR will identify equipment or material requiring extended delivery times and advise PMT on expedited procurement of those items. CMAR will advise the PMT and Design Consultant on the preparation of performance specifications and requests for technical proposals for the procurement and installation of systems and components and for the procurement of long lead items.
- C. CMAR will review the Construction Documents with the PMT to eliminate areas of conflict and overlap in the work to be performed by the various Subcontractors or the City's separate contractors. CMAR will develop a procurement package strategy in coordination with Design Consultant that addresses the entire scope of Work for each phase of the Project. The procurement package strategy shall be reviewed with HAS and the PMT on a regular basis and revised throughout the buyout of the Project so as to best promote the interests of the Project and HAS.

SECTION 7 - DESIGN SUBMITTAL PRODUCTION STANDARDS

7.01 DEFINITIONS

- A. PMT BIM (Building Information Modeling) Manager leads BIM implementation and oversees the BIM application to the program.
- B. Design Consultant BIM Manager leads the BIM implementation and oversight for the Design Consultant.
- C. Construction Manager At Risk BIM Manager (CMAR BIM Manager) leads the BIM implementation and oversight for the Construction Manager At Risk (CMAR).

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- D. Design Model(s): created and developed by the Design Consultant in order to develop the project design.
- E. Construction Model(s): created by the CMAR from the Design Model in order to develop and fulfill the construction needs.
- F. As-Built Model(s): prepared by the CMAR to show on-site changes to the original Construction Models.
- G. Record Model(s): prepared by the Design Consultant from the Design Model and reflect on-site changes the Design Build Contractor noted in the As-Built Models.

7.02 BIM INTENT

- A. The PMT requires that project documentation be created using Building Information Modeling (BIM) processes and software. The intent is to leverage technology to create spatial and data accurate models of the architectural, structural, civil and building systems elements that provide value through design, construction and into operation and maintenance of the airport facilities and infrastructure. The Construction Manager at Risk (CMAR) and Design Consultant shall be expected to freely and openly exchange models and data within a collaborative environment. Development of the models will include collaborative efforts between the CMAR and Design Consultant teams with oversight from the PMT. It is the intent of this section to provide an overview of the use of BIM on this Project and overall Program. A detailed BIM Project Execution Plan (BPxP) will be developed through a series of workshops with stakeholders and will be appended to this scope once complete. The fundamental use and purpose of the BIM for this Project will be to accomplish the following objectives:
 - 1. Deliver an integrated, coordinated, and constructible design.
 - 2. Generate Construction Documentation from Design Models.
 - 3. Share Models and Model data with extended team to leverage information across disciplines.
 - 4. Maintain and update all Models throughout design and construction incorporating all addenda, bulletins, and documented modifications during construction.
 - 5. Deliver a data-rich Record Model at project close-out for use with the HAS FM/Asset Management System.
- B. Model(s) developed for the Project may be utilized for multiple purposes including, but not limited to: design, documentation, building systems spatial coordination, interference checking, record drawings, cost estimation, schedule analysis, project controls, commissioning, and operations and maintenance. The extent to which each model can be utilized will be decided and documented during BIM Project Execution Plan workshops with HAS, the PMT, Design Consultant, and CMAR.

7.03 DRAWING CONVENTIONS FOR DOCUMENTATION

- A. All files are specific to the Project and must be organized and delivered in a manner that facilitates the production of Construction Documents, record documents, as-built

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documents and other project submittals. Project files including building and site models, details, sheets, schedules, text, database, symbols, borders, title blocks, and other files used in the creation of project deliverables shall comply with HAS documentation standards.

7.04 DESIGN SUBMITTAL FILE FORMATS

- A. Design Consultant shall submit drawings electronically at each deliverable Milestone in the following formats:
1. All files and documents used to create design submittals shall be submitted in both native authoring format, PDF format as well as any prescribed deliverable format.
 2. All Models and CAD files shall be delivered in the airport specific NAD83 State Plane Coordinate System as defined in the HAS CAD/Geospatial Data Standards and Procedures.
 3. All electronic deliverables shall include a description of content, required links, references, etc. required for use.
- B. BIM Model and design drawings shall be delivered in the following formats:
- a. Autodesk Revit native Model(s) used to generate documentation with approved HAS version.
 - b. Autodesk Civil3D native Model(s) used to generate documentation with approved HAS version.
 - c. An Autodesk Navisworks .NWC containing each model's specific scope with approved HAS version.
 - d. Autodesk AutoCAD 2D files for each sheet compliant to HAS BIM standards.
 - e. PDF of each drawing.

SECTION 8 - ASIS/ BIM REQUIREMENTS

8.01 GENERAL

- A. HAS maintains CADD/Geospatial Data Standards and Procedures, available on the HAS Fly2Houston website to address Airport Spatial Information System (ASIS) general requirements and CAD drawing standards. This includes an AutoCAD drawing-layering standard for consistency on HAS projects. For this Project, HAS, the PMT along with the Design Consultant and CMAR will jointly develop standards and procedures within the BPxP for delivering the Project using BIM processes and tools.
- B. HAS maintains HAS BIM Standards and Procedures, available on the HAS Fly2Houston website to address Airport Building Information Modeling general requirements.

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- C. A key factor in the creation and maintenance of the use of BIM is direct access to Record Models and As-Built Model that will be readily available to HAS operations and maintenance staff for preventive and predictive maintenance and for planning future facility modifications. The Record Models and As-Built Models must contain information required by HAS operations and maintenance as determined through the BPxP workshops.

