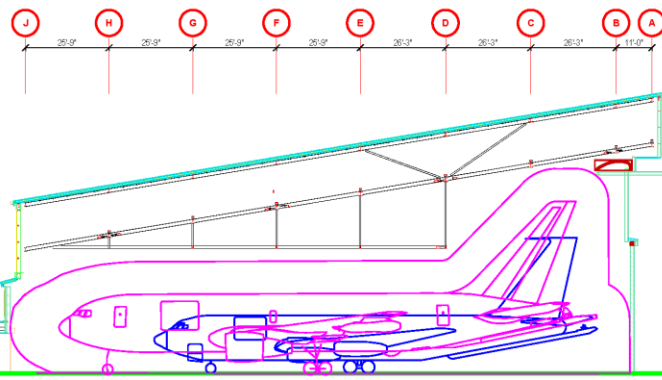
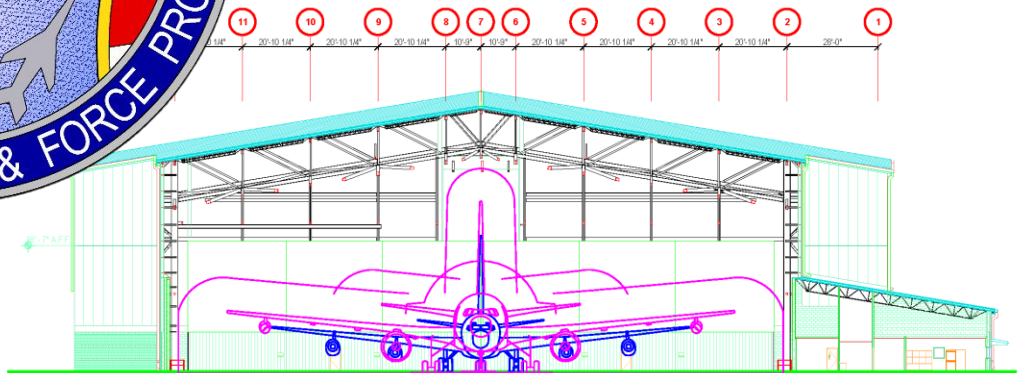
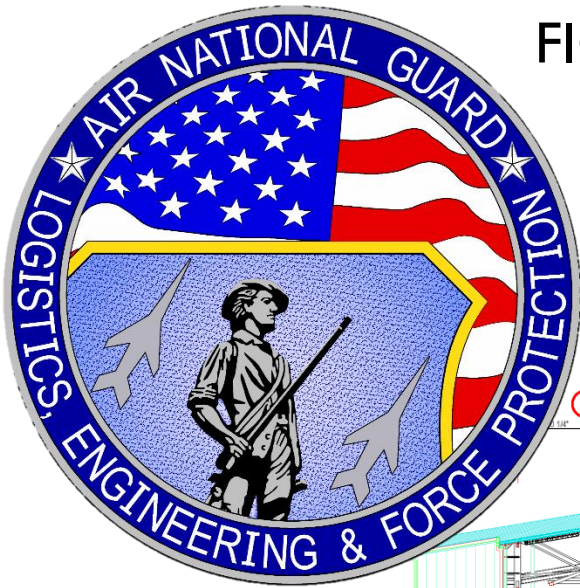


# AIR NATIONAL GUARD MISSION GROUPED AIRCRAFT HANGAR SIZES

C-17,  
REFUELERS,  
C-130s,  
FIGHTERS,



15 March 2023

**ACCESSIBILITY:**

**RELEASABILITY:** There are no release restrictions on this publication.

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OPR: NGB/A4A

Certified by: NGB/A4 Deputy Director, Engineering

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**FOREWORD**

Air National Guard Mission Grouped Hangar Sizes outlines 3 hangar sizes to align with the REGAF CATCODE guidance for a large, medium, and small maintenance dock to replace CATCODE 211-111. This document will serve as a tool to program new facilities, modify existing spaces, and manage hangar space for personnel engaged in planning, programming, designing, certifying, and approving ANG hangars. This does not authorize use of appropriated funds, non-appropriated funds, or private funds for construction or conversion of ANG facilities. Mission Grouped hangar size is considered a case-by-case basis and requires NGB/A4A approval for which hangar size to use. Reference UFC 4-211-01 for hangar details outside of a Mission Grouped hangar look.

**EXECUTIVE SUMMARY**

The use of CATCODE 211-173, 211-175, or 211-177 is a replacement for 211-111 based on mission and would never combine the use at any installation – would only use one Mission Grouped Maintenance Hangar Size CATCODE and would no longer use 211-111. The ANG assigns square footage based on weapon system. Evaluation of the weapon systems can assign a Mission Grouped hangar size for a group of aircraft in keeping Refuelers together, C-130s together, and fighters together. All hangars need to identify the 7 to 1, and any other obstruction needs, to know the impact and what is possible for an eyebrow expansion, example MQ-9 to C-130. Interior heights also need to be planned for future expansion, example MQ-9 to C-130. Hangar framing support beams must be accounted for and must be outside of the aircraft setback bubble. Hangar restrooms and mechanical rooms will move to CATCODE 211-152 for maintenance hangars thus Mission Grouped Hangar Bay square footages is only for the hangar bay, hangar bay walls, and hangar bay door. See below Summary Table for weapon system to Mission Grouped Maintenance Hangar Bay sizes.

**Table 1: Air National Guard Mission Grouped Maintenance Hangar Sizes**

<b>Aircraft / Mission</b>	<b>Covered Spaces</b>	<b>CATCODE</b>	<b>Size</b>	<b>Bay (Gross SF)</b>
C-17	1	211-173	Large	<b>34,000</b>
F-15, F-16, F-22, F-35 Drive Through Hangar	6	211-173	Large	<b>32,000</b>
F-15, F-16, F-22, F-35 Single Door Hangar	6	211-173	Large	<b>35,500</b>
KC-135/KC-46	1	211-175	Medium	<b>28,000</b>
F-15, F-16, F-22, F-35 15° angled in line	6	211-175	Medium	<b>28,000</b>
C-130 / C-130J-30 Stretched	1	211-177	Small	<b>20,000</b>
CRTC	1	211-177	Small	<b>20,000</b>
HH-60G	2	211-177	Small	<b>20,000</b>
Predator - MQ-1 (published 16 November 2007)	6	211-177	Small	<b>20,000</b>
Reaper - MQ-9 (published 16 November 2007)	4	211-177	Small	<b>20,000</b>

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# Chapter 1: Introduction

## 1.1 Hangar Maintenance Dock

The REGAF use Category Codes 211-173, Large Aircraft Maintenance Dock, 211-175, Medium Aircraft Maintenance Dock, 211-177, Small Aircraft Maintenance Dock, and 211-179, Fuel System Maintenance Dock aligned with aircraft size. The use of CATCODE 211-173, 211-175, or 211-177 is a replacement for 211-111 based on mission and would never combine the use at any installation – would only use one Mission Grouped Maintenance Hangar Size CATCODE and would no longer use 211-111. Table 2 shows the different dimensions per aircraft.

