AIR FORCE TACTICS, TECHNIQUES, AND PROCEDURES 3-32.12

3 MAY 2024

MINIMUM AIRFIELD OPERATING SURFACE (MAOS) SELECTION AND REPAIR QUALITY CRITERIA (RQC)

DEPARTMENT OF THE AIR FORCE

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BY ORDER OF THE SECRETARY OF THE AIR FORCE

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Tactical Doctrine

MINIMUM AIRFIELD OPERATING SURFACE (MAOS) SELECTION AND REPAIR QUALITY CRITERIA (RQC)

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This publication supports Air Force Instruction (AFI) 10-210, *Prime Base Engineer Emergency Force (BEEF) Program*, Air Force Pamphlet (AFPAM) 10-219, Volume 4, *Airfield Damage Repair Operations*, and Air Force Doctrine Publication 3-34, *Engineer Operations*. It provides tactics, techniques and procedures (TTP) to accurately and expeditiously select minimum airfield operating surfaces (MAOS) and determine repair quality criteria (RQC) immediately after an attack. This publication applies to all Department of the Air Force (DAF) civilian employees and uniformed members of the Regular Air Force, the Air Force Reserve, and the Air National Guard civil engineer units. This publication does not apply to the United States Space Force. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the DAF Form 847, *Recommendation for Change of Publication*; route DAF Forms 847 from the field through the appropriate functional chain of command and Major Command publications/ forms managers. Ensure all records generated as a result of processes prescribed in this publication adhere to AFI 33-322, *Records Management and Information Governance Program,* and are disposed in accordance with the Air Force Records

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SUMMARY OF CHANGES

This document has been substantially revised and must be completely reviewed. In addition to updating terminology and references, major changes includes the introduction of the remote sensor damage assessment system and how it differs from the manual method; identifies the differences between the MAOS Selection Team compositions when the manual and or remote sensor damage assessment process is used; clarifies how the damage information and MAOS selections are shared between multiple entities to provide redundancy/survivability of information; examines patch numbering and patch spacing; and summarizes Repair Quality Criteria (RQC) for the entire Minimum Operating Strip (MOS).

APPLICATION: This publication is intended for Prime Base Engineer Emergency Force (BEEF) and RED HORSE engineers performing MAOS and RQC immediately after an attack. This document is authoritative but not directive and does not replace mandatory compliance requirements in applicable Air Force Instructions (AFI) or other directive publications. If the TTPs found in this publication conflict with other nondirective publications, contact the AFCEC Reachback Center or CE Dash (with contact info) for resolution. Contact the Reachback Center at 850-283-6995, Toll Free at 888-232-3721, Defense Switched Network 523-6995, or Email at AFCEC.RBC@us.af.mil. See **Attachment 4** for links to other engineer Reachback resources and useful sites.

SCOPE: This publication addresses techniques and procedures for selecting a MAOS and determining RQC after an attack. It provides information for MAOS selection using the Geospatial Expeditionary Planning Tool (GeoExPT).

Chapter 1

INTRODUCTION

1.1. Background. A wing commander's or designated mission commander's number one priority after an attack may be to launch and recover mission aircraft. However, if the takeoff or landing (ToL) surface is damaged during the attack, repairs are likely required before launching and recovering aircraft. In most instances, repairing the entire airfield is not an option; it would take too long to meet the commander's air tasking order (ATO). Initially, only repairing the minimum pavement necessary to launch and recover aircraft expedites the reopening of the airfield.

1.1.1. Engineers, with close coordination from Airfield Management, must recommend the most appropriate airfield surfaces to repair—those that require the least repair time, including unexploded explosive ordnance (UXO) mitigation, but still provide adequate launch or recovery (LoR) surfaces for mission aircraft. The ToL surface selected for repair is called the minimum operating strip (MOS). The MOS is the area where aircraft actually takeoff or land and its dimensions are determined by the installation Crisis Action Team (CAT). The MOS dimensions vary with aircraft type, operation, and weights, as well as environmental conditions.

1.1.2. A suitable MOS cannot be selected without a full appreciation of the damage throughout the entire airfield. For example, if an ideal MOS is identified that involves minimum repair effort, finding acceptable access routes from aircraft parking areas to the MOS must also be considered. These combined surfaces (MOS, minimum taxiways, and minimum aircraft parking areas) are known as the minimum airfield operating surface (MAOS).

1.2. Overview. This publication serves as a guide to select suitable MAOS candidates. It explains the MAOS selection process, to include concept of operations, team organization and resources, sequence of the selection steps, characteristics of a good MOS, and determining Repair Quality Criteria (RQC). An illustrated example of MOS selection is also presented. **Note:** RQC calculations are only required for legacy repair methods (e.g., crushed stone with or without foreign object debris (FOD) cover). The new rapid airfield damage recovery (RADR) capping methods (e.g., rapid-setting concrete or asphalt) are considered semi-permanent repairs and repaired flush with the surrounding pavement.

Chapter 2

CONCEPT OF OPERATIONS

2.1. Sequence of Events. Before repairs begin, airfield damage must be assessed, reported, and plotted; a MAOS selected; and explosive hazards mitigated and removed.

2.1.1. Damage Assessment. Airfield Damage Assessment Teams (ADATs), described in AFTTP 3-32.11, *Airfield Damage Assessment after Attack*, and/or remote sensors provide information about the type, size, and location of damage and explosive hazards on the airfield surfaces to MAOS selection personnel. The CAT provides additional information on operational requirements and expected operating conditions following the attack.

2.1.1.1. Depending on the localized threat, some bases will be outfitted with remote sensors able to detect airfield damage and explosive hazards. The remote sensors expedite the assessment process and removes Airmen from the explosive hazard environment.

2.1.1.2. Manual damage assessment is performed by ADATs at installations where remote sensors are not available.

2.1.2. MAOS Selection. Using information provided by the CAT and manual assessment process with ADATs, the MAOS Selection Team's goal is to identify potential MAOS candidates as soon as possible. Where remote sensors are utilized, the goal is to identify potential MAOS candidates within 30 minutes after damage assessment begins. Once the MAOS candidates are identified, the MAOS Selection Team briefs the MAOS candidates to the wing commander and/or designated mission commander. The commander selects the most desirable candidate to meet the ATO.

2.1.3. Explosive Hazard Mitigation. Once the MAOS is selected, Explosive Ordnance Disposal (EOD) operators begin mitigating explosive hazards by rendering safe and/or removing UXO impacting MAOS recovery (as described in

AFTTP 3-32.5, Volume 6, *Explosive Ordnance Disposal (EOD) Unexploded Explosive Ordnance (UXO) Operations*).

2.1.4. MAOS Repair. As EOD mitigates explosive hazards from repair areas and provides minimum clear space, recovery teams begin pavement repairs, airfield marking and striping, airfield lighting and aircraft arresting system installation, and final sweeping of the MAOS.

2.1.5. Airfield Restrictions and Closures. Civil Engineers coordinate with the Airfield Manager or designated representative through all phases of the repair process (i.e. pre-, ongoing, and post-) to ensure appropriate airfield restrictions and/or closures are imposed and applicable Notice to Air Mission (NOTAMs) issued.