8.02 ORGANIZATIONAL ROLES

8.02.1 DESIGN CONSULTANT BIM MANAGER

- A. Design Consultant BIM Manager will lead the efforts for creating and managing the Design Models for the extended Design Team. Design Consultant BIM Manager will be the primary point of contact for the Design Team including all Subconsultants and will represent the Design Team in development and application of BIM Project Execution Plan. Design Consultant BIM Manager will direct, and coordinate the work of Subconsultants to ensure that Subconsultants' BIM-based work products are seamlessly integrated into the project and result in accurate Construction Documents meeting HAS BIM Standards. Design Consultant BIM Manager will work closely with the CMAR and PMT to incorporate design phase feedback, transition the model to construction phase integration, and represent the Design Team in all BIM related meetings and workshops, as well as developing accurate Record Models.

8.02.2 CONSTRUCTION MANAGER AT RISK (CMAR) BIM MANAGER

- A. The CMAR BIM Manager will work closely with the PMT and Design Consultant to add value to the Design Models by providing feedback during the design phase. CMAR BIM Manager will be the primary point of contact for the extended Construction Team including all subcontractors / trades and will represent the Construction Team in all BIM related meetings and workshops. The CMAR BIM Manager will use the Design Models as the basis for developing Construction Models, As-Built Models and shop drawings for fabrication and will be responsible for the assembly and coordination of the subcontractor (trade) models.

8.02.3 PMT BIM MANAGER

- A. PMT BIM Manager will be the primary point of contact for BIM related issues, overseeing application of BIM technologies and ensuring that the model adheres to all internal and HAS-specific goals. PMT BIM Manager will lead the BIM Project Execution Plan (BPxP) workshops and other BIM related meetings as determined in the BPxP and will oversee the application of the BPxP. PMT BIM Manager will also be responsible for archiving models and conducting reviews/audits of model deliverables.

8.03 BIM EXECUTION PLAN

- A. The PMT jointly with the Design Consultant and CMAR will develop a BIM Project Execution Plan (BPxP) to provide a framework for deploying BIM technology on the Project that will also integrate with HAS facility management software systems. The

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BPxP will document detailed BIM use on the project including roles and responsibilities of each party, relevant business processes, as well as software and hardware requirements and recommendations. The BPxP will at a minimum include the following:

1. Approved BIM uses
2. Roles and Responsibilities
3. General BIM Procedures for the Project
4. Model Progression Specification (LoD Matrix)
5. Facility Data Requirements
6. Collaboration Procedures
7. Change Management process for the BPxP
8. Future and recurring BIM related meetings including but not limited to:
 - a. Model Reviews
 - b. BIM Coordination
 - c. Spatial Coordination / Clash Detection
 - d. Design Review

8.04 INTERFERENCE CHECKS

- A. Design Consultant in collaboration with the CMAR shall coordinate the Design Models to eliminate or minimize conflicts between design elements to the greatest feasible extent. Prior to every transmittal of design files, Design Consultant shall coordinate the Design Models and check for clashes between model elements. Design Consultant will be responsible for presentation and documentation of interference checks/clashes and resolutions during the design phase. The CMAR will be responsible for presentation and documentation of interference checks/clashes and resolutions during the construction phase to the greatest feasible extent. The PMT, CMAR and Design Consultant will collaborate in the resolution of interferences and clashes through all phases of the Project to enable identification of the best solution that addresses both design and construction considerations. Specific processes, meetings and reports will be defined in the BPxP workshops.

8.05 CONSTRUCTION PHASE DELIVERABLES

- A. The CMAR BIM Manager will keep the Design Consultant current with any construction coordination or field changes affecting the model throughout the construction phase. Design Consultant shall support this effort with updates provided in response to RFI's, HAS requested changes, and other design modifications affecting the model. The CMAR will provide the final coordinated trade construction and/or fabrication models in native file format, as well as a federated Navisworks model to HAS at the end of construction.

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- B. After receiving the CMAR's As-Built drawings and As-Built Models, Design Consultant shall revise the BIM Design Model to within tolerances and scope as defined in the BPxP, to incorporate all addenda, all Change Orders, and modifications and deliver the final Record Model to HAS as part of project close-out documents. The deliverables at the minimum shall contain:
1. Autodesk Revit native Model used to generate documentation with approved HAS version.
 2. Autodesk Civil3D native model used to generate documentation with approved HAS version.
 3. An Autodesk Navisworks NWC containing each model's specific scope with approved HAS version.
 4. Autodesk AutoCAD 2D files for each sheet compliant to HAS BIM standards.
 5. PDF of each drawing.

SECTION 9 - ENERGY AND SUSTAINABILITY

9.01 INTRODUCTION

- A. While sustainability and energy conservation are critical factors in the determination of system design concepts and in the selection of building materials, the City will not seek the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED™) certification for the Project. Design Consultant; however, shall design the Project to include energy and sustainability measures as appropriate to the Project for the City's review, using the LEED™ certification rating system for new building design and construction as a guide. The City has defined an aspiration that the initiatives equivalent to LEED Gold be considered during design and construction, as well as including the consideration of all cost effective sustainable measures, defined as cost effective in consideration of total cost of ownership.
- B. The Project shall be designed with energy efficient technologies to achieve a "net zero energy building" such that the new MLIT will consume no additional utilities than the existing Terminal D facility. Energy efficiency improvements associated with the planned enabling utilities project will contribute to this objective.
- C. Design Consultant will be expected and required to consider the facility design to qualify for energy program incentives and then document and request such incentive payments. The incentive payments received, if any, shall be credited to the City.