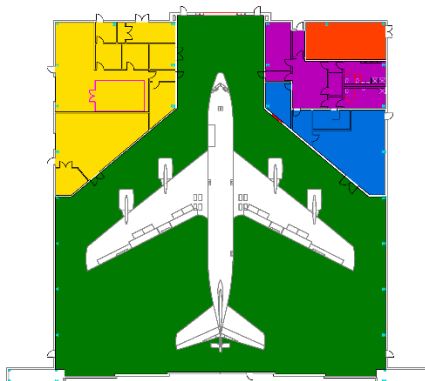
**Table 2: Aircraft Dimensions for Mission Groups**

Aircraft	Wingspan	Length	Tail Height	Fuselage Height
C-17	169 feet, 10 inches	174 feet	55 feet, 1 inch	25 feet
C-130	132 feet, 7 inches	97 feet, 9 inches	38 feet, 5 inches	16 feet, 1 inch
C-130J-30	132 feet, 7 inches	112 feet, 9 inches	38 feet, 10 inches	16 feet, 1 inch
KC-135	130 feet, 10 inches	136 feet, 3 inches	41 feet, 8 inches	17 feet, 10 inches
KC-46	156 feet, 1 inch	165 feet, 6 inches	52 feet, 10 inches	24 feet, 7 inches
F-15	42 feet, 10 inches	63 feet, 9 inches	18 feet, 8 inches	
F-16	32 feet, 8 inches	49 feet, 5 inches	16 feet, 5 inches	
F-22A	44 feet, 6 inches	62 feet, 1 inch	16 feet, 8 inches	
F-35A	35 feet	51 feet, 5 inches	14 feet, 2 inches	

## 1.2 ANG Aircraft Hangar Layout Guidance and Recent AF Project

ANGH 32-1084 outlines the use of nose shaped hangars for large frame aircraft in both floor plan and elevation, which is used in all ANG hangar projects. REGAF is also using nose area shaped Mission Grouped hangars as shown in the recent AMC McGuire hangars. A nose and tail section shaped hangar have not been encouraged due to expected cost increase for more structural steel. The ([Table 1: Air National Guard Mission Grouped Maintenance Hangar Sizes](#)) is a specific reference to maintenance hangar size options per mission.

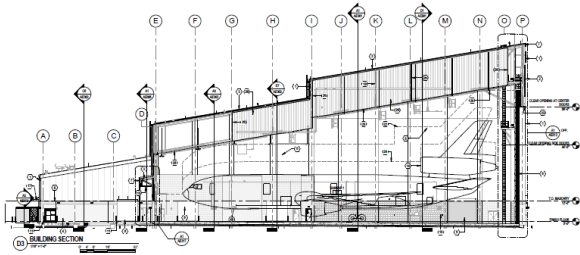
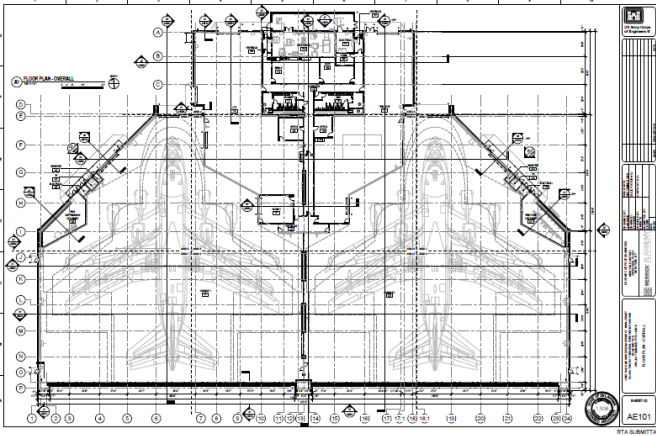
**Figure 1-1: ANGH 32-1084 published graphic for large frame aircraft hangars**



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1.2.1 REGAF is also using nose area shaped Mission Grouped hangars as shown in the recent AMC McGuire hangars.

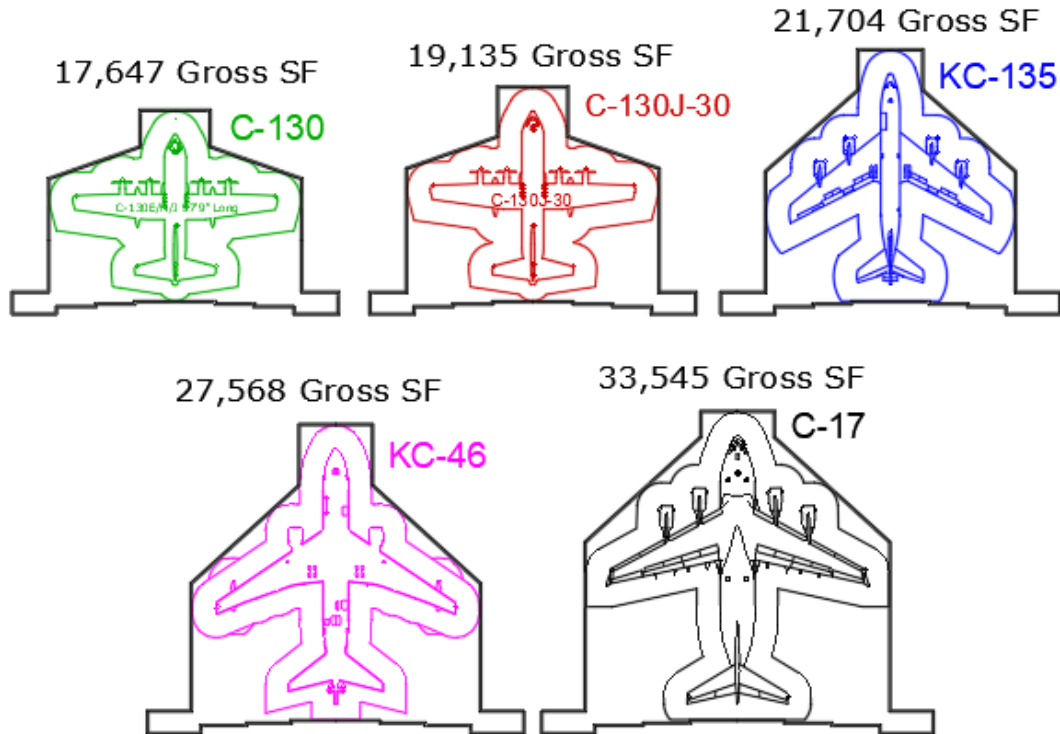
**Figure 1-2: AMC KC-46 Hangars at McGuire sized for the KC-46, C-17, & DC-10/KC-10**