2.2. Minimum Airfield Operating Surface Selection Team. The MAOS Selection Team utilizes damage and explosive hazard data received from ADATs and/or remote sensors, and pertinent operational information received from the CAT (e.g., expected weather conditions, runway conditions, aircraft loads, minimum MOS width, lighting and arresting system requirements) to identify acceptable MAOS candidates.

2.2.1. Deliverable. Airfield damage and explosive hazard data received from remote sensors or ADATs are entered into GeoExPT, or manually plotted on the MOS selection map when GeoExPT is unavailable. The back-up MAOS Selection Team, typically in the Civil Engineer Unit Control Center (CE-UCC), performs the same actions to ensure data is survivable if the primary Emergency Operations Center (EOC) is destroyed during subsequent attacks. GeoExPT generates three suggested MAOS candidates (verified by the selection team) or selected manually by the MAOS Selection Team when GeoExPT is not available and are presented to the wing commander and/or designated mission commander for final selection.

2.2.2. Location. The EOC and CE-UCC each have a MAOS selection team assigned. Information regarding MAOS selection is promptly passed to the Alternate EOC and Alternate CE-UCC. This provides redundancy for damage recording, checks and balances on proposed MAOS candidates, and continuity of operations in the event the Primary EOC and/or Primary CE-UCC is damaged.

2.2.3. Team Composition. The MAOS Selection Team composition depends upon the damage assessment method used.

2.2.3.1. Manual Damage Assessment by ADATs. At a minimum, this MAOS Selection Team is composed of two engineering technicians (AFSC 3E5X1) and an augmentee (**Table 2.1**). The engineering technicians input data into GeoExPT or plots damage on the airfield map, select at least three MAOS candidates, and brief the wing commander and/or designated mission commander on the candidates. The augmentee receives data from the ADATs via radio and records the data on worksheets.

2.2.3.1.1. An EOD representative (AFSC 3E8X1) in the EOC may support the MAOS Selection Team by receiving and recording EOD related data from the ADATs. They also provide technical expertise on explosive hazard standoff distances and estimate explosive hazard mitigation times.

Table 2.1. Team Composition for Manual Damage Assessment.

Position	AFSC	Responsibilities
Team Chief	3E551	- Oversee MAOS Selection activities - Brief wing commander and/or designated mission commander on MAOS candidates
Damage Plotter	3E5X1	- Plot damage and UXO data - Select candidate MAOSs - Calculate RQC
Radio Operator/ Recorder	Any	- Receive/record damage and UXO data - Track ADAT progress/movement
[1]EOD Technician	3E8X1	- Receive/record UXO damage - Provide technical advice on UXO effects - Track ADAT progress/movement

Position	AFSC	Responsibilities
[2]Airfield Management Representative	1C7XX	- Provide technical advice on aircraft characteristics - Provide technical input regarding mission aircraft performance characteristics - Coordinates airfield restrictions and/or closures with Airfield Management Operations - Provide technical advice on priority of pavement repairs in order to expedite takeoffs and landings
[1]Member of EOC staff (Emergency Support Function-5) [2]If vacant, required information is requested from the CAT		

2.2.3.1.2. Installations often support a variety of aircraft with different MAOS requirements which must be considered during MAOS selection. Therefore, coordinate MAOS candidates with an Airfield Management representative, who understands aircraft characteristics and airfield design criteria, prior to briefing the candidates to the wing commander and/or designated mission commander.

2.2.3.2. Damage Assessment via Remote Sensors. This MAOS Selection Team includes an engineering (3E5X1) and EOD technician (3E8X1) for each ground control station receiving sensor data (**Table 2.2**). These individuals digitize and/or verify actual damage and explosive hazards identified on the video within GeoExPT.

2.2.3.3. The goal is to identify three potential MAOS candidates within 30 minutes after damage assessment begins. Once MAOS candidates are identified, the Engineering Technician (3E5X1) transfers the GeoExPT MAOS Selection Report from the Rapid Airfield Damage Assessment to a NIPR machine via digital video disk. The information is passed to the EOC and alternate CE-UCC. The MAOS Selection Team in the EOC briefs the MAOS candidates to the wing commander and/or designated mission commander. The commander selects the most desirable candidate to meet the ATO.

Table 2.2. Team Composition per Each Ground Control Station.

Position	AFSC	Responsibilities
Engineering Technician	3E5X1	- Oversee MAOS Selection activities - Digitize data in GeoExPT - Select candidate MAOSs - Calculate RQC - Brief wing commander and/or designated mission commander on MAOS candidates
EOD Technician	3E8X1	- Digitize data in GeoExPT - Provide technical advice on UXO effects
Small Unmanned Aerial System Operators (x2)	Any 3EXXX	- Setup of all Small Unmanned Aerial System components (aircraft & GCS) - Programming flight plans for assessment runs - All preflight actions (to include airspace approval) - All activities associated with flying (to include user-level maintenance actions) - Transferring data from aircraft to video management system.
[1]Airfield Management Representative	1C7XX	- Provide technical advice on aircraft characteristics, airfield planning, and design criteria - Coordinate airfield restrictions and/or closures with Airfield Management Operations - Provide technical advice on priority of pavement repairs in order to expedite takeoffs and landings
[1]If unavailable, required information is requested from the CAT		

2.3. Minimum Operating Strip (MOS) Selection Kit. Engineers should posture a MOS selection kit at installations with flying missions. At a minimum, the kit should include items listed in **Table 2.3**.

Table 2.3. Minimum Airfield Operating Surface Selection Team Supplies.

Item
• Laptop Computer w/GeoExPT software loaded
• Transparent MOS overlay and crater templates (e.g., clear acetate, Plexiglas, etc.)
• Plotting board
• Critical resource charts
• Straight edge, engineer scale, and transparent circle templates with decimal units matching the airfield map scale
• AFTTP 3-32.12
• Dry erase markers, pens, and pencils
• Damage reporting and recording forms
• Base grid map – 1:4800 (1-inch = 400-foot) scale
• Airfield map[1] – 1:1200 (1-inch = 100-foot) scale with Pavement Reference Marking System (ToL map)
• Airfield Suitability Analysis (See AMCI 11-211, *Destination Airfield Suitability Analysis*)
• Applicable Air Tasking Orders or sortie requirements
• Base Support Plan
Note 1: Ideally, the runway portion of the airfield map should be lightly partitioned in 10-foot increments to ease and expedite plotting.

2.4. Minimum Airfield Operating Surface Characteristics. Simply stated, the goal of MAOS candidate selection is to locate the best available MOS that can be repaired in the least amount of time. A good MOS has many characteristics, the ranking of which will depend upon the situation at a particular installation. Consequently, the MAOS selection process must be flexible to identify the best option under a wide variety of circumstances. Generally, a good MAOS will allow rapid restoration of launch and recovery capability. Crater repair is a lengthy process; thus, it is important to initially repair no more damage than necessary. That is why it is imperative to wait for completion of airfield damage assessment before finalizing MAOS selection. The MAOS selection procedure is designed to choose a takeoff and landing area that is comparatively low in crater and spall damage. Repair time, therefore, is saved at the cost of initial delay caused by accurately identifying and plotting damage and selecting a MOS. Selecting a MAOS is a balance of identifying candidates with the least amount of damage, maximum utilization of existing markings, lighting, and aircraft arresting systems, and a high LoR rating.