9.02 SUSTAINABLE MANAGEMENT PLAN

- A. HAS is in the process of developing a Sustainable Management Plan for IAH and William P. Hobby airports to be prepared in two phases with final completion targeted June 2016.
1. Phase 1 will focus on energy and waste reduction/ recycling

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2. Phase 2 will focus on water efficiency/ reuse

B. The Phase 1 Report will be available to the selected respondent.

9.03 LIFE CYCLE COST ANALYSIS

A. Design Consultant shall perform Life Cycle Cost Analysis (LCCA) for the life time period as delineated by the PMT, minimum 20-year service life, to select design alternatives related to all energy and water consuming devices and to materials and finishes for total cost of ownership that reflects overall building operation and maintenance that are the most cost effective.

B. Design Consultant shall specify systems that present the least cost (in net present value terms) and that demonstrate simple payback of five (5) years or less. Consider the life-cycle cost (total cost of ownership) of implementing energy efficient and water conserving technologies, including the use of renewable energy sources, in the Project. The systems to be considered for LCCA include, but are not limited to: systems such as HVAC, heat recovery, renewable energy, and variable air volume; motors and drives; building envelope; lighting; controls; and sustainable building material where feasible.

C. Design Consultant is expected to be familiar with economic analyses required to perform LCCA. All LCCA for project design alternatives should be completed no later than conclusion of Design Development.

SECTION 10 - COMMISSIONING AND ACTIVATION

10.01 OVERVIEW

A. Commissioning refers to a systematic process confirming that building systems have been installed, properly started, and consistently operated according to criteria set forth in the Contract Documents, that all systems are complete and functioning in accordance with the Design Consultant's Basis of Design document at Substantial Completion, and that the CMAR has provided HAS operations staff with required system documentation and training.

B. The City will contract directly with a Commissioning Authority (CxA) to perform technical reviews of project design documents focused on energy efficiency design and documentation of maintainability, building system control sequences, and operational strategies; and prepare technical commissioning specifications. During construction, CxA will verify equipment and system testing by the CMAR, observe system tests against Contract Document requirements, track deficiencies, and recommend solutions.

C. Design Consultant's tasks to support Commissioning from design through construction phases are as follows.

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10.02 DESIGN

- A. Document the development of design intent and operating parameters within the Basis of Design. The Basis of Design describes the complete architectural and engineering design intent for the project including design guiding principles, assumptions, issues, recommendations, and narrative assessment of the architectural and infrastructure systems that comprise the Project.
- B. Update the Basis of Design at each Phase of design to incorporate current design documentation.
- C. Specify testing requirements and control sequences of operation within the Contract Documents.
- D. Consult with the CxA to clarify operation and control of equipment and systems to be commissioned.
- E. Participate in meetings related to Commissioning activities.

10.03 CONSTRUCTION

- A. Review test procedures and results.
- B. Review training plan.
- C. Review test, adjust, and balance execution plan.
- D. Coordinate resolution of design and operational deficiencies identified during Commissioning.
- E. Review operating and maintenance manuals.
- F. Coordinate resolution of design non-conformance and design deficiencies identified during the warranty-period.
- G. Participate in project meetings related to Commissioning activities.

10.04 ORAT

- A. Design Consultant may be required to assist the PMT in preparing materials for operational readiness and airport transfer activities.

10.05 DIVISION 01 COMMISSIONING SPECIFICATION

- A. Refer to **Attachment B**, Specification Section 01 91 13 General Commissioning Requirements, for additional requirements.

SECTION 11 - TECHNOLOGY REQUIREMENTS

- A. As the Project's design and construction phases are expected to span several years, Design Consultant's technology planning shall provide sufficient information technology and communications infrastructure, electrical power for equipment, and connectivity

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flexibility to accommodate future growth and enable installation of presently unforeseen technology advancements.

- B. Design Consultant must look beyond the outlined design phase horizon to plan the Project for functionality that will endure for 10-plus years beyond occupancy of the final phase of construction. As stated in Section 2 of this Scope of Services, Design Consultant shall provide the services of a Technology Integration Services Provider to manage the design and implementation of all systems with a communications component, including but not limited to: all low voltage systems, building automation and controls system, supervisory control and data acquisition system (SCADA), information technology, signage, security, baggage handling, lighting, etc.
- C. Key HAS objectives to consider related to technology include:
1. cost reduction through streamlined processes and workflow approval;
 2. deployment of electronic tools to perform basic tasks;
 3. increased gate scheduling flexibility by implementing a common use platform;
 4. enabling easily accessible records online;
 5. network and internet connectivity throughout the terminal;
 6. provision for ample convenience power for passenger devices including consideration for inductive (wireless) charging capabilities;
 7. consideration for Beacon technology;
 8. biometrics for identification and access control;
 9. system accessibility through mobile web and applications;
 10. upgrading or replacing “legacy” hardware and software components before they become difficult or expensive to maintain;
 11. sharing asset data between systems to enhance asset decision-making;
 12. proactively managing specifications, maintenance, security, data management, and audit provisions for technology assets within HAS concession and service contracts, and design/ construction projects;
 13. reduction in passenger wait times for processing;
 14. providing passengers information needed to make “where”, “how” and “what do I need” decisions including parking, processing kiosks, and baggage information;
 15. providing passengers with access to amenities and services that are convenient and entertaining;
 16. availability of real time data to support decisions about safety, customer service, and the business; and
 17. operational and business data and statistics shared among HAS business units to improve performance.