### 1.3 Large Frame Aircraft Shaped Nose Area

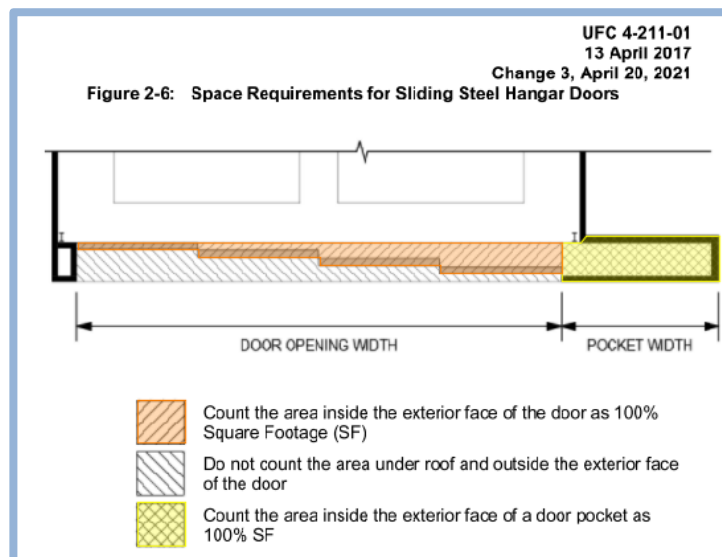
Following ANGH 32-1084 and current AF hangar layouts will look at nose shaped hangar layouts for large frame aircraft. The Gross SF in Figure 1-3 accounts for 14" wall thickness, 19" hangar door thickness, and any area taken by the pocket door. Gross SF does not include restrooms and directly related mechanical rooms which will be moved to CATCODE 211-152 at an additional 2,000 SF for all Mission Grouped maintenance hangars.

**Figure 1-3: Large Frame Aircraft Minimal Hangar Bay Sizes**



1.3.1 Hangar door scope is defined in UFC 4-211-01: "Count the area inside the exterior face of a door pocket as 100% SF".

**Figure 1-4: Image from UFC 4-211-01 (April 20, 2021) hangar door scope**



1  
2 1.3.2 Limited use of Fabric Hangar Doors per UFC 3-301-01.

3 **Figure 1-5: Image from UFC 3-301-01 (4 February 2022) hangar door limited use**

**1609.2.4 - Vertical Lift Fabric Hangar Doors (VLFD) [Addition]**

Vertical Lift Fabric Doors are prohibited within windborne debris regions.

In addition to windborne debris regions, VLFD's are prohibited for use in aircraft maintenance hangars where risk category III wind speeds equal or exceed wind speeds defining a windborne debris region. Namely, 130 mph (58 m/s) within one mile of the coastal mean high-water line or 140 mph (63.6 m/s) anywhere.

**[C] 1609.2.4 – Vertical Lift Fabric Hangar Doors (VLFD) [Addition]**

VLFD's are currently prohibited for use in windborne debris regions due to failures experienced during hurricane Michael. These failures were predominately caused by wind driven debris. Additionally, the DoD has prohibited VLFD use where hangar design wind speeds are consistent with windborne debris regions, which provides commensurate design wind speed protection against windborne debris for Risk Category III hangar facilities.

4  
5 1.3.3 Per UFC 4-211-01 Section 2-3.3 add in jack height to overhead aircraft clearance.

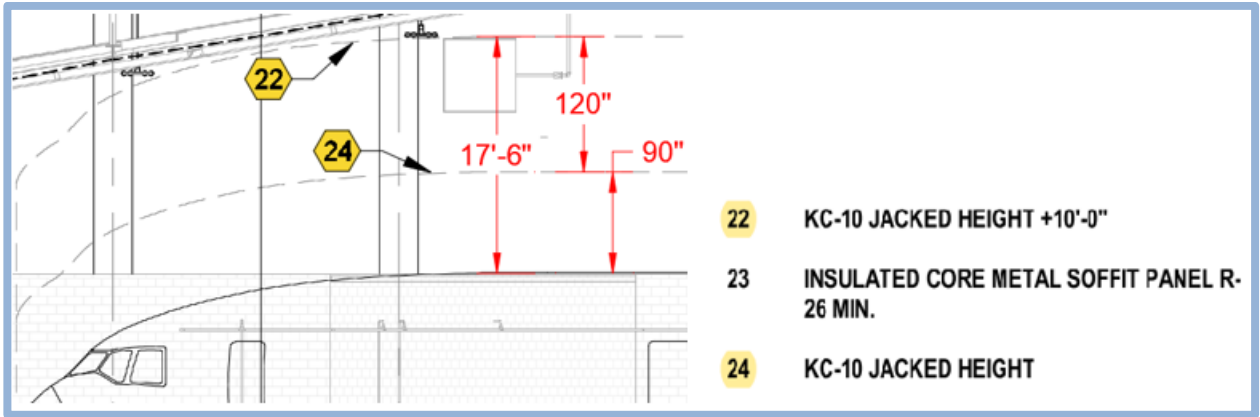
6 **Figure 1-6: Image from UFC 4-211-01 Section 2-3.3**

**2-3.3 Additional Clearances**

Specific airframe or Service requirements may increase the minimum clearances required by Table 2-1: Minimum Aircraft Maintenance Bay Clearances to allow performance of certain maintenance operations. Coordinate with the maintenance unit staff to determine if additional space is required to maintain the aircraft. Provide additional clearances where required by an approved document such as the design aircraft's Facility Requirements Document (FRD) or a Service-specific standard design, defined Service hangar type, or other approved criteria. For example, the FRD may require additional space aft of the aircraft to remove the engine, or additional space above an aircraft to provide the crane hook height to perform maintenance operations such as pulling the rotor shaft out of a helicopter or maintaining the radar dome on an Airborne Warning and Control System (AWACS) aircraft. Jacking the design aircraft will reduce the overhead clearance below requirements in this UFC. Confirm jacking the design aircraft in the parking position does not require additional height to avoid conflict with an overhead obstruction. Minimum hook height is to the saddle of the hook.

