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12 January 2010

From: Commander, Naval Facilities Engineering Command

Subj: INTERIM TECHNICAL GUIDANCE (ITG 2010-01) – MAINTENANCE HANGAR
DESIGN AND PLANNING GUIDANCE FOR F35 B OR C

Ref: (a) DOC NUMBER, UFC 2-211-01N, Aircraft Maintenance Hangars: Type I, Type II
and Type III, 16 December 2009

Encl: (1) UFC 2-211-01N, F35B or C Supplement

1. Purpose. The F 35B or C Supplement to UFC 4-211-01N “Aircraft Maintenance Hangars: Type I, Type II and Type III” provides interim guidance for evaluating, planning, programming and designing aircraft maintenance hangars which are anticipated to support the Naval and Marine Corps variants of the F-35 aircraft.

2. Background. Unique building systems are required to support operations and maintenance of this aircraft. The information contained in the UFC supplement was developed based on the aircraft Facilities Requirements Document dated February 2008 in consultation with NAVAIR, Headquarters Marine Corps and the F35 Joint Program Office. The Interim Guidance is referenced in the main UFC as change 3 and will be periodically updated as new requirements for the aircraft emerge. Ultimately, these requirements will be consolidated into Unified Facilities Criteria, once they mature. The ITG is available on the Whole Building Design Guide at http://www.wbdg.org/ccb/browse_cat.php?o=30&c=212.

3. Point of Contact. For clarification or additional information related to this subject, please contact Mr. Richart Kahler, P. E., DSN 262-4234, Comm. (757) 322-4234, or e-mail richart.kahler@navy.mil


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SUPERSEDED

UNIFIED FACILITIES CRITERIA (UFC)

AIRCRAFT MAINTENANCE HANGARS: TYPE I, TYPE II AND TYPE III

F-35B or C SUPPLEMENT



This supplement to UFC 4-211-01N "Aircraft Maintenance Hangars: Type I, Type II and Type III" and UFC 2-000-05N, (P-80) Facility Planning Criteria for Navy/Marine Installations is intended to provide interim guidance for evaluating, planning, programming and designing aircraft maintenance hangars which are anticipated to support the naval and marine variants of the F-35. The following amendments to the UFC are applicable for this aircraft.

1-4 TYPES OF HANGARS.

1-4.1.1 Type I Hangar.

Replace "A Type I maintenance hangar is primarily designed for carrier aircraft, but is adaptable to meet requirements for rotary wing and various types of smaller aircraft."

With "A Type I maintenance hangar is primarily designed for carrier aircraft, but is adaptable to meet requirements for rotary wing and various types of smaller aircraft, including Navy and Marine Corps variants of the F-35."

2-3 DESIGN GUIDANCE.

2-3.2 O1 Shops and Maintenance Administration

Add to the list of shop spaces:

"

- Vault(s) for SAP Failed/Secret components

2-3.3 O2 Squadron Administration and Operations.

Add to the first paragraph:

"Hangars incorporating the F-35 shall have a Special Access Program Facility (SAPF). This area incorporates the requirements to meet the Automatic Logistics Information System (ALIS)."

2-3.3.1 Representative Typical Spaces.

Add after the list of Operations spaces:

"As a part of the F-35 program requirements, a suite of spaces designated as Special Access Program Facility (SAPF) shall be provided. While it may be composed of similar spaces that are encountered in a typical hangar, specific security issues need to be addressed in this suite of spaces. The typical spaces that are a part of the SAPF include the following spaces:

Space Name	Function	Notes or special features
Security Work Space	Office	
Security Office	Office	
Assistant Security Office	Office	
Mission Planning	Office	
ALIS Administration	Office	
ALIS Maintenance	Office	
ALIS OMS Operations	Office	
Intel	Office	
Assistant Intel	Office	
Pilot Briefing (6)	Briefing	
Large Pilot Briefing (2)	Briefing	Separate by operable partition
Storage	Storage	
Head(s)	Toilet	
Break Room	Support	
SOU Communications	Office	
Vaults for SAP Failed/Secret Components	Vault	Spaces may be located in another area per activity requirements but meet the requirements for access and security. Vaults shall be provided within the Maintenance Control Area and the Avionics Shop.
SIPRNET Communications	Support	

The above spaces shall be located within the SAPF and shall be addressed as similar types of spaces indicated in Part 4 Specific Design Criteria. See additional requirements in Part 4 that addresses the enclosure of the SAPF."

The Special Access Program Facility (SAPF) shall meet the requirements of JAFAN 6/9 and TEMPEST requirements of the JSFPO. Coordinate with the JPO TEMPEST IPT.

In general, SAPF requirements shall be compliant with the "Open Storage" classification of JAFAN 6/9 and shall be based on CONUS or OCONUS locations. Vaults shall compliant with the JAFAN 6/9 requirements. For Design Build projects, the RFP writer shall verify all of the specific requirements of the SAPF with the squadron or approving agency. The data shall be reflected in the Room Requirements of the RFP.