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- D. Key points to consider in the planning and design process include:
1. movement of passengers throughout the new MLIT terminal and how passengers will process real-time information;
 2. consistent access to real-time information for HAS operations staff to enable staff to plan and react to situations in order to enhance operational efficiencies and passenger experience;
 3. supporting the wider data management strategy of IAH and HAS operations; and
 4. consideration of HAS technology subject matter experts throughout the design and construction process to support specification of technology-related equipment and systems for CMAR procurement.

SECTION 12 - TECHNICAL REQUIREMENTS/ SPECIFICATIONS

- A. MLIT Technical Requirements will be available to the Design Consultant at First NTP for Basic Services.
- B. The following HAS design criteria, available on the Fly2Houston website, shall be incorporated into the Project by reference:
1. MLIT Program Definition Manual, dated December 2014
 2. IAH Utilities Master Plan, dated September 12, 2014
 3. HAS Design Criteria Manual 2015
 4. HAS Wayfinding System – Signage Design Guidelines, Standards and Typical Applications (01.17.2014)
 5. CAD/ Geospatial Data Standards and Procedures

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**ATTACHMENT A –
Project Boundary Graphic**

**ATTACHMENT B –
General Commissioning Requirements**

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including 0700 General, 0800 Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
- C. City Policies, Standards and Procedures.

1.02 SECTION INCLUDES (NOT USED)

1.03 SUMMARY

- A. Commissioning (Cx) is a quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and able to be maintained long term to meet the owner's requirements.
- B. Commissioning consists of systematically documenting that the specified components and systems have been installed and started up properly. Each system is functionally tested to verify and document proper operation through all sequences of its operation and conditions. Each system must also be tested for its integration and coordination with other systems of the building and the Airport environment.
- C. An Airport Terminal Building (ATB) is a unique intermodal transportation environment. There are many aspects and operational constraints that must be considered in how differing systems once commissioned, must operate and coordinate together in harmony to meet the overall operational conditions of the building and the Airport together.

1.04 DEFINITIONS

- A. Acceptance Phase – Phase of construction after pre-functional checkout and startup when functional performance tests, final O&M documentation review, and training occur.
- B. Approval – Acceptance that a piece of equipment or system by the Design Consultant that the systems and equipment have been properly installed and is functioning in the test modes according to the Contract Documents, Owner's Project Requirements (OPR) and the Basis of Design (BOD).
- C. Basis of Design (BOD) – A narrative description of what the designer has or will use to respond to and meet the Owner's Project Requirements.
- D. Commissioning Team (CxT)

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

1. HAS's Commissioning Manager (CxM): The CxM will provide commissioning review and verification on behalf of HAS. The CxM will oversee the overall commissioning process and will provide review of the design and installation, as well as verification of the functional performance testing, documentation, and training by the contractors. The Commissioning Manager will coordinate and review the Commissioning Authority's (CxA) overall Commissioning Plan (CxP) and the Installing Contractors detailed CxP's. The Commissioning Manager reports directly to the PMT.
 2. HAS's Commissioning Authority: The CxA will provide an overall Commissioning Plan and will provide overall commissioning verification on behalf of HAS. The CxA will oversee the overall commissioning process and will provide review of the design and installation, as well as verification of the functional performance testing, documentation, and training by the contractors. The CxA will provide the final Commissioning Report and Systems Manual. The Commissioning Authority (CxA) chairs the Commissioning Team. The Commissioning Authority shall be selected by the City and reports to HAS.
 3. HAS Stakeholders: As required by the commission process, and as directed by the CxM, HAS's stakeholders including but are not limited to HAS's Project, Construction, and Quality Managers, consultants, facility management, IT management and department managers will participate in the commissioning process including review of the technical CxP's, as appropriate.
 4. CMAR Lead Commissioning Coordinator (CxL) and Subcontractor's Commissioning Coordinators (CxC): The CMAR shall provide Commissioning Coordinators qualified in each area or construction trade or specialty. CxCs shall also report to the CMAR's Lead Commissioning Coordinator (CxL) on the project. The CxL shall communicate directly with HAS's Commissioning Manager (CxM) on all commissioning issues and activities. The CxCs shall review, track, verify and document that their specific systems are installed, tested, and are functionally performing in accordance with HAS's Owners Project Requirements (OPR), Basis of Design (BOD), contract documents, and other sustainability requirements, and codes and standards. The CxL shall oversee pre-functional and final functional performance tests for each specific discipline. The CxL shall certify and submit documentation confirming that systems are complete and functionally performing as required. Each CxC shall have a minimum of five years' experience in start-up of similar systems and requires prior approval by HAS CxM. The CxL shall, develop and maintain an organizational chart showing the various Commissioning Teams and associated members from all parties.
 5. Design Consultant: Person or firm, under contract with the City, to provide professional services during design and construction and its authorized representatives. The Design Consultant is also the person or firm responsible for the preparation of the Construction Documents. The Design Consultant shall be responsible for review and approval of the technical Commissioning Plans as complying with the Contract Documents.
- E. Contractor (CMAR) – The individual, partnership, firm, or corporation primarily responsible for the acceptable performance of the Work contracted and for the

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payment of all legal debts pertaining to the Work who acts directly or through lawful agents or employees to complete the contract Work.