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**Figure 1-7: McGuire setback added in 90 inches to account for a 120 Ton Tripod Jack**



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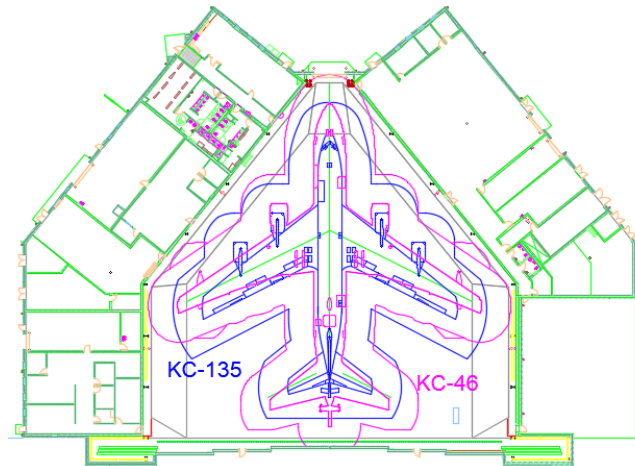
1        1.4        **Past ANG Hangar Projects**

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2        1.4.1        Previous new construction 211-111 Mx Hangars for C-130s and KC-135 moved the  
3                restrooms and mechanical rooms to shop and admin CATCODEs in order to build a bigger  
4                hangar bay for a larger aircraft. With Mission Grouped Maintenance Hangar sizing the  
5                hangar bay size is now planned and protected area ready for all aircraft within the mission  
6                group.

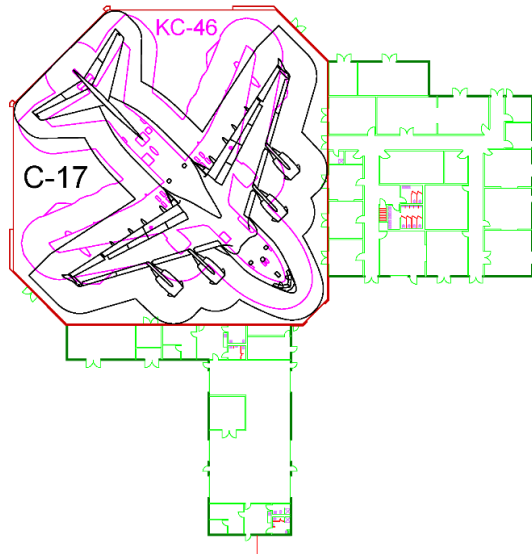
7                1.4.1.1        Project “PSXE999132, REPLACE KC-135 MAINTENANCE HANGAR AND  
8                    SHOPS” at McGhee Tyson was used to build a KC-46 hangar although it was  
9                    originally programmed for the KC-135 at 28,000 SF in CATCODE 211-111. Actual  
10                  hangar bay size is 28,616 SF counting the pocket doors per UFC 4-211-01.

11        **Figure 1-8: McGhee Tyson KC-135 and KC-46 Maintenance Hangar.**



12  
13        1.4.1.2        Project JTVE999090 Gulfport for Bldg 75 was originally programmed as a C-130  
14                CATCODE 211-111 MX Hangar at 28,000 SF, although was used to build a nose and  
15                tail shaped hangar for the C-17 and KC-46. Actual hangar bay size is 28,340 SF.

16        **Figure 1-9: Gulfport C-17 and KC-46 Maintenance Hangar**



17  
18        1.4.2        Review of these past projects highlight that NGB/A4 has coordinated with ANG Air Wings  
19                for possible future missions or expected larger aircraft use of hangar bay.

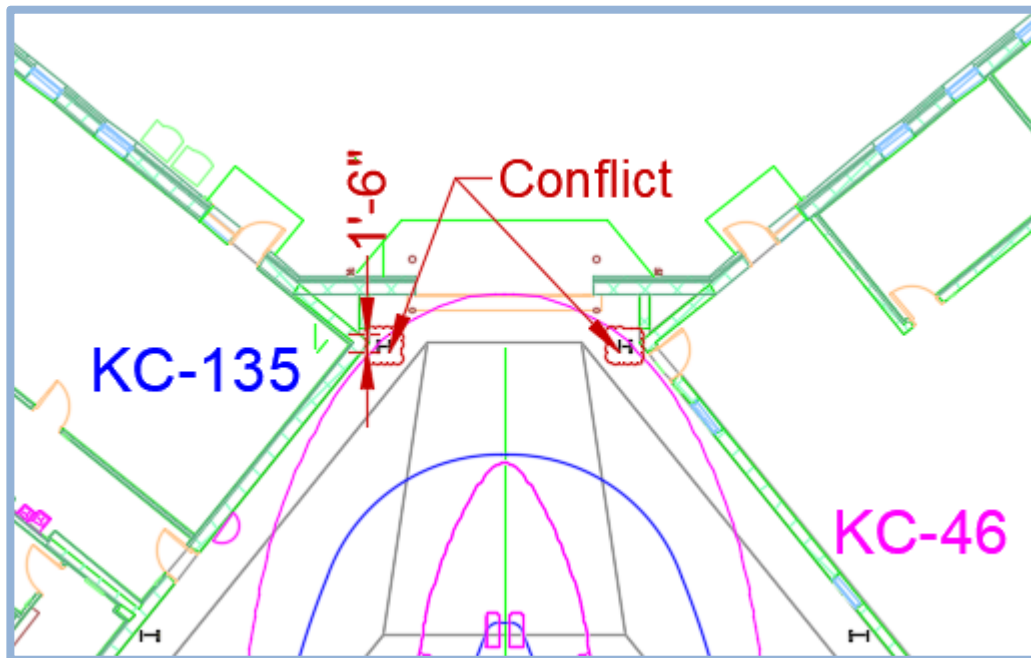
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## 1.5 Plan for the Aircraft Setback Bubble

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In the past there have been purpose-built hangars that required a waiver once completed because the planning did not completely plan for the setback. Consideration needs to be taken for the complete aircraft setback bubble during all phases of the design to include all vertical and horizontal framing members and overhead rolling door hood. NGB/A4 preference is for all designers to use the same aircraft drawings based on manufacture (Boeing supplies dwg files) or detailed AF Technical Order (TO). NGB/A4AM can provide three view aircraft drawings and is open to feedback to make sure the drawings are correct. In the below figure the A&E actually built while showing the conflict thus a designed and built need for a waiver when could have

**Figure 1-10: Hangar Example, Framing 18" Inside Setback Bubble**

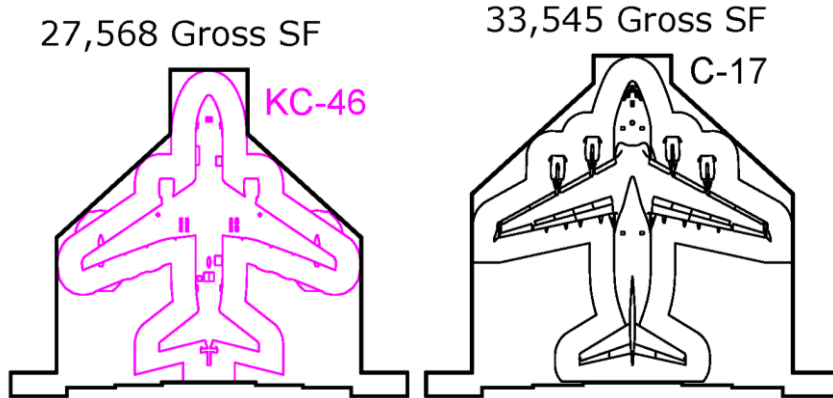


# Chapter 2: Large Aircraft Hangar Size

## 2.1 CATCODE 211-173, Large Aircraft Maintenance Dock, C-17

2.1.1 211-173, Large Aircraft Maintenance Dock only includes the C-17 and Fighters. There is approximately 6,000 SF difference from the KC-46 to the C-17, partially because the front of the wing profile is quite different.