Add section "3-9.8 Aircraft Cooling Air

Hangars supporting F-35 aircraft must provide cooling air for the aircraft in the hangar bay. Coordinate the service point locations with using activity. The cooling air system shall be sized to support two thirds of the aircraft at any one time. One aircraft requires air to be supplied at 46.6 pounds per minute at 55 degrees Fahrenheit at a minimum pressure of 5.25 psig (-0.25/+0.50 psig). The moisture content shall be 18 grains per pound of dry air."

Add section "3-9.9 Special Access Program Facility (SAPF) HVAC"

Provide heating, ventilating, and air conditioning within the SAPF to comply with the security requirements for the SAPF. Design systems as required based on any special equipment provided within the SAPF.

For Design Build projects, the RFP writer shall verify all specific requirements of the systems within the SAPF with the squadron or approving agency. The data shall be reflected in the Room Requirements of the RFP and/ or defined in the Engineering Systems Requirements.

3-11.1.2.2 Power Service Points.

Delete the four bulleted items listing power requirements.

Delete text "The power service points will provide"

Insert "The power service points shall provide, at a minimum, the quantity, type, and feature of each power system requirement recommended by the aircraft manufacturer's data."

Remove the bullet before the item "External aircraft power ... (amperage) requirements." to make it paragraph text.

Insert after final paragraph "Aircraft specific power is required for each aircraft type supported by the hangar. The electrical systems shall be sized for the addition of other aircraft without service upgrades."

3-15.4 Telecommunications Service Requirements for Voice, Data and Video

Add to the end of the bullet list:

"

The F-35 aircraft utilizes an Automatic Logistics Information System (ALIS) operating over a classified and an unclassified local area network at various locations within the hangar spaces. Coordinate network and user requirements"

Add Section "3-16.6.2 "Pavements for F 35B

Runways, Taxiways, and Parking Aprons

F-35B versions of the JSF have integrated power packages (IPP) that point down towards the pavement (the F-35C IPP points upwards and is of no concern for the pavements). The current version of the IPP in those two aircraft generates an exhaust under Burn mode which results in pavement surface temperatures in excess of those generated by the F/A-18 (and B-1) auxiliary power unit (APU). The IPP is always on, and in the Burn mode whenever the aircraft is stopped. This IPP exhaust will result in accelerated decay of both asphalt and concrete: for asphalt it could result in very quick rutting and accelerated oxidation, and for concrete it could result in scaling after

a few months or years, depending on exposure time, exposure cycles, wind, precipitation, ambient temperature, etc. Therefore, for F-35B aircraft:

- The runway ends shall be concrete
- Holdshorts on taxiways shall be concrete
- Parking aprons shall be concrete
- The concrete shall be heat resistant to an exhaust similar to that of an F/A-18 APU, per UFGS 32 13 13.03 (Airfields and Heavy-Duty Concrete Pavement Less Than 10000 Cubic Yards) or Air Force Engineering Technical Letter ETL 02-7.

VTOL Pads

The F-35B, or short take-off and vertical landing (STOVL), version of the JSF is capable of both vertical take-off (VTO) and VL, although take-off will typically be via STO. For landing, VL (or VTOL) pads will be used. These pads will be exposed to 1700°F and high velocity (Mach #1) exhaust. This exhaust will melt the top surface of asphalt pavements, and is likely to spall the surface of standard airfield concrete pavements on the first VL. Therefore high heat resistant materials are required for the pavement and for the joint sealants. At the present time there are no identified sealants that can survive a significant number of VLs, and the pads shall be constructed using continuously reinforced concrete (CRC). The pads shall have a minimum 96-ft by 96-ft (or 100-ft by 100-ft) CRC center, with continuous reinforcement in both directions to insure that all cracks and joints remain closed (the center is surrounded by a 50-ft wide paved area). High heat resistant materials for the pavement have been identified but are still being tested. For the latest information on those materials, contact the Naval Facilities Engineering Service Center (NAVFAC ESC) or the Air Force Civil Engineer Support Agency (AFCESA)."

Add to Part 4 SPECIFIC DESIGN CRITERIA

Add the following to the Notes after the third paragraph.

"Design Criteria allocates space for the listed "off-Equipment Maintenance Areas" listed based on the maintenance practices found at typical Naval and Marine Corps Air Stations. Designer or RFP preparer shall develop project specific requirements based on the JSF Facilities Requirements Document (FRD) and existing maintenance capabilities at each base.