2.4.1. Resource Limitations. A RADR team's capability may be hampered by resource shortages and equipment deficiencies. The MAOS selection team should consider any noticeable limitations when determining candidates. As damage reports are received, the selection team must make a conscious decision to monitor airfield damage repair equipment and materials status during the MOS selection process. Engineer personnel in the alternate EOC and CE-UCC should also monitor equipment and material status as a crosscheck for accuracy. As airfield damage assessment nears completion, a quick verification of equipment and material between all control centers should be accomplished to ensure the most current information is considered.

2.4.2. Sortie Capability. Aircraft should be able to get to and from the MOS quickly. If a MAOS is selected without regard to sortie generation capability, aircraft operations could be restricted after MOS repair. The LoR status of an airfield measures sortie generation capability, independent of variables such as mission time, aircraft attrition, and origin of aircraft (aircraft may launch at one air base and be recovered at another). A few examples of how various restrictions can reduce LoR capabilities are shown in **Table 2.4**. For example, a MOS with two access taxiways that requires an aircraft to backtrack more than 2,000 feet will have an LoR capability of only 50 percent. Additional explanations of other common LoR restrictions are described below.

2.4.2.1. LoR Status. The LoR status of a MOS is the total number of launches and recoveries the surface can handle per unit time compared to the number that could be handled by the same undamaged airfield. An LoR status of 100 percent simply means the MOS and its access route(s) are not restricting sortie capacity. Even if its LoR status is substantially less than 100 percent, it does not necessarily mean that the MOS is limiting sortie capability. Normal operations may not use the entire capability, and other factors in the base status after an attack may be even more limiting.

2.4.2.2. MOS Location. A MOS may be located on the main runway parallel to the centerline, on a parallel taxiway, or even on an alternate LoR surface on or off base that has the proper structural capacity. The MOS location affects LoR status in various ways by limiting access and egress, by limiting air traffic control, or by restricting the flight approach of aircraft.

Table 2.4. Minimum Operating Strip Launch or Recovery (LoR) Capability.

2 Access Taxiways	One Access Taxiway	Taxi Backtrack > 1K Ft.	Taxi Backtrack > 2K Ft.	Arrestment of Each Aircraft	ATC Eqpt. Not Functional	Relative LoR Capability
X						100%
X				X		34%
X				X	X	25%
X		X				60%
X			X			50%
	X					40%
	X			X		27%
	X			X	X	19%

2.5. Pre-Attack Actions. When an attack is imminent, the primary MAOS Selection Team reports to the EOC, while the backup MAOS selection teams report to the Alternate EOC, CE-UCC, and Alternate CE-UCC. The primary MAOS Selection Team performs the following actions and passes information to the backup MAOS Selection Teams:

2.5.1. If time permits, gather the following information and pass the information to the backup MAOS Selection Teams.
2.5.1.1. Contact the Mission Director within the CAT for:

2.5.1.1.1. Expected mission aircraft operations (e.g., landing, takeoff, evacuation).

2.5.1.1.2. Gross weights of mission aircraft expected to use the MOS.

2.5.1.1.3. Uni-directional or bi-directional MOS.

2.5.1.2. Contact Base Weather for current and forecasted weather conditions.

2.5.1.3. Determine operational lengths and widths for mission aircraft.

2.5.2. Have a GeoExPT Scenario ready for the location, digitized airfield, taxiways, parking, MOS templates, etc.

2.5.3. Conduct communications checks with EOC, CE-UCC, and ADATs.

Chapter 3

GEOSPATIAL EXPEDITIONARY PLANNING TOOL (GeoExPT)

3.1. Introduction. When performing MAOS selection with GeoExPT, users should refer to the GeoExPT User Manual for guidance. The application is constantly being upgraded and modified; therefore, users should ensure they are using the most current manual for the latest updates and procedures.

3.2. Acquiring the GeoExPT Training Manual. Contact the Air Force Civil Engineer Center Reach Back Center (AFCEC RBC), 888-232-3721 (toll free), DSN 523-6995, or via email at afcec.rbc@us.af.mil to acquire the current application and user manual.

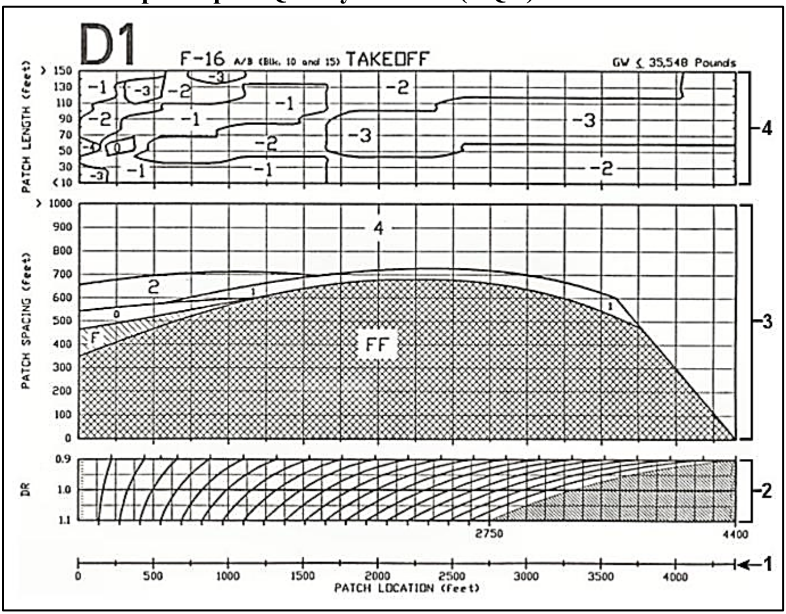
Chapter 4

LEGACY (MANUAL) MINIMUM AIRFIELD OPERATING SURFACE (MAOS) SELECTION

4.1 Purpose. Manual MAOS selection is used when GeoExPT is unavailable.

4.2. Chart Description. Figure 4.1 is an example of charts used to determine the MOS requirement for a given aircraft and aircraft operation. The chart has four areas: 1) the location baseline shift area; 2) the environmental shift area; 3) the uncorrected RQC area; and 4) correction factor area as shown in **Figure 4.1**.

Figure 4.1. Sample Repair Quality Criteria (RQC) Chart.



4.2.1. Location Base Line. The location baseline is the starting point for calculations. This area is used to determine the MOS requirement, as well as mark the repair patch locations when determining the RQC requirement.

4.2.2. Environmental Shift. This area compensates for aircraft performance variations due to weather and runway conditions. These include the Density Ratio (DR) and the Runway Surface Condition (RSC). **Note:** Some charts may not have an RSC section.