**Figure 2-1: C-17 Wing Front Area**

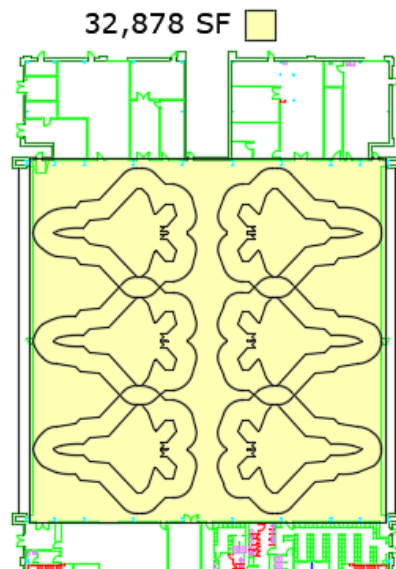


2.1.2 The C-17 211-173, Large Aircraft Maintenance Dock would be 34,000 SF.

## 2.2 211-173, Large Aircraft Maintenance Dock, Six Fighters

2.2.1 The universal fighter is based on the F-22 width and F-15 length. The hangar bay at Hickam AFB is 32,878 SF for six F-22 fighter aircraft in a pass-through configuration.

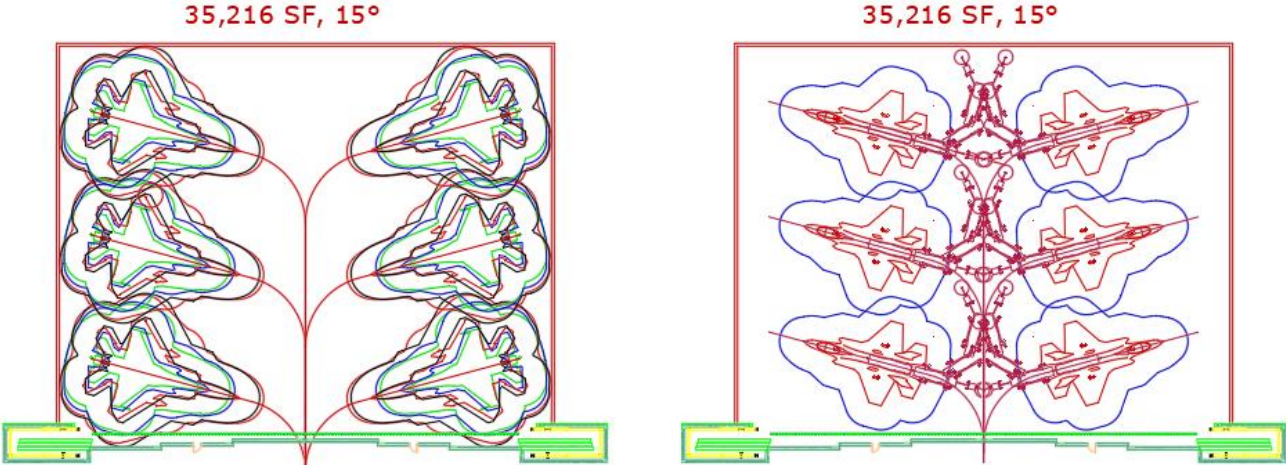
**Figure 2-2: Hickam Hangar Bay Size with Two Hangar Doors**



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2.2.2 The pass-through hangar configuration at Hickam may not be achievable at some locations. Considering a traditional single door hangar provides 35,216 SF and will fit six universal fighters while allowing each to have a path for direct exit. The six fighter layouts account for the hangar bay wall thickness, hangar door, and door pockets.

**Figure 2-3: Six Mission Grouped Fighter with Single Door Hangar Bay Size**



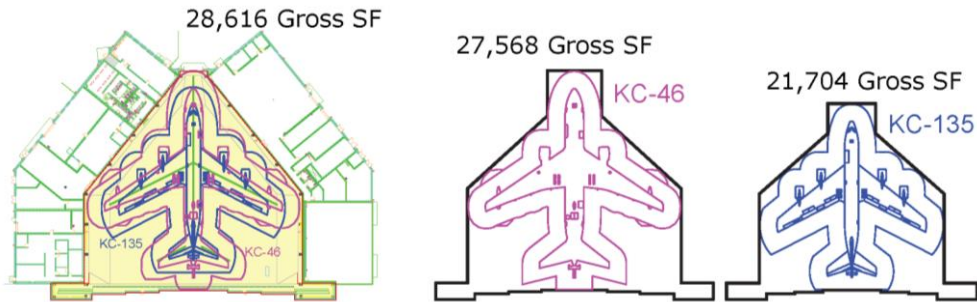
2.2.3 For six Mission Grouped fighters would use 32,000 SF for drive through and 35,500 SF for a single door hangar.