Add the attached sheets that modify existing spaces or are additions to the requirements. These spaces include:

Space or Room Type		Maintenance Control
Description / Usage		This space provides for administration of squadron maintenance. The space also provides flight crews to access the maintenance records and flight data. This space may also be used for briefing of maintenance personnel prior to beginning of work day.
Minimum Ceiling Height		9 ft (2.74M)
Finishes	Walls	Painted CMU with resilient base. Internal separation partitions may be gypsum board on metal studs.
	Floors	Resilient Tile, minimum on office side; sealed concrete, epoxy coating on the customer side. Do not provide carpet.
	Ceiling	Suspended Acoustical Ceiling
Built in Equipment or casework		Service Counter to provide for maintenance personnel to receive daily assignments. The counter shall be a bi-level counter. Work Counter to provide a work space for review of records. Counter for flight crew to enter flight records. Record entry is by computer. Marker Board
Furnishings		Desks and Chairs, bookcases, lateral files, copy machine, fax machine, printer
Plumbing		Not required
HVAC		Heating, ventilation and cooling required.
Fire Protection		Required
Power		Workstation and Convenience Outlets, Dedicated Equipment Outlets
Lighting		Fluorescent
Communication		Conduits to Roof Mounted Antenna Farm Platform, Base Radio Outlet, CATV Outlet, Workstation Outlets, Telephone Only Outlet, LAN outlets
Intercommunications Systems		Master Control Station
Special Requirements		Activity may request that this space be combined with Material Control. Sometimes access to the exterior is provided if it is part of Material control. CCTV monitoring and PTZ control of hangar and apron cameras. This space may have direct visual access to the hangar bay. Windows shall be fixed with fire rated glass. A vault may be required for ALIS support as a part of Maintenance Control. Coordinate requirement with Squadron.
Acoustics		No special requirements

Space or Room Type	Shop – Avionics	
Description / Usage	Maintains Aircraft electrical systems. This shop also provides storage for specialized communication equipment and may require special secure storage areas. Consider providing a vault within the shop as opposed to making the entire shop a secure space.	
Minimum Ceiling Height	-	
Finishes	Walls	Painted CMU with resilient base. Partitions extend to the floor or roof deck above.
	Floors	Sealed concrete is the minimum. Epoxy or Thin Film Flooring Systems shall be provided if requested by the squadron.
	Ceiling	Shops shall have exposed construction. Paint exposed structure, ductwork, conduit, piping, devices, etc.
Built in Equipment or casework	Marker Boards	
Furnishings	Desks and Chairs, bookcases, vertical file cabinets, workbench with stools, aircraft parts shelf, vice, storage cabinets. Coordinate the quantities of furniture with the squadron. Other types of furniture may be required based on squadron and airframe type utilizing the hangar.	
Plumbing	Service Sink Compressed air drop at workbench Emergency Eyewash	
HVAC	Heating, ventilation and cooling required. Specialized exhaust system(s) required. Exhaust directly outdoors.	
Fire Protection	Required	
Power	Required	
Grounding Systems	Shop Ground Bus	
Electrical Special Systems and Devices	400 Hz Frequency Converter, 400 Hz Panelboard, Convenience Outlets, Dedicated Equipment Connections, 400 Hz Bench Connections, Test Bench Connections	
Lighting	Fluorescent	
Communication	Workstation Outlets, CATV Outlet	
Intercommunications Systems	Call-In and Volume Control Stations	
Special Requirements	Due to the potentially large pieces of equipment brought into this shop, a rolling service door should be provided in lieu of double doors opening onto the hangar bay. Door shall be at least 5 feet (1.52M) wide and 6'-8" (2.03M) high. If a 4' (1.22M) wide opening is adequate, provide a single 4' (1.22M) wide personnel door in lieu of double doors. Sometimes this space may require a vault for ALIS support or secure file cabinets. Coordinate requirement with squadron.	
Acoustics	No special requirements above the STC provided by full height masonry walls	

Space or Room Type	Shop – Tool Room	
Description / Usage	Tool Storage and Issue	
Minimum Ceiling Height	-	
Finishes	Walls	Painted CMU with resilient base. Partitions extend to the floor or roof deck above.
	Floors	Sealed concrete is the minimum. Epoxy or Thin Film Flooring Systems shall be provided if requested by the squadron.
	Ceiling	Shops shall have exposed construction. Paint exposed structure, ductwork, conduit, piping, devices, etc.
Built in Equipment or casework	Tool issue counter located within the tool room. Provide a service counter with overhead rolling service counter door if requested by the activity. Marker Boards Peg Board	
Furnishings	Desks and Chairs, bookcases, vertical file cabinets, workbench with stools, aircraft parts shelf, vice, storage cabinets, parts storage bins. Coordinate the quantities of furniture with the squadron. Other types of furniture may be required based on squadron and airframe type utilizing the hangar.	
Plumbing	Service Sink Compressed air drop at workbench Emergency eye and face wash	
HVAC	Heating, ventilation and cooling required.	
Fire Protection	Required	
Power	Convenience Outlets, Dedicated Equipment Connections, Workstation Outlets	
Lighting	Fluorescent, HID	
Communication	Workstation Outlets	
Intercommunications Systems	Call-In and Volume Control Stations	
Special Requirements	Due to the potentially large pieces of equipment brought into this shop, a rolling service door should be provided in lieu of double doors opening onto the hangar bay. Door shall be at least 5 feet (1.52M) wide and 6'-8" (2.03M) high. If a 4' (1.22M) wide opening is adequate, provide a single 4' (1.22M) wide personnel door in lieu of double doors. Consider using modular rolling storage shelving units for large tool rooms. Sometimes this space may require a vault for ALIS support. Coordinate with squadron.	
Acoustics	No special requirements above the STC provided by full height masonry walls	