4.2.3. Uncorrected RQC. This area determines initial RQC for individual repairs.

4.2.4. Correction Factor. This area provides RQC correction factors based on the repair location on the MOS and its proximity to other repairs.

4.3. Assumptions. The following assumptions apply when performing the manual MAOS selection method.

4.3.1. Users are familiar with the functions of damage assessment and MAOS selection, including reporting of airfield damage nomenclature.

4.3.2. RQC represents the maximum allowable repair height, in inches, for all values except flush (F) and a flush repair followed by a flush repair (FF).

4.3.3. Allowable sag depth is 2.0 inches for all RQC, except "F" and "FF."

4.3.4. Allowable repair slope is 5.0 percent for all RQC, except in a landing touchdown zone. Allowable repair slope is 3.4 percent in landing touchdown zones.

4.3.5. Aircraft contact the entire length of each repair on the MOS. Lateral repair location does not affect RQC.

4.3.6. All spalls are repaired to flush criteria.

4.3.7. Aircraft operation lengths are defined as takeoff or landing distance in the aircraft performance manual. Since the MOS length may be specified by the CAT and the wing commander and/or the mission commander, it may be longer than the longest operation length. Any repair in a section of the MOS beyond the longest operation length has an RQC equal to flush “F.”

4.3.8. Aircraft are maintained in accordance with relevant technical orders and service manuals.

4.3.9. Relay the following caution to the CAT and Airfield Management for taxiway repairs: “All operations on taxiway repairs are limited to 5 knots. Taxiway repairs may have up to 6 inches of upheaval and up to 2 inches of sag. Braking in vicinity of repairs on taxiway surfaces must be avoided.”

4.4. Step-by-Step Directions for Determining Minimum Operating Strip (MOS) Lengths. Table 4.1 provides a step-by-step checklist for determining MOS lengths. It is recommended the user follow these steps to ensure accuracy and quality of the process. Steps 1 and 2 may be performed during pre-attack actions to save time when selecting MAOS candidates after the attack. Information in the following paragraphs expound upon **Table 4.1**.

Table 4.1. Instructional Guidelines for Determining Minimum Operating Strip (MOS) Lengths.

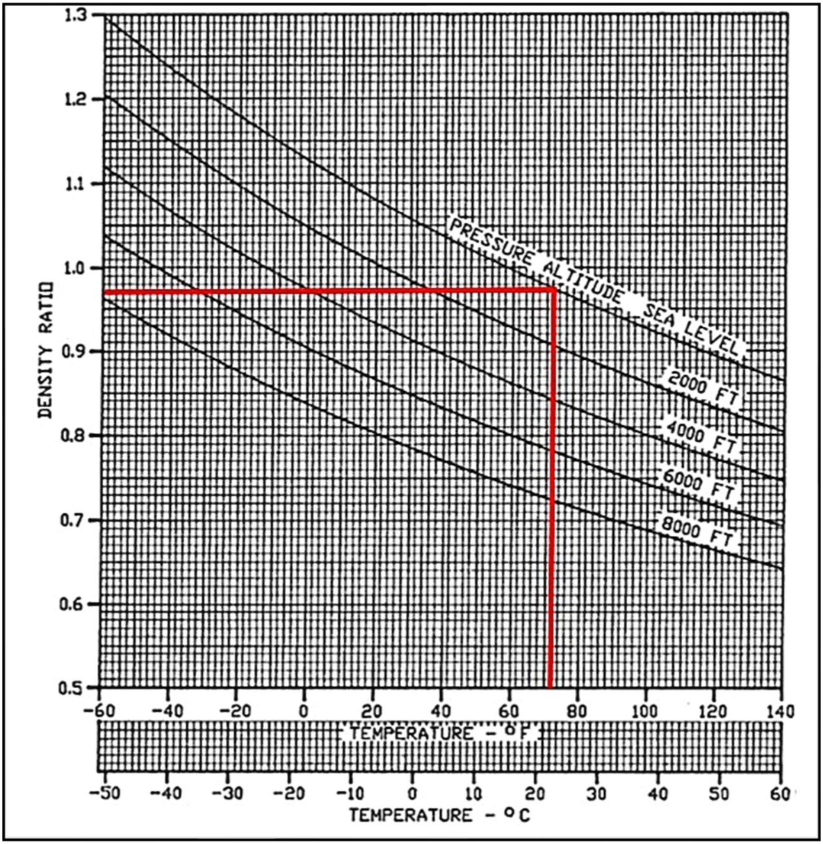
Step	Process Action		
1	**Collect Aircraft and Environmental Data – Record on Worksheet 1**		
	1.1	Record data for aircraft operation expected on the MOS	
		1.1.1	Aircraft model
		1.1.2	Gross weight (pounds)
		1.1.3	Operation (takeoff, landing, or evacuation)
		1.1.4	Special landing operations (aero braking; wheel braking; short field arrestment, with chute, without chute, or normal)

		1.1.5 Direction of operations (from MOS threshold or departure end)
	1.2	Record the RQC chart number for each operation
	1.3	Record *highest* expected temperature, pressure altitude, and *lowest* Density Ratio (DR) expected for that day. If DR is unavailable, use DR Chart (**Figure 4.2** & **Attachment 2**) by drawing a vertical line from the temperature axis until intersecting with the pressure altitude and then draw a horizontal line to the DR axis.
	1.4	If applicable, record condition or greatest expected depth of condition (i.e. average depth of water, slush, loose snow, packed snow, or ice on runway surface to nearest tenth of an inch).
2	**Determine Operational Lengths** (See **Figure 4.4**)	
	2.1	Draw a horizontal line, corresponding to the DR (0.97), across the DR section.
	2.2	Draw horizontal line in condition-type section (Chart D2) corresponding to worst type of condition expected in that section of MOS in next 12 hours.
	2.3	From the intersection of the DR line and the shaded section, draw a vertical line to the bottom of the RSC section. Follow guideline until line intersects with RSC. From this intersection, draw a vertical line downward to location baseline to determine operational length (4,400) and record on Worksheet 1.
	2.4	If no RSC section (**Chart D1**), locate intersection of DR line with shaded section. From this point, draw a vertical line downward to location baseline to determine operational length (*3,525*) and record on Worksheet 1.
3	**Define Repair Patches on the ToL Map**	
	3.1	Draw lines, perpendicular to sides of MOS, at beginning and end of each crater on, or partially on, MOS.
	3.2	Shade area between lines for each crater

	3.3	If two shaded areas are within 25 feet of each other, shade area between them
	3.4	From MOS threshold, number each shaded area as a patch
4	**For each Operation, Determine Patch Locations, Lengths, and Spacing**	
	4.1	Draw double lines, perpendicular to sides of MOS, marking operation threshold and operation length
	4.2	For each patch within two sets of double lines, record operation number and patch number on Worksheet 2 (e.g., for Operations 2 – Patch 3, enter "2/3")
	4.3	For each patch, measure distance from operation threshold to center of patch, record "Patch Location" on Worksheet 2. If distance is greater than operation length, record operation length.
	4.4	Measure length of each patch and record on Worksheet 2.
	4.5	For each patch, measure distance from center of patch to center of next patch (in operational direction) and record this distance as "Patch Spacing" on Worksheet 2. For last patch, record maximum spacing value from RQC chart.
	4.6	Repeat step 4 for each operation using MOS.
5	**Determine Uncorrected RQC and Correction Factor**	
	5.1	Mark location of each patch on location baseline
	5.2	Mark spacing and length for each patch on their respective axes
	5.3	Draw a horizontal line, corresponding to the current DR, across the DR section. If there is an RSC section, draw a horizontal line, corresponding to current RSC, across that section.
	5.4	For each patch, draw a vertical line from location baseline to intersect with current DR. Then follow guidelines to top of DR section. From this point, draw a vertical line to intersect with current RSC. Then follow guidelines to top of the section. From this point, draw a vertical line to top of DR section to top of RQC chart.