# Chapter 3: Medium Aircraft Hangar Size

## 3.1 CATCODE 211-175, Medium Aircraft Maintenance Dock, Tanker

3.1.1 KC-135 and KC-46 Refueler aircraft will both fit in a 28,000 SF hangar bay if using a doghouse for the nose area.

**Figure 3-1: KC-135 Hangar Compared to KC-46**

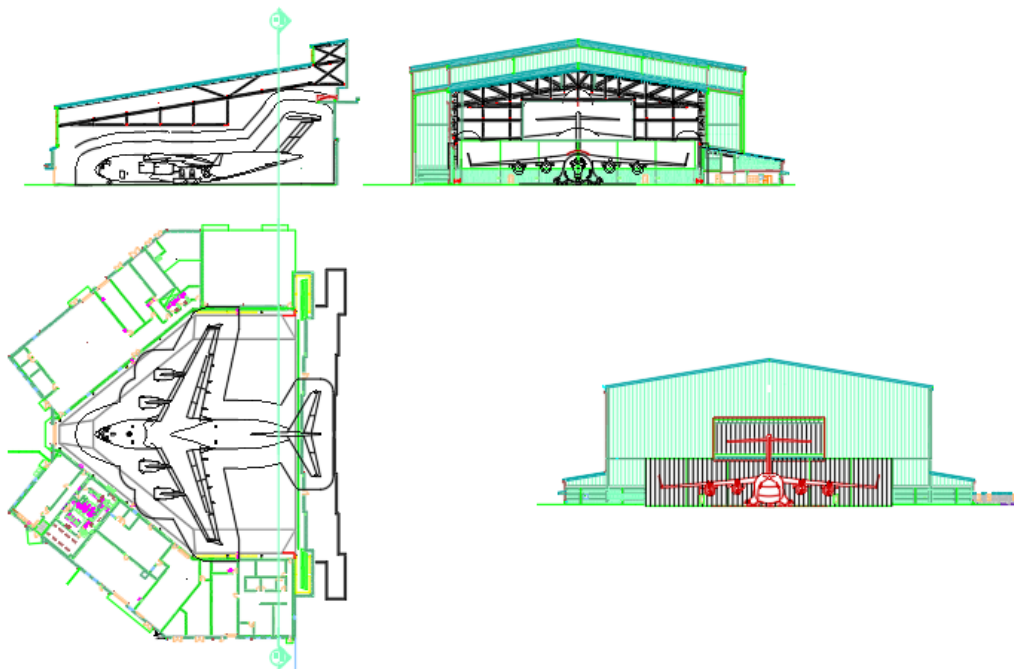


3.1.2 The KC-135 and KC-46 are the only two aircraft missions in the 211-175, Medium Aircraft Maintenance Dock at 28,000 SF.

3.1.3 When deciding to construct The Tanker Medium Hangar bay, one should also plan for possible expansion into a C-17 hangar (Ref Fig 3-2). The KC-46 fuselage is taller than the C-17, thus the eyebrow addition would account for the C-17 tail. For planning purpose, evaluate the C-17 eyebrow for the 7 to 1 glide slope and parking plan setback. See Figure 3-3 which illustrates the eyebrow hangar moved 54'-4". The impact of the expansion should be identified in the planning phase to select the best site plan.

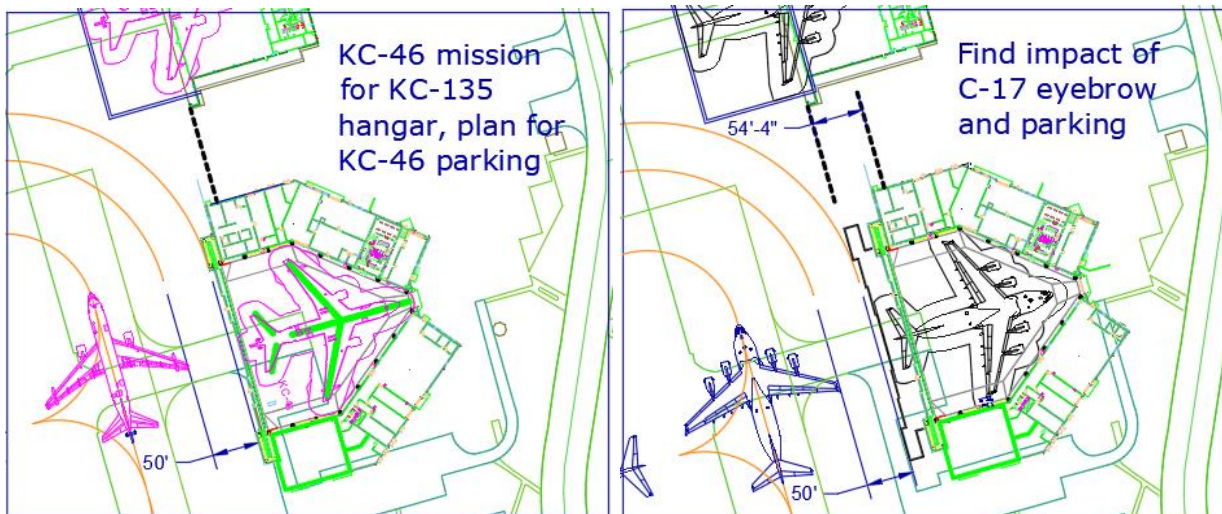
3.1.4 Plan for overhead fall protection rail to be outside the KC-46 jacked height + 10' overhead setback.

**Figure 3-2: Medium Hangar with C-17 Eyebrow Evaluation**



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**Figure 3-3: Medium Hangar Eyebrow Evaluation impact on site plan**



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**3.2 CATCODE 211-175, Medium Aircraft Maintenance Dock, Fighters**

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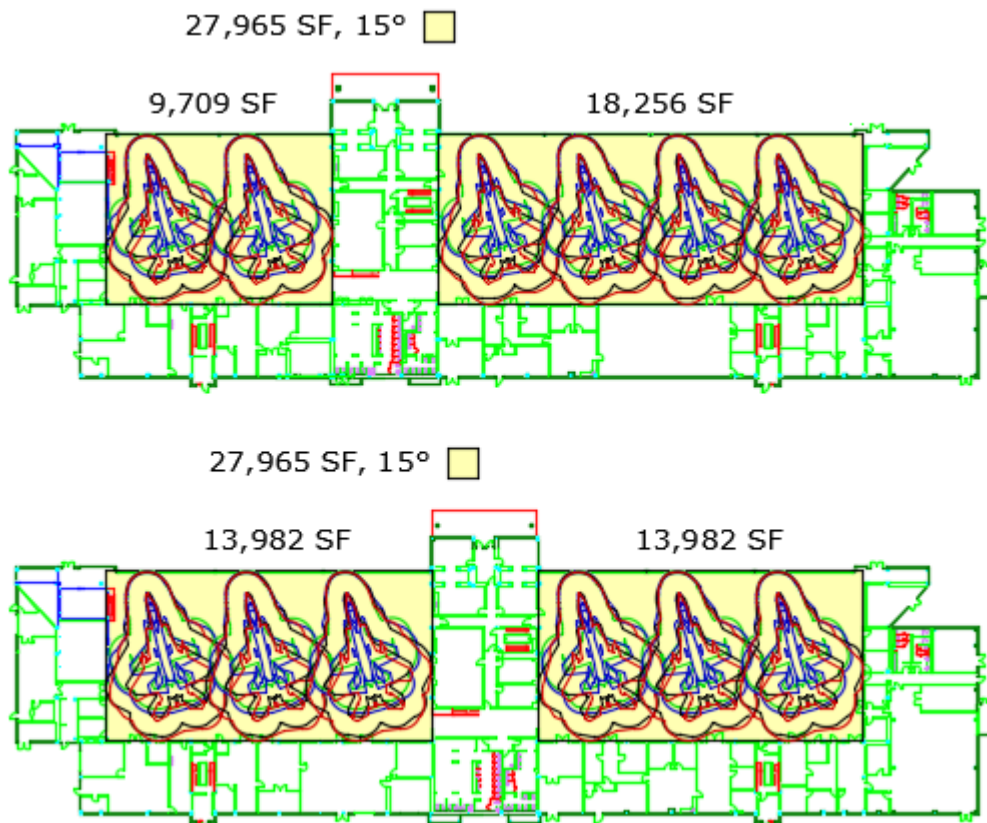
3.2.1 The most efficient Fighter hangar area provides 15° angled in-line parking for 6 parking spots fitted into 28,000 SF regardless of whether the hangar is arranged as a 2 bay and 4 bay or two 3 bay layout (Ref Fig 3-4).