Space or Room Type	Shop – Seat Maintenance (F-35 Only)	
Description / Usage	Maintains ejection seats. Includes arming and de-arming with storage of explosives used in the ejection seats.	
Minimum Ceiling Height	-	
Finishes	Walls	Painted CMU with resilient base. Partitions extend to the floor or roof deck above.
	Floors	Sealed concrete is the minimum. Epoxy or Thin Film Flooring Systems shall be provided if requested by the squadron.
	Ceiling	Shops shall have exposed construction. Paint exposed structure, ductwork, conduit, piping, devices, etc.
Built in Equipment or casework	Marker Boards	
Furnishings	Desks and Chairs, bookcases, vertical file cabinets, workbench with stools, aircraft parts shelf, vice, storage cabinets. Coordinate the quantities of furniture with the squadron. Other types of furniture may be required based on squadron and airframe type utilizing the hangar.	
Plumbing	Compressed air drop	
HVAC	Heating, ventilation and cooling required. Specialized exhaust system(s) required. Exhaust directly outdoors. Thermostat/humidistat. Separately controlled zone. Humidifier/Dehumidifier may be required due to the presence of ordnance. Explosion-proof fans & motors may be required for MK16E aircraft ejection seats.	
Fire Protection	Required	
Power	Workstation Outlets, Convenience Outlets, 400 Hz Panelboard, 400 Hz Bench Connection, Test Bench Connections, Ground Bus Bar	
Lighting	Fluorescent, explosive proof	
Communication	Workstation Outlets, CATV Outlet	
Intercommunications Systems	Call-In and Volume Control Station	
Special Requirements	<p>Seat Maintenance Shop should have direct access to the exterior. Provide panic devices on all doors from the shop.</p> <p>Space shall accommodate classifications of 1.3 and 1.4 with a net explosive weight (NEW) of 6.31 pounds of explosives (used in each ejection seat. Coordinate requirements for allowable quantities without creating separate occupancy type, if possible.</p> <p>Space shall accommodate classifications of 1.4b and 1.4d with a net explosive weight (NEW) of 0.54 pounds of explosives used in the Transparency Removal System (TRS)</p> <p>Criteria for explosive classifications are based on Joint Technical Bulletin 700-2 <i>Department of Defense Ammunition and Explosives Hazard Classification Procedure</i></p> <p>Doors shall be wide enough to accommodate the seat dolly.</p>	
Acoustics	No special requirements above the STC provided by full height masonry walls	

Space or Room Type	OH – Hangar Bay (F-35 Only)	
Description / Usage	Maintenance Hangar area	
Minimum Ceiling Height	See mandatory height requirements based on hangar type.	
Finishes	Walls	Painted CMU between O1/O2 and hangar bay Exterior walls shall have a protective panel system or masonry partition to 7' above the hangar floor Fire protection on columns shall be provided to a height of 20' above floor line
	Floors	Thin Film Flooring System
	Ceiling	Exposed construction. Paint exposed structure, deck, ductwork, conduit, piping, devices, etc.
Built in Equipment or casework	Avian Intrusion Prevention System shall be incorporated in the hangar bay. Do not use bird netting.	
Furnishings		
Plumbing	Emergency Shower and Eyewash per NAVOSH requirements	
HVAC	Heating and ventilation required. Exhaust directly outdoors. Thermostatic control switch required. May require overhead radiant heating. May require snow-melting system at hangar door tracks in colder climates. F-35 aircraft may require cooling carts. (Specific requirements TBD.)	
Fire Protection	Required. Provide Draft Curtains, Low-Level AFFF system, and fire separation between office and shop areas.	
Power	Ground Power Equipment Connection, Dedicated Equipment Connections, Convenience Outlets, 120/208 VAC, 60Hz, 20 receptacle, 270VDC 40kW power connection, 480VAC, 60Hz, 100-amp minimum ground power connections, network connection ,Classified Area up to 18" AFF	
Lighting	Fluorescent, HID	
Communication	Workstation Outlets, SCI Communications Outlets, Network LAN connection at each aircraft parking location, and any F-35 wheel and tire maintenance area.	
Intercommunications Systems	Microphone and Auxiliary Jacks, Paging Speaker System (Neoplanar Emitters), GPS Repeater Systems	
Electrical Special Systems and Devices	400 Hz Frequency Converters, if required by Legacy aircraft, 270VDC converters Security – CCTV Cameras, Access Control (if required by Government)	
Special Requirements	Provide Vertical Lift Fabric Doors with personnel doors as discussed in the UFC Provide catwalks and ladders to provide service for Vertical Lift Fabric Doors Provide platforms and ladders to provide service of bridge crane(s)	
Acoustics	No Special requirements above the full height CMU wall separating the O1/O2 area from the hangar bay. Doors between the O2 level and the hangar bay, if required, shall have acoustical seals including automatic door bottoms and perimeter seals	