- F. Control System – A component of environmental, security, baggage, and fire systems for reporting/monitoring and issuing of commands to/from field devices.
- G. Data Logging – The monitoring and recording of flows, currents, status, pressures, etc., of equipment using stand-alone data recorders separate from the control system or the trending capabilities of control systems.
- H. Deferred Functional Tests – Functional Tests that are performed, at the discretion of the Owner and Design Consultant, after Substantial Completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that do not allow the test from being performed.
- I. Owner’s Project Requirements (OPR) – A detailed explanation of the ideas, concepts, and criteria that are defined by the Owner to be important. The OPR is utilized as a communication tool to help the Owner and Design Consultant document requirements and objectives of the project.
- J. Deficiency – A condition in the installation or function of a component, piece of equipment, or system that is not in compliance with the Contract Documents. (includes non-compliance and non-conformance).
- K. Factory Testing – Testing of equipment on-site or at the factory, by factory personnel, with or without an Owner’s representative present.
- L. Functional Test / Verification Plans – Performance testing of the dynamic function and operation of equipment, system and interlocks between systems using manual (direct observations) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g. the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure set point). Systems are tested under various modes, such as during low cooling loads, high loads, pressure loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all control system sequences of operation and components are verified to be responding as the approved sequences state. Functional Tests are performed after pre-functional checkouts and startups are completed.
- M. Manual Test – Using hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).
- N. Monitoring – The recording of parameters (flow, current, status, pressure, etc.) of equipment or system operation using data loggers or the trending capabilities of control systems.
- O. Phased Commissioning – Commissioning that is completed in phases (eq. zones, etc.) due to the size of the structure or other scheduling / operational issues.
- P. Pre-functional Checklist – A list of items to inspect and elementary component tests to verify proper installation of equipment. Pre-functional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation

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(e.g. belt tension, oil levels, labels affixed, gages in place, sensors calibrated, etc.). Pre-functional checklist items may entail simple testing of the function of a component, a piece of equipment or system (eq. measuring the voltage imbalance on a three phase motor). The word pre-functional refers to before functional testing. Pre-functional checklists augment and are combined with the manufacturer's startup and checkout checklists.

- Q. Sampling – Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.
- R. Seasonal Functional Tests – Performance functional tests that may be deferred until the system(s) will experience conditions closer to their design conditions.
- S. Simulated Condition – Condition that is created for the purpose of testing the response of a system (e.g. raising/lowering the set point of a thermostat to see the response in a VAV box).
- T. Startup – The initial starting of dynamic equipment, including executing the pre-functional checklists.
- U. Test Requirements – Requirements specifying what modes and functions performance and other parameters that shall be tested and the acceptable range of performance limits that must be met. The test requirements are specified in the Technical Specification Sections of the Contract Documents.
- V. Trending – Monitoring, using the building management system, whereby data gathered over a period of time is compiled for analysis and verification of performance within specified requirements.
- W. Warranty Phase – Phase of the project after final acceptance and before the end of the life of the warranty where the CxA works with the Owner's maintenance staff to observe and operate the installed systems and finalize system operation and modify the associated systems manual as appropriate. This time period is also when the Contractor responds to warranty calls.

1.05 REFERENCE STANDARDS (NOT USED)

1.06 SUBMITTALS

- A. The Installing Contractor CxC, via the CxL, shall submit to the PMT for acceptance and distribution no less than sixty (60) days prior to starting the commissioning process, the following:
 - 1. Technical Commissioning Plan
 - 2. Phased Commissioning / Training Schedules
 - 3. Training Plan (including training agenda and syllabus)
 - 4. Closeout Plan
 - 5. Operation and Maintenance Manuals

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- B. CxL and CxC Qualifications Submittal: The CMAR shall submit CxL and each CxC resume and sample documents thirty (30) days prior to starting the commissioning process to the PMT for approval; which shall include the following:
1. Education and technical training.
 2. Present employment:
 3. Company name and address
 4. Present title and job description
 5. History of employment (include dates and positions held)
 6. Relevant work experience:
 7. Job name
 8. Position held
 9. Work history (include dates and positions held)
 10. Example of prior building commissioning project performed by the proposed CxL or CxC (Submitted project shall be similar in commissioning scope and complexity.)
 11. List test procedures developed by proposed CxL
- C. Test Checklists and Report Forms: CxL shall submit sample checklists and forms to CMAR's Quality-Control Manager and CxT, and subcontractors for review and comment. Submit three copies of each checklist and report form plus electronic version.
- D. The CMAR shall provide the Submittal Schedule to PMT per the requirements of the Submittal Specification 01 33 00. The CMAR shall indicate on the submittal schedule which submittals are "Commissioning Related" for review and approval.
- E. The CMAR shall provide one (1) hard copy and an electronic copy of each commissioning related Submittal Package and Operation and Maintenance (O&M) Manual to PMT for distribution. Training Program Submittals
1. The CMAR shall provide the training submittals in the following order for review and acceptance by PMT and approval by the Design Consultant as conforming to their design intent.
 - a. First Draft in accordance with the CMAR's Commissioning Plan and Closeout Plan and schedule as approved by PMT and the Design Consultant at least sixty (60) days prior to proposed instruction date.
 - b. Final Draft in accordance with the CMAR's Commissioning Plan and Closeout Plan and schedule as approved by PMT and the Design Consultant at least thirty (30) days prior to proposed instruction date.