	5.5	For each patch, draw a horizontal line corresponding to spacing for that patch until line intersects with vertical line from step 5.4. Determine uncorrected RQC from region of intersection and record on Worksheet 2. If intersection falls within a shaded region, a correction factor is not required.
	5.6	For each patch, draw a horizontal line corresponding to length of that patch until line intersects with vertical line from step 5.4. Determine correction factor from region of intersection and record on Worksheet 2.
	5.7	Perform step 5 for each operation.
6	**Determine RQC for Each Repair Patch**	
	6.1	Add correction factor to uncorrected RQC and record on Worksheet 2. If result is a negative number, record an "F." If uncorrected RQC for a repair is "FF," record an "F" for both that patch and patch immediately following it.
	6.2	Calculate RQC for each patch for each operation
7	**Summarize RQC for Entire MOS**	
	7.1	List each MOS threshold operation on top half of Worksheet 3.
	7.2	List each operation from MOS departure end on bottom half of Worksheet 3.
	7.3	Mark each patch number from MOS on both top and bottom of Worksheet 3.
	7.4	For each operation and patch number, record RQC from Worksheet 2 onto Worksheet 3. For patches on MOS but not within length of any operation, record an "F."
	7.5	For each repair patch and each operation direction, record the lowest RQC in the summary lines on Worksheet 3
	7.6	For each repair patch, record lower summary value in combined line on Worksheet 3
	7.7	Transfer combined RQC to ToL map, and brief Base Civil Engineer and/or wing commander and/or mission commander.
Note: See **Attachment 2** for blank worksheets identified in **Table 4.1**.		

Figure 4.2. Example Density Ratio Table.



4.4.1. Collect Aircraft Operational and Environmental Data. Contact the CAT and Airfield Management to gather information on aircraft operations and environmental data (contact Base Weather if the CAT does not have the environmental data). Record each operation and corresponding chart number from **Table 4.2** on a separate line of Worksheet 1 (**Figure 4.3**). If uncertain as to procedures used during aircraft operations, select charts for all possible operations (charts may be found in **Attachment 3**). **Note:** If possible, perform this step during pre-attack actions to save time during actual MAOS selection.

Note: Some aircraft models found in these RQC charts have been retired by the US, but ally nations may still fly them; therefore, the charts remain. If there is no chart for an aircraft or a particular aircraft operation, plan for a 10,000-ft by 150-ft MOS unless the Senior Airfield Authority (SAA) provides specific MOS dimensions. Projects are scheduled to develop charts for new aircraft models not listed and will be added when available.

Table 4.2. Repair Quality Criteria (RQC) Chart and Figure Numbers.

Aircraft MOS Requirement Charts/Figure Numbers			
Aircraft	**RQC[1] Chart**	**Operation**	**Figure #**
F-4 C/D, MQ-9	A1	Takeoff	**A3.1**
F-4 C/D	A2	Landing – Arrestment	**A3.2**
F-4 C/D	A3	Landing – w / Chute	**A3.3**
F-4 C/D, MQ-9	A4	Landing – w/o Chute	**A3.4**
F-4 C/D	A5	Evacuation	**A3.5**
F-4 E	B1	Takeoff	**A3.6**
	B2	Landing – Arrestment	**A3.7**
	B3	Landing – w / Chute	**A3.8**
	B4	Landing – w/o Chute	**A3.9**
	B5	Evacuation	**A3.10**
F-15 A/B	C1	Takeoff	**A3.11**
	C2	Landing – Aero Braking	**A3.12**
	C3	Landing – Wheel Braking	**A3.13**
	C4	Landing – Arrestment	**A3.14**
	C5	Evacuation	**A3.15**
F-15 C/D	C6	Takeoff	**A3.16**
	C7	Landing – Aero Braking	**A3.17**

Aircraft MOS Requirement Charts/Figure Numbers			
Aircraft	**RQC[1] Chart**	**Operation**	**Figure #**
	C8	Landing – Wheel Braking	**A3.18**
	C9	Landing – Arrestment	**A3.19**
F-15 C/D, F-22, F-35, F-14, F/A-18	C10	Evacuation	**A3.20**
F-15 E, F-22, F-35, F-14, F/A-18	C11	Takeoff	**A3.21**
	C12	Landing	**A3.22**
	C13	Landing – Arrestment	**A3.23**
	C14	Evacuation	**A3.24**
F-16 A/B Block 10/15	D1	Takeoff	**A3.25**
	D2	Landing	**A3.26**
	D3	Landing – Arrestment	**A3.27**
	D4	Evacuation	**A3.28**
F-16 C/D Block 25/30/32	D5	Takeoff	**A3.29**
	D6	Landing	**A3.30**
	D7	Landing – Arrestment	**A3.31**
	D8	Evacuation	**A3.32**
F-16 C/D Block 40/42	D9	Takeoff	**A3.33**
	D10	Landing	**A3.34**
	D11	Landing – Arrestment	**A3.35**
	D12	Evacuation	**A3.36**
F-111 A/E	E1	Takeoff	**A3.37**
	E2	Landing	**A3.38**
	E3	Landing – Short Field	**A3.39**
	E4	Landing – Arrestment	**A3.40**
	E5	Evacuation	**A3.41**
C-5 B	F1	Takeoff	**A3.42**
	F2	Landing	**A3.43**

Aircraft MOS Requirement Charts/Figure Numbers			
Aircraft	**RQC[1] Chart**	**Operation**	**Figure #**
C-130 E/H/B/J, AC-130, EC-130, HC-130, MC-130, WC-130, E-2C, P-3	G1	Takeoff	**A3.44**
C-130 E/H/B/J, AC-130, EC-130, HC-130, MC-130, WC-130, KC-10, C-135, E-2C, P-3	G2	Landing	**A3.45**
C-141 A/B	H1	Heavy Weight Takeoff	**A3.46**
	H2	Heavy Weight Landing	**A3.47**
C-141 A/B	I1	Medium Weight Takeoff	**A3.48**
	I2	Medium Weight Landing	**A3.49**
A-7D	J1	Takeoff	**A3.50**
	J2	Landing	**A3.51**
	J3	Landing – Arrestment	**A3.52**
	J4	Evacuation	**A3.53**
A-10 A, OA-10	K1	Takeoff	**A3.54**
	K2	Landing	**A3.55**
KC-135 R	L1	Heavy Weight Takeoff	**A3.56**
	L2	Normal Weight Takeoff	**A3.57**
	L3	Landing	**A3.58**
KC-10, KC-767	M1	Heavy Weight Takeoff	**A3.59**
	M2	Normal Weight Takeoff	**A3.60**
	M3	Landing	**A3.61**
C-9	N1	Heavy Weight Takeoff	**A3.62**
	N2	Normal Weight Takeoff	**A3.63**
	N3	Landing	**A3.64**