Space or Room Type		Special Access Program Facility (SAPF)
Description / Usage		Combined operational spaces requiring high level of security. Other spaces such as Operations, Intel, Briefing, etc. may be combined into a SAPF. This group of spaces will provide Offboard Mission Support (OMS) This area is composed of different operational spaces such as Tactics, OPS, Briefing Rooms, Security spaces. See representative diagram attached. JAFAN 6/9 shall be utilized for the design and construction of this area. Coordinate the requirements for CONUS and OCONUS.
Minimum Ceiling Height		As required by requirements but 9 ft (2.74M), minimum
Finishes	Walls	Painted Gypsum Board with resilient base. Partitions shall be constructed in accordance with the written requirements as addressed in JAFAN 6/9
	Floors	Resilient Tile, minimum
	Ceiling	Suspended Acoustical Ceiling
Built in Equipment or casework		
Furnishings		Provide workstations as required by ALIS equipment
Plumbing		Not required
HVAC		Heating, ventilation and cooling required. Dedicated unit required. Security bars required as per JAFAN 6/9.
Fire Protection		Required
Power		Convenience Outlet, Workstation Outlet
Lighting		Fluorescent
Communication		Rack Mounted Equipment and Racks, Workstation Outlets
Intercommunications Systems		Call-In and Volume Control Stations
Special Requirements		This area is a secured area and requires controlled access hardware. Partitions shall extend to the roof construction above Provide combination lock as required SCIF construction requirements. SAPF shall be TEMPEST certified if required by program manager. SAPF shall be designed to "OPEN STORAGE" classification.
Acoustics		Provide acoustically enhanced ratings as required by JAFAN 6/9 requirements. If no specific requirements are indicated, provide full height partitions with an STC rating of 45. Provide doors with an STC rating of 45.

Space or Room Type	Shop – Paraloft Also may be part of AME shop or Flightline Equipment	
Description / Usage	This space is used to repair flight gear and parachutes. It also provides the storage area for flight gear.	
Minimum Ceiling Height	-	
Finishes	Walls	Painted CMU with resilient base. Partitions extend to the floor or roof deck above.
	Floors	Sealed concrete is the minimum. Epoxy or Thin Film Flooring Systems shall be provided if requested by the squadron.
	Ceiling	Shops shall have exposed construction. Paint exposed structure, ductwork, conduit, piping, devices, etc.
Built in Equipment or casework	<p>Marker Boards</p> <p>Flight Gear Lockers – coordinate requirements with squadron. Generally, lockers are open style with mesh sides. Due to the storage of combustible materials (flares), doors are not desirable on the locker fronts. Lockers must be sized to accommodate helmets and the particular gear associated with the aircraft type.</p> <p>Work table – provide large worktable to provide workspace for working on flight gear.</p> <p>Consider Rolling Storage units in lieu of fixed lockers to save space.</p>	
Furnishings	Desks and Chairs, bookcases, vertical file cabinets, workbench with stools, aircraft parts shelf, vice, storage cabinets. Coordinate the quantities of furniture with the squadron. Other types of furniture may be required based on squadron and airframe type utilizing the hangar.	
Plumbing	Washer hook up and hot & cold water required.	
HVAC	Heating, ventilation and cooling required. Dryer vent required. Specialized exhaust system(s) required. Exhaust directly outdoors. Explosion-proof fan motors may be required.	
Fire Protection	Required	
Power	Convenience Outlets, Workstation Outlets, Dryer hookup.	
Lighting	Fluorescent	
Communication	Workstation Outlets, CATV Outlet	
Intercommunications Systems	Call-In and Volume Control Stations	
Special Requirements	<p>2 exits are required from this space. Doors shall swing out and have panic devices.</p> <p>Verify quantity of Class C/D1.4G explosive material within the space. Provide protective construction if the allowable quantities of explosive material are exceeded.</p> <p>Space may need to be classified as a “Hazardous Occupancy” based on types and quantity of pyrotechnical devices stored in the space. Verify quantity (pounds) of material prior to establishing a special occupancy separation.</p>	
Acoustics	No special requirements above the STC provided by full height masonry walls	

Space or Room Type	Shop – Seat Shop	
Description / Usage	Shop and storage area for seats and other components that are part of reconfigurable aircraft.	
Minimum Ceiling Height	-	
Finishes	Walls	Painted CMU with resilient base. Partitions extend to the floor or roof deck above.
	Floors	Sealed concrete is the minimum. Epoxy or Thin Film Flooring Systems shall be provided if requested by the squadron.
	Ceiling	Shops shall have exposed construction. Paint exposed structure, ductwork, conduit, piping, devices, etc.
Built in Equipment or casework	Marker Boards	
Furnishings	Desks and Chairs, bookcases, vertical file cabinets. Coordinate the quantities of furniture with the squadron. Other types of furniture may be required based on squadron and airframe type utilizing the hangar.	
Plumbing		
HVAC	Heating, ventilation and cooling required. Specialized exhaust system(s) may be required. Exhaust directly outdoors. May require explosion proof fans & motors for MK16E ejection seats.	
Fire Protection	Required	
Power	Convenience Outlets, Workstation Outlets	
Lighting	Fluorescent	
Communication	Workstation Outlets, CATV Outlet	
Intercommunications Systems	Call-In and Volume Control Stations	
Special Requirements	Due to the potentially large pieces of equipment brought into this shop, a rolling service door should be provided in lieu of double doors opening onto the hangar bay. Door should be at least 5 feet (1.52M) wide and 6'-8" (2.03M) high. If direct access to the hangar bay is not provided, provide an exterior double door.	
Acoustics	No special requirements above the STC provided by full height masonry walls	