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2. The review of the training material does not constitute its approval unless specifically stated so. The training material submittal shall contain, but not be limited to, the following:
 - a. Sufficient background information on each instructor for various sessions shall be provided to allow evaluation of the proposed instructor's qualifications and capability of training the specific discipline.
 - b. At the completion of the training, the CMAR shall forward to the PMT one complete electronic set of training materials and support material for each defined training category.
3. The "First Draft" of the training material shall, as a minimum, contain the following:
 - a. Instructional text that details the specific topics of training for the system(s). These topics are detailed below. All text, sections, photographs etc. must be complete.
 - b. Power Point, Media Player, and any other types of visual training aids that will be used in conjunction with the training plan.
 - c. Reference materials as detailed in the lesson plan (e.g. handout, manufacturer catalogues, brochures, and pamphlets). All materials shall be reviewed by the PMT and Design Consultants to determine applicability and functionality. Reference materials that do not pass this review shall be modified and resubmitted within two weeks for approval.
 - d. The CMAR shall not proceed to the "Final Draft" stage of training material until the PMT and Design Consultant have approved the "First Draft".
 - e. With the final draft of the training material, the CMAR shall submit a Training Agenda that provides the following information:
 - 1) Company name, address, and telephone number(s) for the vendor.
 - 2) Name and telephone number(s) of the vendor training representative.
 - 3) Duration of class (total hours).
 - 4) Breakdown of class and duration in hours of each training activity.
 - 5) Target audience (e.g. operators, maintenance personnel, etc.).
4. After the CMAR has received approval of the "Final Draft" of the training material and the training agenda from the PMT, only then can the actual training be scheduled. CMAR shall submit the proposed training schedule to the PMT for approval. The proposed training schedule shall be submitted in accordance with the CMAR and Subcontractor's Commissioning Plan, Closeout Plan and schedule as approved by the PMT and at a minimum of sixty (60) calendar days prior to the start of the training. If the proposed training schedule is approved, then it becomes the final training schedule.

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5. The scheduling, content and duration of training programs must be coordinated with the CMAR's approved Commissioning and Closeout plans.

1.02 SCHEDULING (NOT USED)

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

- A. All standard and special testing equipment required to perform initial checkout, startup and functional performance testing shall be provided by the Contractor responsible for the equipment being tested. This includes, but is not limited to, two-way radios, meters and data recorders.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified in the Contract Documents. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 degree F and resolution of +/- 0.1 degree F. Pressure sensors shall have an accuracy of +/- 2.0% of the value range being measured (not full range of meter) All equipment shall be calibrated according to the manufacturer's recommended intervals and shall be verified as fully functional and re-calibrated, if when dropped or damaged. At a minimum, all test equipment shall at the minimum have been calibrated within the last year unless specifically approved otherwise by the PMT Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.01 COMMISSIONING ACTIVITIES

- A. The CMAR shall be responsible for commissioning under the oversight of aCxA. The commissioning process shall at a minimum address and achieve the following:
 1. Design Phase
 - a. The goals of the commissioning tasks during the design phase of the project include but not limited to:
 - 1) Revision/completion of the Basis of Design which reflect the actual final system configurations and intended operation, including normal, abnormal, by-pass, shutdown and restart for all systems and equipment.
 - 2) Completion of Contract Documents by the Design Consultants and released for review by the PMT and CMAR for constructability, operability, and maintainability assessment.
 - 3) Development of the Overall Commissioning Plan by the CxA and draft Technical Commissioning Plans by the CxL
 2. Construction Phase

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- a. The goals of the commissioning tasks during the construction phase of the project include but not limited to:
 - 1) Updating the Basis of Design as required to reflect any changes made during construction, if required.
 - 2) Review, comment, and approve CMAR submittals.
 - 3) Scheduling, planning and final preparation for verification testing during the Acceptance Phase
 - 4) Completion of the equipment/system specific Technical Commissioning Plans by the CMAR.
 - 5) Verifying that all systems to be commissioned are installed per the Contract documents and the Basis of Design. If discrepancies are found, document on the Cx Issues Log and identify mitigation measures for CxM review.
 - 6) Modify, review and approve commissioning, training and closeout plans and schedule, as required.

- 3. Acceptance Phase
 - a. Acceptance Phase activities shall be defined in the Project Schedule and coordinated with and clearly defined in the CMAR's Project Management Plan. Refer to Spec Section 01 77 00.

 - b. The goals of the commissioning tasks during the acceptance phase of the project include but not limited to:
 - 1) Verifying that all systems and equipment to be commissioned were installed and operate to meet the requirements of the Contract Documents, operational Performance Requirements and the Basis of Design
 - 2) Submit Operation and Maintenance Manuals to the PMT for distribution.
 - 3) Training of HAS Operation and Maintenance Staff and other Stakeholders on the intent and operation of systems and equipment.
 - 4) Documenting the commissioning process for future reference and use by HAS O&M staff and other Stakeholders. The Commissioning Report shall include but not limited to:
 - a) Introduction
 - b) Executive Summary
 - c) Commissioning Plans
 - d) Owners Project Requirements and Basis of Design

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- e) Commissioning Specifications
 - f) O&M Training Records
 - g) Issues Log
 - h) Commissioning Coordination Meeting Notes
 - i) Pre-functional and Functional Performance Test Forms
 - j) Test Reports
 - k) Blank Functional Test Procedures for retesting by HAS (electronic forms)
- 5) Submit closeout items to the PMT for distribution, review and approval.
4. Warranty Phase
- a. The goals of the commissioning tasks during the warranty phase of the project include but not limited to:
 - 1) Revision/completion of the Owner's Project Requirements and Basis of Design Documents by the CxA which reflect the actual final system configurations and intended operation.
 - 2) The CxA with HAS O&M Staff to review functional performance of systems commissioned to determine their level of performance 10 months after final acceptance, against the criteria and performance perimeters established in the Contract documents and Basis of Design and documented during the Functional Performance Testing
 - 3) CMAR to repair/replace and re-test equipment and/or systems that have failed during the warranty period