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**Figure 3-4: Fighter Medium Maintenance Hangar**



9

# Chapter 4: Small Aircraft Hangar Size

## 4.1 211-177, Small Aircraft Maintenance Dock Summary

4.1.1 This Category Group is for all other flying missions C-130J-30 Stretched and smaller.

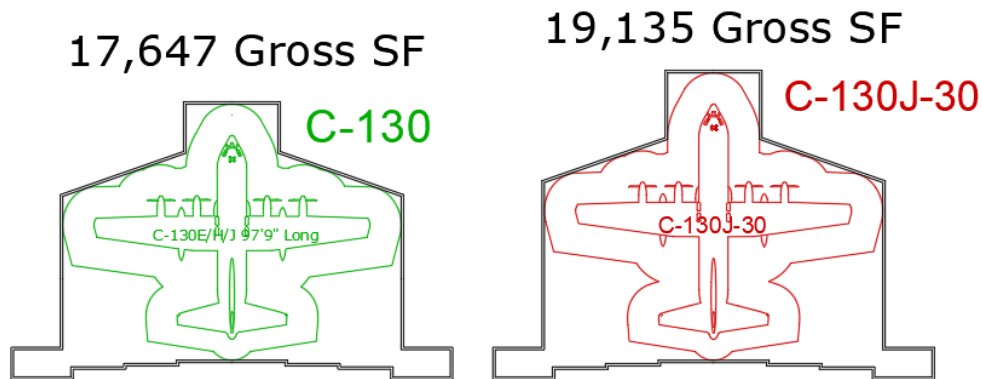
**Table 4-1: CATCODE 211-177, Small Aircraft Maintenance Dock Aircraft**

Aircraft / Mission	Covered Spaces	CATCODE	Size	Bay (Gross SF)
C-130 / C-130J-30 Stretched	1	211-177	Small	20,000
CRTC	1	211-177	Small	20,000
HH-60G	2	211-177	Small	20,000
Predator - MQ-1	6	211-177	Small	20,000
Reaper - MQ-9	4	211-177	Small	20,000

## 4.2 C-130 and C-130J-30 Stretched Maintenance Hangar

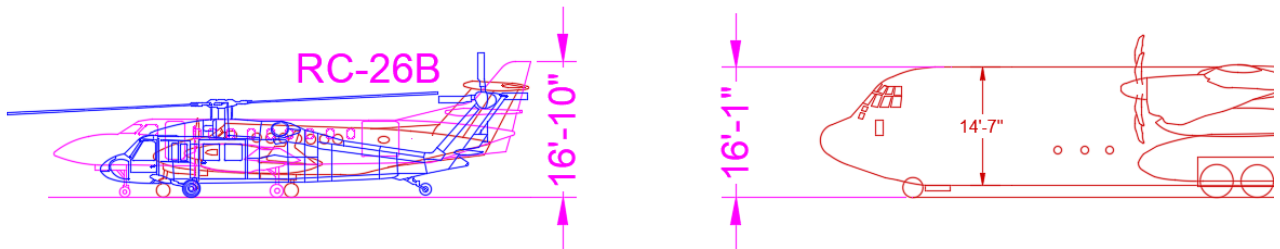
4.2.1 Plans for the C-130J-30 Stretched and is 20,000 Gross SF inclusive of the wall thickness, hangar door, and hangar door pocket.

**Figure 4-1: C-130 and C-130J-30 Stretched Maintenance Hangar Size**



4.2.2 Plan for interior clear height of to allow for the C-130 jacked height + 10' overhead setback.

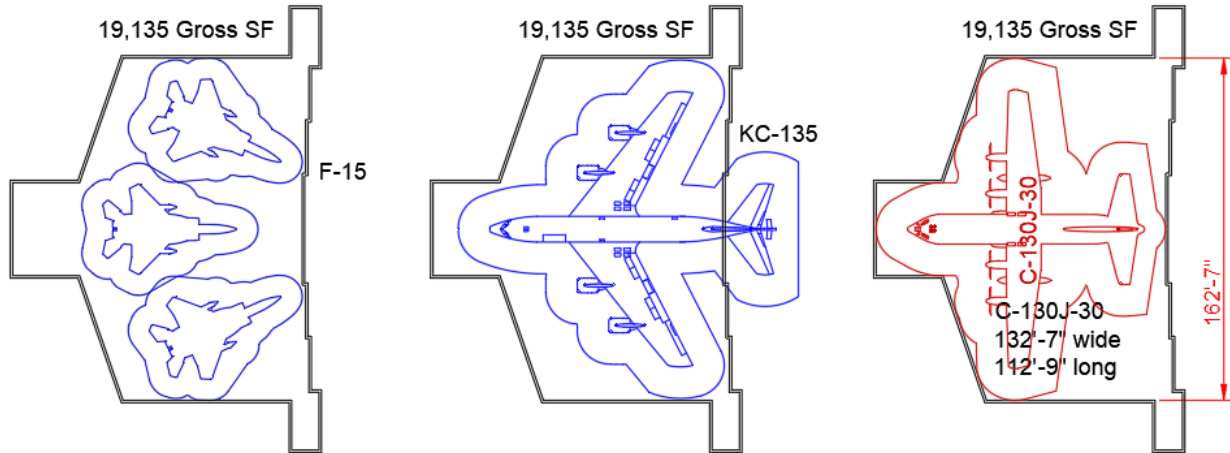
**Figure 4-2: 211-177, Small Aircraft Maintenance Dock Interior Elevation**



### 4.3 CRTC Maintenance Hangar

4.3.1 Would plan for a fully enclosed C-130J-30 Stretched, KC-135 nose dock, and three F-15 fighters as a multipurpose use maintenance hangar at 20,000 Gross SF counting the wall thickness, hangar door, and hangar door pocket.