Space or Room Type	Communications Room	
Description / Usage	Provides space for NMCI head-in equipment Allow space for ALIS equipment Single Point of Entry	
Minimum Ceiling Height	-	
Finishes	Walls	Painted CMU with resilient base. Partitions shall extend to the construction above.
	Floors	Sealed concrete is the minimum. Epoxy or Thin Film Flooring Systems shall be provided if requested by the squadron.
	Ceiling	Exposed construction. Paint exposed structure, ductwork, conduit, piping, devices, etc. Provide suspended gypsum board ceiling as an option
Built in Equipment or casework		
Furnishings		
Plumbing	Not required	
HVAC	Heating, ventilation and cooling required. Dedicated unit required.	
Fire Protection	Required	
Power	Dedicated Equipment Outlets, Equipment Connection, Convenience Outlets	
Lighting	Fluorescent	
Communication	Rack Mount Equipment and Racks	
Special Requirements	Verify requirements for distance between communications rooms.	
Acoustics	No special requirements	

Space or Room Type	Sensitive Compartmented Information Facility (SCIF)	
Description / Usage	Operational spaces requiring high level of security. Other spaces such as Operations, Briefing, etc. may be combined into a SCIF.	
Minimum Ceiling Height	As required by requirements but 9 ft (2.74M), minimum	
Finishes	Walls	Painted Gypsum Board with resilient base. Partitions shall be constructed in accordance with the written requirements for a SCIF
	Floors	Resilient Tile, minimum
	Ceiling	Suspended Acoustical Ceiling
Built in Equipment or casework		
Furnishings	Provide workstation if required by squadron.	
Plumbing	Not required	
HVAC	Heating, ventilation and cooling required. Dedicated unit required. Security bars required as per DCID 6/9.	
Fire Protection	Required	
Power	Convenience Outlet, Workstation Outlet	
Lighting	Fluorescent	
Communication	Rack Mounted Equipment and Racks, Workstation Outlets	
Intercommunications Systems	Call-In and Volume Control Stations	
Special Requirements	This area is a secured area and requires controlled access hardware. Partitions shall extend to the roof construction above Provide combination lock as required SCIF construction requirements	
Acoustics	Provide acoustically enhance ratings as required by SCIF requirements. If no specific requirements are indicated, provide full height partitions with an STC rating of 45. Provide doors with an STC rating of 45.	

Section C

Add to imperial table:

AIRFRAME TYPE, OR MODEL AND SERIES	TYPE HANGAR MODULE	WINGSPAN (MAX)		FUSELAGE LENGTH	MAX HEIGHT (³)	WEIGHT	
		NORMAL	FOLDED			EMPTY	MAX TAKE OFF
		(ft-in)	(ft-in)				
F-35B ⁽¹⁾	I	35-0	35-0	51-4	15-4	32,332	61,500
F-35C ⁽²⁾	I	43-0	31-4	51-5	16-9	34,986	74,700

Footnotes

1. Data derived from "F-35 Lightning II Facilities Requirements Document" 29 February 2008, figures 1-3 and 1-4.
2. Data derived from "F-35 Lightning II Facilities Requirements Document" 29 February 2008, figures 1-5 and 1-6.
3. Note: The maximum height in this table has been increased to allow for the maximum extension of the landing gear.

Add to system international table:

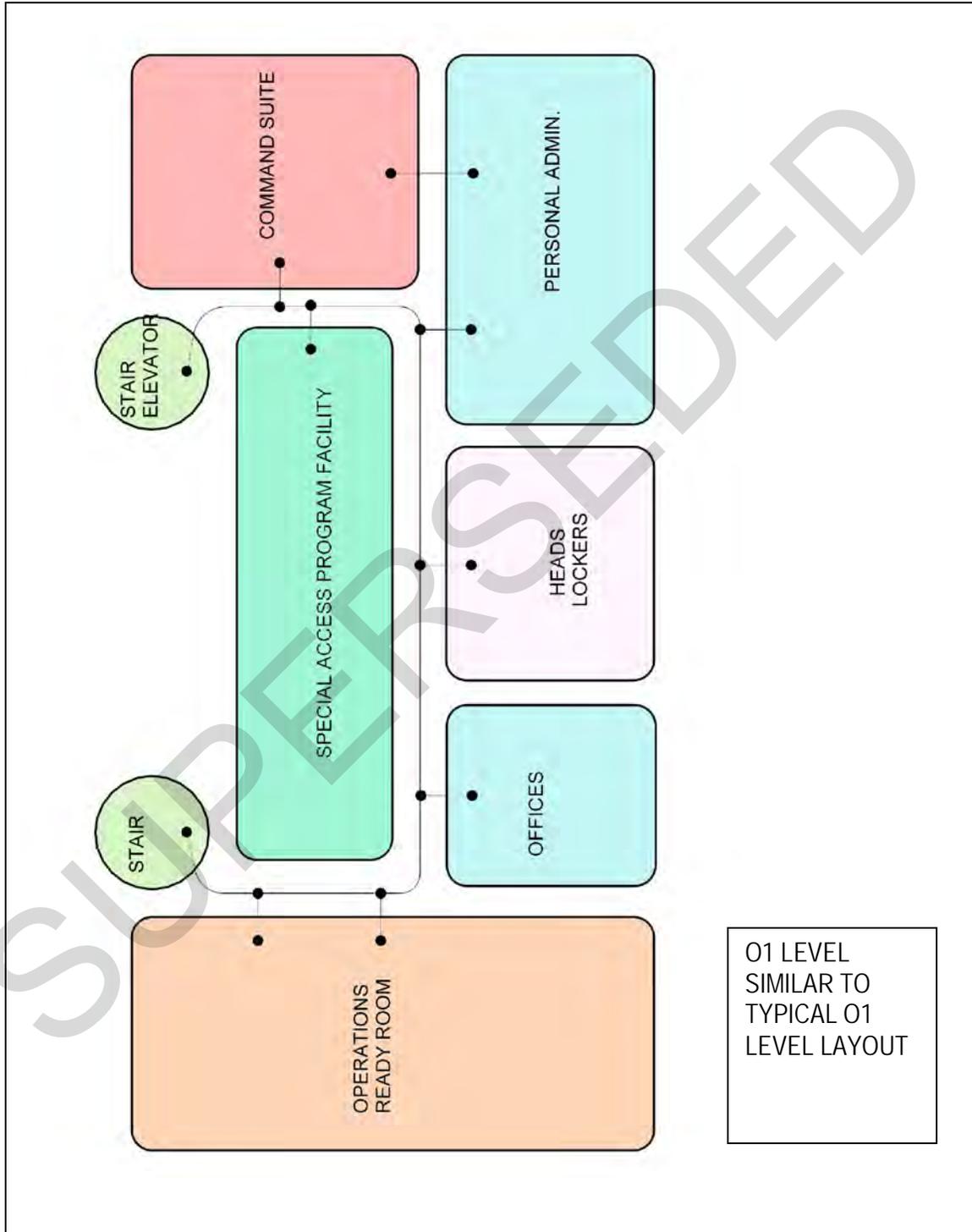
AIRFRAME TYPE, OR MODEL AND SERIES	TYPE HANGAR MODULE	WINGSPAN (MAX)		FUSELAGE LENGTH	MAX HEIGHT (³)	WEIGHT	
		NORMAL	FOLDED			EMPTY	MAX TAKE OFF
		(m)	(m)				
F-35B ⁽¹⁾	I	10.67	10.67	15.62	4.67	143.81	273.6
F-35C ⁽²⁾	I	13.44	9.53	15.65	5.09	156.62	332.3

Footnotes

1. Data derived from "F-35 Lightning II Facilities Requirements Document" 29 February 2008, figures 1-3 and 1-4.
2. Data derived from "F-35 Lightning II Facilities Requirements Document" 29 February 2008, figures 1-5 and 1-6.
3. Note: The maximum height in this table has been increased to allow for the maximum extension of the landing gear.

Section F

Add the following diagrams



O2 LEVEL DIAGRAM (F-35)

Supplement to UFC 2-000-05N, (P-80) Facility Planning Criteria for Navy/Marine Corps Shore Installations

This section provides planning guidance for the following Category Codes based on Section 3 of the F-35 II Lightning Facilities Requirements Document dated 29 February 2009. The guidance considers Organizational or "O" level maintenance functions and adds additional space to support unique requirements of the aircraft including communication systems, pilot briefing, and computer support. Section 3.5.3, Off-Equipment Aircraft Maintenance Areas, of the FRD identifies activities will likely be performed in existing Intermediate or "I" Level maintenance facilities at the installation. Coordinate these requirements during project development.

211-05, Maintenance Hangar - O/H Space (High Bay)
211-06, Maintenance Hangar - 01 Space (Crew and Equipment)
211-07, Maintenance Hangar - 02 Space (Administrative)

Additional requirements for planning and design of hangars can be found in UFC 4-211-01N, Aircraft Maintenance Hangars: Type I, Type II and Type III. The modular style hangar was developed to maintain squadron integrity and to provide flexibility for potential changes in mission and aircraft.