Aircraft MOS Requirement Charts/Figure Numbers			
Aircraft	**RQC[1] Chart**	**Operation**	**Figure #**
C-17, B-1, B-2	O1	Disclaimer	**A3.65**
	O2	Heavy Weight Takeoff	**A3.66**
	O3	Normal Weight Takeoff	**A3.67**
	O4	Heavy Weight Landing Steep Approach	**A3.68**
	O5	Heavy Weight Landing Normal Approach	**A3.69**
	O6	Normal Weight Landing Normal Approach	**A3.70**
F-117	P2	Heavy Weight Takeoff	**A3.71**
	P3	Normal Weight Takeoff	**A3.72**
	P4	Light Weight Takeoff	**A3.73**
	P5	Normal Weight Landing – No Chute	**A3.74**
	P6	Normal Weight Landing – Chute	**A3.75**
	P7	Heavy Weight Landing – No Chute	**A3.76**
	P8	Heavy Weight Landing – Chute	**A3.77**
Note 1: Charts reflect legacy 990 feet maximum runout for arrestment landings; current maximum runout is 1,200 feet. See note at bottom of each arrestment-landing chart for operational length correction to reflect 1,200 feet maximum runout.			

Figure 4.3. Worksheet 1 Example.

WORKSHEET 1 - REPAIR QUALITY CRITERIA (RQC) ENVIRONMENTAL DATA							
TEMPERATURE (°F)			MOS THRESHOLD *(Feet)*		RUNWAY SURFACE CONDITION (RSC)		
ALTITUDE (Feet)			DEPARTURE END *(Feet)*		Condition *(Choose One)*		DRY ☐ WR ☐ SLR/LSR/ PSR/IR ☐
DENSITY RATIO			MOS LENGTH *(Feet)*		Condition Depth *(Estimated to Nearest Tenth)*		__.__ Inch
OPERATION NUMBER	AIRCRAFT MODEL	GROSS WEIGHT *(Lbs)*	OPERATION	SPECIAL LANDING PROCEDURES	DIRECTION *(Choose One)*	CHART	OPERATION LENGTH *(Feet)*
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
RSC: WR=WET RUNWAY	SLR=SLUSH ON RUNWAY	LSR=LOOSE SNOW ON RUNWAY	PSR=PACKED SNOW ON RUNWAY	IR=ICE ON RUNWAY			

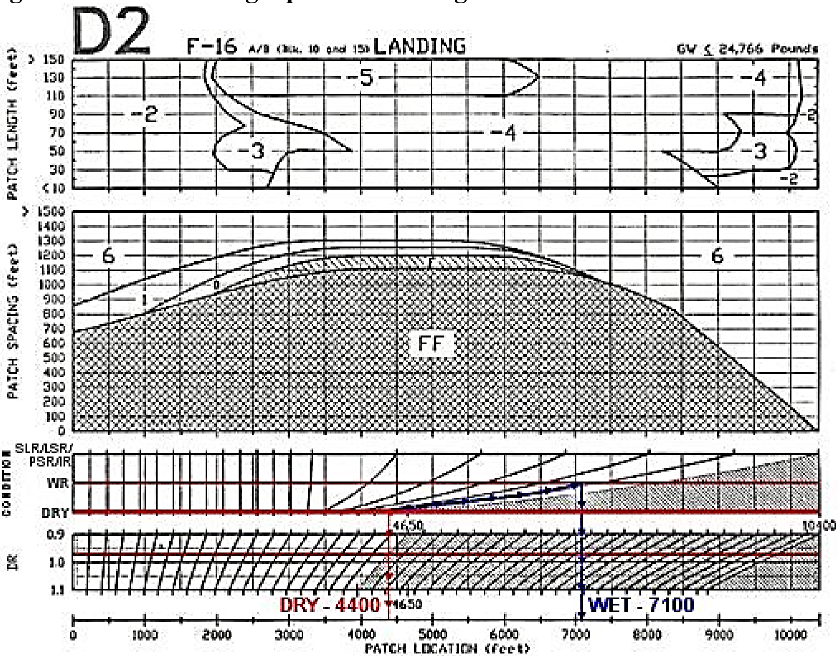
4.4.2. Determining Operational Lengths. Once proper charts are selected, determine operation length for each combination of aircraft configuration and operation. The longest calculated length for aircraft operations to be performed is the minimum overall length of the MOS. **Note**: If there is no chart for an aircraft or a particular aircraft operation, plan for 10,000-feet by 150-feet MOS unless the (SAA) provides other MOS dimensions.

4.4.2.1. RQC Charts with RSC. **Figure 4.4.** provides an example of determining operational lengths for F-16 landing operations with a DR = 0.97, Condition = DRY, and Condition Depth = 0.0. **Note:** See **Table 4.1., Step 1.3**, for instructions to determine DR when unavailable from the CAT. **Note:** For illustration purposes, landing operation with condition of WR (7,100) is also shown in **Figure 4.4**.

4.4.2.1.1. Draw a horizontal line across the DR section corresponding to the DR recorded on Worksheet 1 (0.97).

4.4.2.1.2. Draw a horizontal line across the RSC section corresponding to the condition recorded on Worksheet 1 (*DRY*).

Figure 4.4. Determining Operational Lengths.



4.4.2.1.3. From the intersection of the DR line with the shaded section, draw a vertical line down to the location baseline (4,400).

4.4.2.1.4. If the RSC were *Wet (WR)* or *Slush/Loose Snow/Packed Snow/Ice (SLR/LSR/PSR/IR)*, follow the horizontal DR line to the shaded area. Draw a vertical line up to the bottom of the RSC section and follow guidelines until the line intersects with current RSC. Stay between guidelines in proportion to starting location (e.g., *WR/SLR/LSR = 7,100*).

4.4.2.1.5. Record length (4,400) in space provided on Worksheet 1 (**Figure 4.5**).

4.4.2.1.6. Perform the above steps for each operation on Worksheet 1.

4.4.2.2. RQC Charts without RSC. Operational length determination using charts with no RSC is simply accomplished by eliminating the shift in the RSC area.

Figure 4.5. Operational Lengths Entered on Worksheet 1.