**Figure 4-3: CRTC Maintenance Hangar Size**

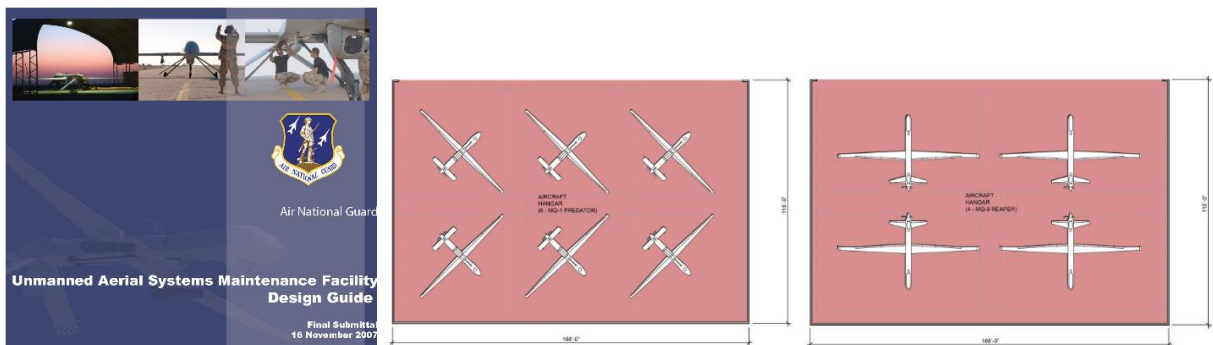


4.3.2 Plan for interior clear height of to allow for the KC-135 jacked height + 10' overhead setback.

### 4.4 MQ-1 and MQ-9 Hangar Bay Size

4.4.1 The ANG UAV Maintenance Final Design Guide published 16 November 2007 outlined the Hangar Bay would be 168' x 115' outside wall to outside wall which provides 19,300 Gross SF. The Small Aircraft Maintenance Dock in ANGH 32-1084 is published as 20,000 SF and the requirement will remain 20,000 SF for use by MQ-1 and MQ-9 aircraft.

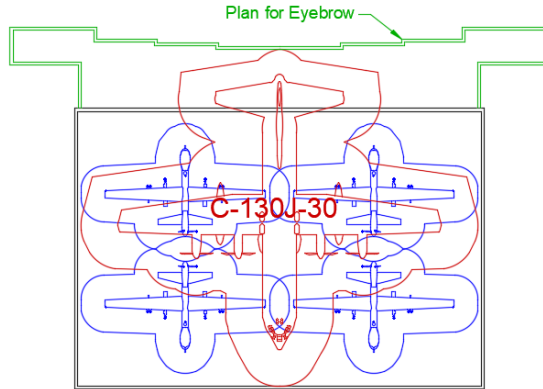
**Figure 4-4: MQ-1 and MQ-9, UAV Maintenance Final Design Guide**



4.4.2 Also included in the ANG UAV Maintenance Final Design Guide site planning should allow for possible expansion to a C-130 hangar to include interior C-130 jacked height + 10' overhead setback.



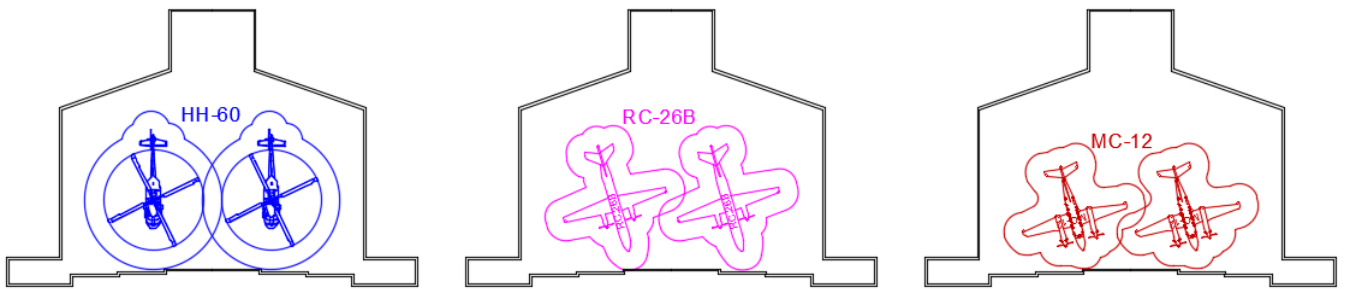
1 **Figure 4-5: UAV Maintenance Final Design Guide C-130J-30 Stretched Expansion**



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3 **4.5 HH-60, RC-26, and MC-12 Maintenance Hangar Sizing**

4 4.5.1 The HH-60, RC-26B, and MC-12 typically use existing hangar thus the minimal Mission  
5 Grouped hangar would be 20,000 SF planned for the C-130 Stretched if ever a new hangar  
6 is built.

7 **Figure 4-6: HH-60, RC-26, and MC-12 Mission Grouped Maintenance Hangar Sizing**



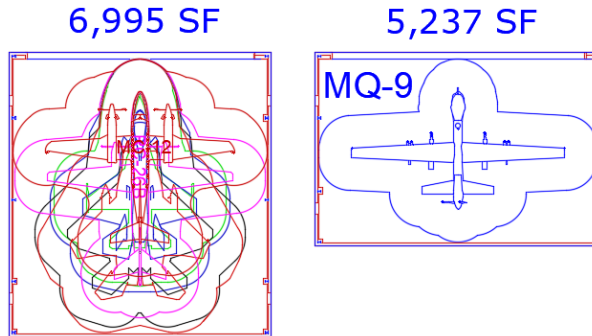
8  
9 4.5.2 Interior clear area elevation should allow for interior C-130 jacked height + 10' overhead  
10 setback for all 211-177, Small Aircraft Maintenance Dock, to include any MQ-9 hangar.

# Chapter 5: Fuel System Maintenance Dock

## 5.1 211-179, Fuel System Maintenance Dock.

5.1.1 For improved planning guidance, 211-179, Fuel System Maintenance Dock changes to reflect the hangar bay only sized for the Mission Grouped Hangar Bay sizing with Clean/Dirty Room added.

**Figure 5-1: For Fuel Cell only the MQ-9 is unique which matches past standards**



5.1.2 Mission Grouped Hangar 211-179 Fuel System Maintenance Dock with Clean/Dirty Room added.

**Table 5-1: Mission Grouped CATCODE 211-179, Fuel System Maintenance Dock Summary**

Aircraft / Mission	Hangar Area (Gross SF)	Directly Related Mechanical & Clean Dirty Bathroom	Shop Area (Gross SF)	Functional Standard (Gross SF)
Fighter Aircraft	7,000	1,500	1,500	<b>10,000</b>
MQ-9	5,300	1,500	1,500	<b>8,300</b>
MC-12	7,000	1,500	1,500	<b>10,000</b>
RC-26	7,000	1,500	1,500	<b>10,000</b>
XX-130	20,000	1,500	1,700	<b>23,200</b>
KC-135	28,000	in 211-159	2,500	<b>30,500</b>
KC-46	28,000	in 211-159	2,500	<b>30,500</b>
C-17	34,000	in 211-159	2,500	<b>36,500</b>