The following typical F-35II squadrons are envisioned; all other squadrons or units operating aircraft are considered "non-standard". Guidance for

- Aircraft Operational Squadron (Marine Corps): 16 F-35II (B) aircraft and 250 to 350 personnel.
- Aircraft Operational Squadron (Navy or Marine Corps): 10 to 15 F35II (B) or 10 to 15 F35II (C) aircraft and 200 to 300 personnel.
- Combined (Navy and Marine Corps) Fleet Replacement Squadron (FRS): 15 to 20 F35II(B) and 15 to 20 F35II(C) aircraft and 600-800 personnel. The Marine Corps portion of the FRS would tend to be at the upper range of both aircraft and personnel.
- Single (Navy and Marine Corps) Fleet Replacement Squadron (FRS): 15 to 20 F35II (B or C) and 300 to 400 personnel. The Marine Corps FRS would tend to be at the upper range of both aircraft and personnel.

Table 1 - Type I Modular Hangar Dimensional Statistics

Category Code 211 05: Hangar (OH)		
Gross Area per Module (SM / SF)	1,854	19,500
Wall thickness and structural loss compensation factor (5% of Module Gross Area (SM / SF) ¹	93.8	998
Clear Height (meters/feet)	9.91	32.5
Usable Depth ²	24.4	80
Usable Width ³ :		
1 Module	61	200
1-½ Module	93	305
2 Modules	125	410
2-½ Modules	157	515
3 Modules	189	620
3 ½ Modules	218	715
4 Modules	253	830
Each additional ½ Module	+32	+105
Category Code 211 06: Crew and Equipment		
Gross Area per Module (SM / SF)	803	8,640
Category Code 211 07: Administrative		
Gross Area per Module (SM / SF)	803	8,640

1. The clear dimensions are measured to any obstruction in the hangar including columns, walls and other permanently mounted equipment. Wall thickness, structure and equipment loss are accounted for in the compensation factor.

2. Add an additional 3.05 meters (10 feet) for fire equipment clearance along the rear wall of the hangar and 1.52 meters (5 feet) clearance between the aircraft and the doors to calculate the required clear depth of the hangar.

3. Add 1.52 meters (5 feet) work clearance from the aircraft to the outer walls. Also assumes that aircraft are parked parallel to each other and to the side walls of the hangar to minimize evacuation time.

Table 2 - Modification for F35 Type I Hangar Modules

Squadron Type	Gross Area (Category Code) (SF)			Total Area (SF)	Remarks
	211-05 (OH)	211-06 (O1)	211-07 (O2)		
Operational Squadron (Marine Corps) 16 F35 (B) aircraft	24,439	13,446	13,513	51,398	OH space is 245' x 95' 1 Type I OH Module, modified 1 Type I O1 & O2 Module, modified
Operational Squadron (Navy or Marine Corps) 10-15 F35 (B or C) Aircraft	20,948	12,796	13,405	47,149	OH space is 210' x 95' 1 Type I OH Module 1 Type I O1 & O2 Module, modified
Combined FRS Squadron 15 to 20 F35 (B) 15 to 20 F35 (C)	52,369	23,675	29,638	105,682	OH space is 525' x 95' Single Story O1/O2 space 2 ½ Type I OH Modules, modified 2 Type I O1 & O2 Module, modified
Combined FRS Squadron 15 to 20 F35 (B) 15 to 20 F35 (C)	52,369	26,866	31,467	110,702	OH space 525' x 95' Two Story O1/ O2 space 2 ½ Type I Modules, modified 2 Type I O1 & O2 Module, modified
FRS Squadron (Navy or Marine Corps) 15 to 20 F35 (B or C)	31,421	11,838	14,990	58,48	OH space is 315' x 95' Single Story O1/O2 space 1 ½ Type I OH module, modified 1 Type I O1 & O2 Module, modified
FRS Squadron (Navy or Marine Corps) 15 to 20 F35 B or C	31,421	13,493	15,956	60,870	OH space is 315' x 95' Two Story O1/ O2 space 1 ½ Type I module, modified 1 Type I O1 & O2 Module, modified

Notes to Table 2:

1. Squadrons operating with detachments are authorized an addition 19 SM (200 sf) of O1 and O2 space per detachment based on the average number of detachments on board
2. Since line operations and line maintenance functions must be performed as close as possible to the apron parked aircraft and additional 27.9 SM (300 SF) is authorized per squadron. Note, if line operations and maintenance is currently provided in separate structures, use Category Code 141-30, Aircraft Line Operations Building and Category Code 211-15, Line Maintenance Shelter for inventory purposes only.
3. The widths of the O1 and O2 spaces shall not exceed the width of the computed number of OH modules. However, should the computed width exceed the width of the computed OH module by twenty percent, a deviation from the standard hangar dimensions can be requested from the Commander, Naval Air Systems Command, Code 8.0Y1.

Table 3: Number of aircraft per Module

Aircraft	Module Type	Maximum Number of Aircraft per Module
F-35II (B)	Type I	5
F-35II (C)	Type I	5

See UFC 2-00-05N for formulas for calculating required hangar width. Aircraft dimensional data is given in Section C.

Non Standard F-35II Squadrons:

Calculate required space by combining the requirements for standard sized squadrons and the spaces needed to support the remainder of the aircraft loading. Partial modules will be normalized to full modules as follows:

- (a) Less than one module, one module required
- (b) More than one module, but less than one and one half modules, one module required
- (c) Additional modules assigned on the same basis