B. Required Meetings

- 1. Commissioning Kickoff Meeting
 - a. The CMAR's CxL will coordinate with the CxM and CxA to schedule, plan and conduct a Kickoff Meeting for the Cx Teams. The intent of this meeting is to introduce the key players of the commissioning teams and develop a go-forward processes and procedures for implantation of commissioning and activation of all systems and equipment.
- 2. Commissioning Meetings and Coordination:

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- a. The CMAR shall attend Commissioning Planning and Coordination work sessions during the Design Phase. The Commissioning Planning and Coordination Meetings are intended to review the Commissioning Plan and resolve issues of equipment and systems identified as requiring commissioning. These meetings may include but are not limited to:
 - 1) Mechanical, Electrical and Plumbing (MEP)
 - 2) Life Safety and Fire Protection
 - 3) Special Systems such as WiFi, PA, Backbone and Horizontal Cabling
 - 4) Access Control and Video Surveillance
 - 5) Baggage Handling
 - 6) Vertical Transportation and other Conveyance Systems
 - 7) Ramp Equipment such as PBB's, PCA, 400 Hz, VGDS, and potable water
 - 8) Aircraft fueling, leak detection, and emergency shutoff
- b. The Commissioning Teams shall attend Commissioning Team Coordination Meetings throughout the construction period until completion turn-over and project closeout. The CxT Coordination Meetings shall be planned, conducted and documented by the CMAR as the project progresses. These meetings shall include but are not limited to coordination, scheduling, progress, deficiency and conflict resolution and planning issues. These meetings will be held at least monthly, until the start of the Acceptance Phase when they may be held as frequently as once a week.
- c. Pretesting Meetings: The CMAR shall attend bi-weekly pretest meetings of the CxT to review start-up procedures testing procedures, testing personnel and instrumentation requirements plus manufacturers' authorized service representative services for each system, subsystem equipment and components to be tested.
- d. Testing Coordination: The CMAR shall coordinate the sequence of testing activities weekly to accommodate required quality assurance and quality control services with a minimum of delay and to avoid the necessity of removing and replacing built facilities to accommodate testing and inspection.
- e. Commissioning Meeting Minutes and Reports shall be prepared by the CMAR CxL and distributed to the PMT within 5 days of meeting

C. Systems and Equipment to be Commissioned

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1. The systems and equipment to be commissioned shall be identified by the CMAR and verified by the Design Consultant with the assistance of the CxM and the PMT during the Design Phase of the project.
 - a. An equipment matrix shall be prepared as part of the commissioning documentation. The equipment matrix shall be formatted as a computerized spreadsheet with the capability of sorting and filtering for printing of various data columns (ranges) to meet documentation requirements at various stages of construction, and for different purposes as required by the various technical sections of the Contract Documents. The matrix shall be submitted as part of the Commissioning Plan development for reviews as part of the CxP's submission. The electronic database program shall be used for all commissioning activities.
 - b. The matrix shall identify all operable devices and equipment to be provided and are to be grouped by the system they primarily support. When sorted by column for system identification, the resulting printout should identify all system components regardless of whether a part of mechanical, electrical, life safety, low voltage special systems or other in nature. The matrix shall include the following data as a minimum, for each device, and shall allow for additional columns for subsequent data requirements.
 - 1) Equipment or device id number
 - 2) Brief equipment identification text
 - 3) Associated building system, if any
 - 4) Installing location, by room number or column, as indicated on the Contract Documents
 - 5) Governing specification section
 - 6) Appropriate submittal reference number(s)
 - c. Include the equipment matrix as part of the CxP. Any subsequent updates to the matrix shall be submitted for the PMT and Design Consultant for review and acceptance. The final equipment matrix for each device or system is to be provided as an attachment to the CMAR request/notice for startup of equipment or systems.

D. Project Schedule

1. The CMAR shall incorporate all commissioning coordination and activities into the Project Schedule and review all monthly updates with the PMT.

E. Prior to Pre-Functional Checkout

1. Prior to equipment start-up, the following conditions shall be required
 - a. Submit to the CxT for review and approval a comprehensive start-up plan using Manufacturers approved start-up methods and pre-start checklists as applicable.

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- b. No equipment will be started until all applicable quality control requirements of the Contract Documents have been completed for the installation and safe operations of the equipment being started has been verified.
- c. Verify that all required field pre-testing has been completed and testing forms have been submitted to and reviewed / accepted by the CxT.
- d. The CMAR has verified that all wiring and support components for equipment are complete and have been tested in accordance with the Contract Documents and/or the manufacturer's written recommendations
- e. Provide no less than a 3 work day notification in writing to the CxT that start-up is pending.

F. Pre-Functional Checkout

- 1. The CMAR or its subcontractors shall not energize or activate any building system for final use until the following conditions have been met:
 - a. Verify that all Pre-Functional Checklists are approved for use
 - b. The CMAR shall execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturer's instructions and specification requirements if applicable.
 - c. Verify that all Pre-Functional Checkout forms and Manufacturers checklists are completed, submitted and accepted by the PMT prior to proceeding to Functional Performance Testing.