WORKSHEET 1 – REPAIR QUALITY CRITERIA (RQC) ENVIRONMENTAL DATA

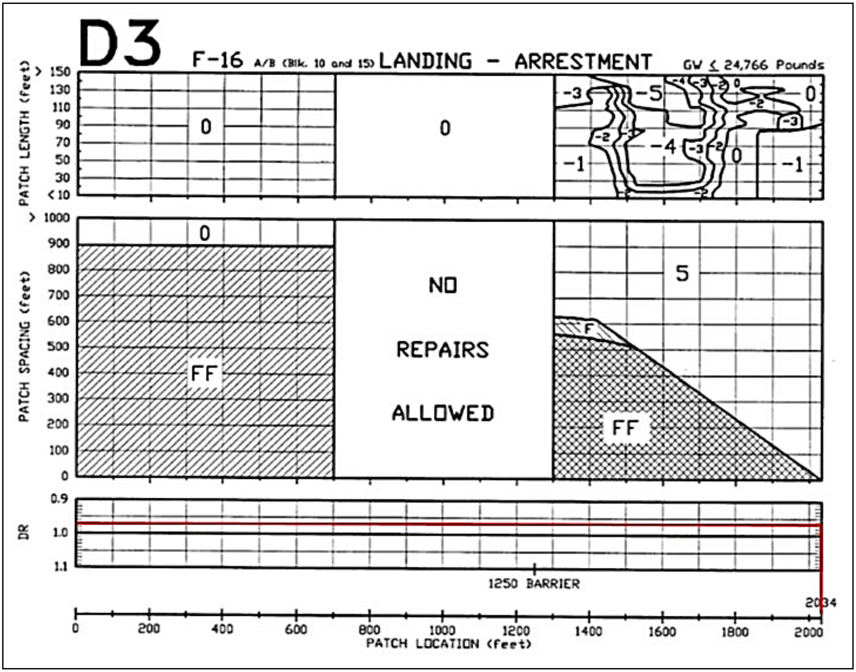
				RUNWAY SURFACE CONDITION (RSC)	
TEMPERATURE (°F)	72	MDS THRESHOLD (Feet)		Condition (Choose One)	DRY ☒ WR ☐ SLR/LSR/PSR/IR ☐
ALTITUDE (Feet)	Sea Level	DEPARTURE END (Feet)			
DENSITY RATIO	.97	MDS LENGTH (Feet)		Condition Depth (Estimated to Nearest Tenth)	0.0 Inch

OPERATION NUMBER	AIRCRAFT MODEL	GROSS WEIGHT (Lbs)	OPERATION	SPECIAL LANDING PROCEDURES	DIRECTION (Choose One)	CHART	OPERATION LENGTH (Feet)
1	F-16B	33,000	Takeoff		☒ FROM MDS THRESHOLD ☐ FROM DEPARTURE END	D1	3,525
2	F-16B	22,800	Landing		☒ FROM MDS THRESHOLD ☐ FROM DEPARTURE END	D2	4,400
3	F-16B	22,800	Landing	Arrestment	☒ FROM MDS THRESHOLD ☐ FROM DEPARTURE END	D3	2,034
4	F-16B	33,000	Takeoff		☐ FROM MDS THRESHOLD ☒ FROM DEPARTURE END	D1	3,525
5	F-16B	22,800	Landing		☐ FROM MDS THRESHOLD ☒ FROM DEPARTURE END	D2	4,400
					☐ FROM MDS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MDS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MDS THRESHOLD ☐ FROM DEPARTURE END		

RSC: WR=WET RUNWAY SLR=SLUSH ON RUNWAY LSR=LOOSE SNOW ON RUNWAY PSR=PACKED SNOW ON RUNWAY IR=ICE ON RUNWAY

4.4.2.2.1. Continuing with the example above, if the RSC were *WR*, the landing operation length would be 7,100 feet; this would require a MOS of at least that length. In this case, determine if the MOS length could be decreased by calculating the arrested landing operational length using RQC Chart D3 (**Figure 4.6**), which does not have an RSC section. **Note:** Using arrested landing operational lengths may result in fewer pavement repairs but may also lower the MOS LoR capability (**Table 2.3**).

Figure 4.6. Determining Arrested Landing Operational Length.

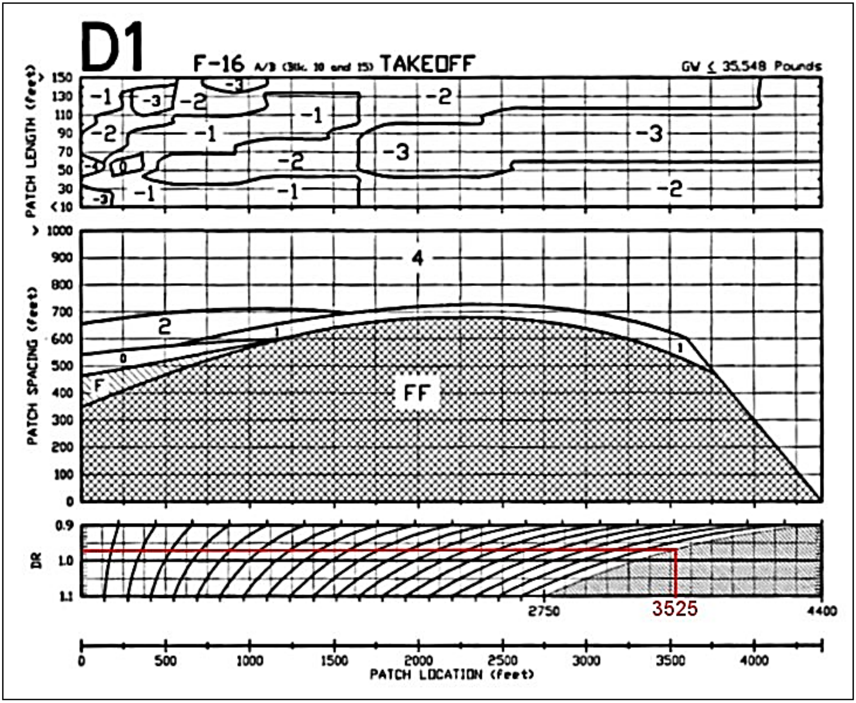


4.4.2.2.2. Draw a horizontal line across the DR section corresponding to the DR recorded on Worksheet 1 (0.97).

4.4.2.2.3. There is no shaded area in the DR section; therefore, draw a vertical line from the far right side of the DR section down to the location baseline and record the value (2,034) on Worksheet 1 (**Figure 4.5**).

4.4.2.2.4. Use Chart D1 (**Figure 4.7**) to determine takeoff operational length. Where DR line intersects shaded area, draw vertical line to location baseline since there is no RSC section and add results to Worksheet 1 (**Figure 4.5**).

Figure 4.7. Determining Takeoff Operational Length.



4.4.3. Damage Plotting. Runway damage is plotted on a 1:1200 scale (1-inch equals 100 feet) ToL map as reported by the ADATs. The ToL map should utilize the same Pavement Reference Marking System (PRMS) as the grid overlay. The MOS selection team uses the ToL map (located in the EOC when possible) to select MOS candidates. Damage is initially plotted on the ToL map with estimated repair diameters (double the apparent diameter). Utilize the 1:4800 (1-inch equals 400 feet) Crash Grid Map for all damage items not located on the runway. This map should utilize the Military Grid Reference System as the grid overlay. Following completion of runway repairs, RQC must be recalculated using the actual repair lengths.