G. Functional Performance Testing

- 1. The CMAR, their Subcontractors with oversight of the CxA (as required) will develop and issue Functional Performance Test Procedures for each piece of equipment and/or system to be commissioned. The CMAR and their Subcontractor's shall perform the Functional Performance Test Procedures observed by the CxT.
- 2. The CMAR shall provide personnel and equipment to perform the Functional Performance Test Procedures. This includes any Specialty Subcontractor's.
- 3. The CMAR shall notify all personnel on the project site prior to any start-up or testing which may create a hazardous or dangerous condition. Coordinate with other trades.
- 4. The CMAR shall initiate, develop, and document functional performance test procedures. Include functional performance test procedures data sheets for each system or equipment. Determine actual system performance and compliance with the design. Personnel experience in the technical aspects of each system to be commissioned shall be engaged.
- 5. Test procedures shall fully describe system configuration and sequence of operation plus the steps required for each test and be appropriately documented so that another party can repeat the tests with virtually identical results.

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6. Functional test procedures must confirm the performance of systems And comply with the requirements of the Contract Documents. The functional test shall meet the design intent and applicable code under which the project was permitted. When a system is accepted, the CxL must confirm to the satisfaction of the CxM that the system is complete, works as intended, and is correctly documented.
7. The mechanical equipment requires integral safety devices to stop/prevent equipment operation unless minimum safety standards or conditions are met. This shall include adequate oil pressure, proof-of-flow, non-freezing conditions, and maximum head pressure. Functional performance test procedures shall demonstrate the actual performance of safety shutoffs in real or closely-simulated conditions of failure.

H. Deferred Testing

1. Deferred testing may be required to address seasonal conditions that may prohibit a required test, or to accommodate changes in the project schedule. All such deferred testing requirements shall be coordinated with the Construction schedule monthly updates and submitted for the PMT review and acceptance.

I. Reporting and Documentation

1. Test and Inspection Reports: CxL shall record test data, observations, and measurements on test forms and checklists. Photographs, and other means appropriate for the application shall be included with the test data. CxL shall compile test and inspection reports plus test and inspection certificates for submittal to the CxT for review and acceptance.
2. Corrective Action Documents: CxL shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.
3. Issues Log and Report: CxL shall prepare and maintain an electronic (Microsoft excel compatible) issues log that describes design, installation, and performance issues that are at variance with the OPR, BOD, and Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.
 - a. Issues Log Report: On a periodic basis, but not less than 2 working days prior to each CxT meeting, CxL shall submit a written narrative for CxM's and CxA review of outstanding issues and a status update of the issues log.

J. Operation and Maintenance Training

1. No actual training of a piece of equipment will be permitted until the equipment is properly installed and is verified as fully functional.
2. Operation and maintenance training shall be a prerequisite to the beneficial use of the facility or any portion thereof and shall be completed a minimum of one week prior to substantial completion being requested by the CMAR.

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3. Maintenance training shall occur within the sixty (60) days prior to substantial completion and in accordance with the CMAR approved Commissioning Plan, Closeout Plan and schedule.
4. All training shall be coordinated through the PMT via the CxM. Repeat training sessions shall be provided for operation and maintenance and other stakeholder shift workers.
5. Training Preparation Conference: Before operation and maintenance training, CxL shall convene training preparation conferences to include the PMT, HAS's operation and maintenance management personnel, CMAR, and Subcontractors. In addition to requirements specified, perform the following:
 - a. Review the Basis of Design.
 - b. Review installed systems, subsystems, and equipment.
 - c. Review instructor qualifications.
 - d. Review instructional methods and procedures.
 - e. Review training module outlines and contents.
 - f. Review course materials (including approved operation and maintenance manuals).
 - g. Discuss locations and other facilities required for instruction.
 - h. Review and finalize training schedule and verify availability of educational materials, instructors, and required training facilities.
 - i. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to be followed if the weather conditions are unfavorable.
6. Submit training syllabus, agenda and instructor qualifications to the CxT for review and acceptance.
7. All demonstration, training, and instructional sessions will be monitored and accepted by the PMT. Any session or portion thereof deemed unsatisfactory, based on evaluation of the training shall be repeated by the manufacturer or manufacturer's representative at no additional cost.
8. When deemed appropriate by HAS, field instruction to HAS and/or tenant personnel designated to receive training may be acceptable as a training session. The instruction shall be provided by a field service technician qualified to perform corrective or preventive maintenance, troubleshooting, or related field services.

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9. Training shall be conducted so that home study will not be required. The training shall include courses, which combine classroom and field hands-on training that is structured and scheduled to facilitate trainee comprehension of the subject material. Courses shall be continuous, and the field training shall immediately follow the classroom instruction.
10. HAS reserves the right to videotape any and all training materials and presentations, except for proprietary material, and retain all rights for usage of such recorded material to train.
11. Refer to the Contact Documents for specific requirements for demonstration, training, and instruction of operation adjustment, and maintenance of products, equipment, and systems.
 - a. Demonstration: In accordance with the CMAR's Commissioning Plan, Closeout Plan and schedule as approved by HAS and at least four (4) weeks prior to date of substantial completion, submit for HAS's approval, a proposed outline of demonstration program including a schedule of proposed dates, times and length.
 - b. Operational Training: Manufacturer supplied (Vendor) equipment training for all major equipment and subsystem shall be provided for the end users.
 - c. Maintenance Training: The maintenance training shall include the function, adjustment, repair, overhauls, and replacement plus troubleshooting of equipment and auxiliary or support systems of all components related to the trainee's trade. Safety aspects shall also be stressed.
 - d. Models, "exploded" views, and/or audiovisual materials shall be used for this training. These materials shall be turned over to HAS upon completion of training.