4.4.4. Initial MAOS Selection. Choose several potential launch and recovery strips with support areas (e.g., refueling area, munition loading area, arm/de-arm area, parking, maintenance). Consider all suitable pavement surfaces that can be used for ToL surfaces (e.g., parallel taxiways and access roads). Keep limiting factors and shortfalls in mind. Slide MOS template across the ToL map until a suitable MOS is found. Bracket ([ ]) the MOS ends and list using the MOS identifier as explained in **paragraph 4.4.5.1**. Continue this same procedure until two alternatives are located. **Table 4.3** lists positive and negative MAOS attributes.

4.4.5. Additional Factors. Other factors that may influence MAOS selection:

4.4.5.1. In most cases a unidirectional MOS results in less stringent RQC values, which may permit greater latitude in repair quality.

Table 4.3. Minimum Airfield Operating Surface (MAOS) Attributes.

Positive	Negative
• Minimal number of craters	• Damage unrepairable within 6.5 hours
• Aligned with existing centerline	• Dense clusters of craters
• Use existing thresholds and departures	• Craters within 1,000 feet of threshold & departure
• Craters not close together	• MOS without potential for expansion
• Access and Egress routes at both ends	• Crater within 550 feet of arresting system when using FOD covers, or within 200 feet of arresting system with a RADR flush repair
• Use existing aircraft arresting systems	• Damage in first and last 1,000 feet of pavement
• Use existing airfield lighting	• Only one access route

Positive	Negative
• Close to material stockpiles	• Damaged utility lines (e.g., water and fuel)
• Longer and wider dimensions	• Dense clusters of UXO

4.4.5.2. In most situations landing operations require more pavement length than takeoff operations, especially in wet or icy conditions. If an aircraft arresting system is available, the landing length can be shortened with an accompanying decrease in the repair efforts. Ensure sufficient undamaged pavement exists before recommending an aircraft arresting system.

4.4.5.3. There may be occasions, particularly with bidirectional operations, when moving an operational threshold could decrease the RQC value for a repair patch. Look for the takeoff or landing operation that drives the lowest RQC value for a particular patch and if moving the applicable threshold results in a less restrictive RQC value. Chances are the need for the repair patch will not be eliminated, but the degree of required quality will be lessened.

4.4.5.4. After repairs are completed and accurate dimensions are obtained, it is critical to repeat the RQC process to ensure safe aircraft operations.

4.4.6. Define Repair Patches on the ToL Map.

4.4.6.1. After selection, determine MOS coordinates using the same method as locating damage and UXO as explained in AFTTP 3-32.11. For example, the 50-feet by 5,000-feet MOS in **Figure 4.8** is selected on 150-feet wide by 9,000-feet long runway. The MOS would be identified as: BM4000R50F9000R50W50 as explained in **Table 4.4**.

Figure 4.8. Takeoff or Landing (ToL) Map.

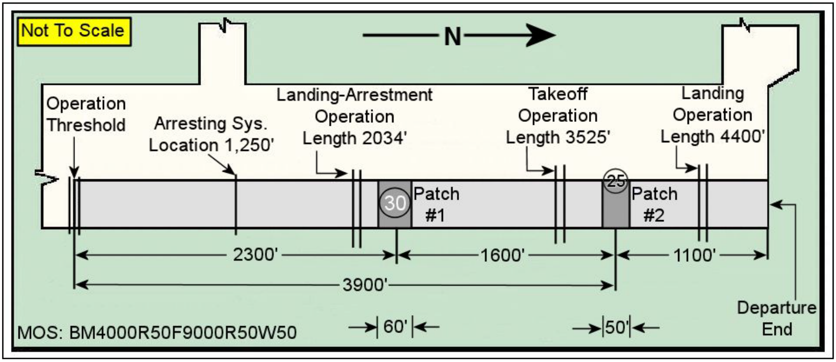


Table 4.4. Minimum Operating Strip (MOS) Designation Identifier Explained (BM4000R50F9000R50W50).

Identifier	Explanation
BM	Bidirectional MOS (UM – Unidirectional MOS)
4000	Distance from 0 point of PRMS to leading edge (threshold) of MOS
R	Denotes left or right of centerline to center of leading edge of MOS
50	Numerical distance left or right of centerline expressed in feet
F	Field Identifier
9000	Distance from PRMS 0-point to center of field's trailing edge (departure)
R	Denotes left/right of centerline to center of field's trailing edge
50	Numerical distance left or right of centerline expressed in feet
W	Width of field (MOS)
50	Numerical width of field (MOS)

4.4.6.2. Draw lines perpendicular to the MOS edges at the beginning and end of each crater on (or partially on) the MOS (**Figure 4.8**).

4.4.6.3. Shade areas on the MOS between the lines for each repair. If two or more shaded areas overlap, or are within 25 feet of each other, shade the area or areas between them.

4.4.6.4. From the MOS operational threshold, number each shaded area as a repair patch. For operations on bidirectional MOSs, do not renumber patches when the operation direction changes. Once a patch is numbered, it should not be changed.

4.4.7. Finding Repair Patch Location, Length, and Spacing.

4.4.7.1. Once repair patches have been numbered, determine location, length, and spacing for each. **Figure 4.8** shows examples of patch locations, lengths and spacing. **Figure 4.9** provides an example of results recorded on Worksheet 2.

4.4.7.2. Draw double lines on the ToL map perpendicular to the sides of the MOS to mark the operations threshold and operation length.

4.4.7.3. For each patch within the two sets of double lines, record the operation number and patch number on Worksheet 2.

Figure 4.9. Worksheet 2 Example.

WORKSHEET 2 - REPAIR QUALITY CRITERIA (RQC) VALUES WORKSHEET									
MDS THRESHOLD *(Feet)*	4,000	OPERATION #		1	2	3	4	5	
DEPARTURE END *(Feet)*	9,000	DIRECTION	FROM MOS THR	X	X	X			
			FROM DEP END				X	X	
MDS LENGTH *(Feet)*	5,000	OPERATION LENGTH		3525	4400	2034	3525	4400	

CHART #	OPERATION # / PATCH #	PATCH LOCATION (Feet)	PATCH LENGTH (Feet)	PATCH SPACING (Feet)	UNCORRECTED RQC	CORRECTION FACTOR	RQC
D1	1/1	2,300	60	1,000			
D2	2/1	2,300	60	1,600			
D2	2/2	3,900	50	1,500			
D3	3/--	2,034	-----	-----			

4.4.7.4. Find the center of each repair patch. Measure the distance (in feet) from this point back to the operational threshold. If the distance is greater than the operation length, use the operation length. If the patch center is in front of the operation threshold, use zero. Record these repair locations in the "Patch Location" column of Worksheet 2.

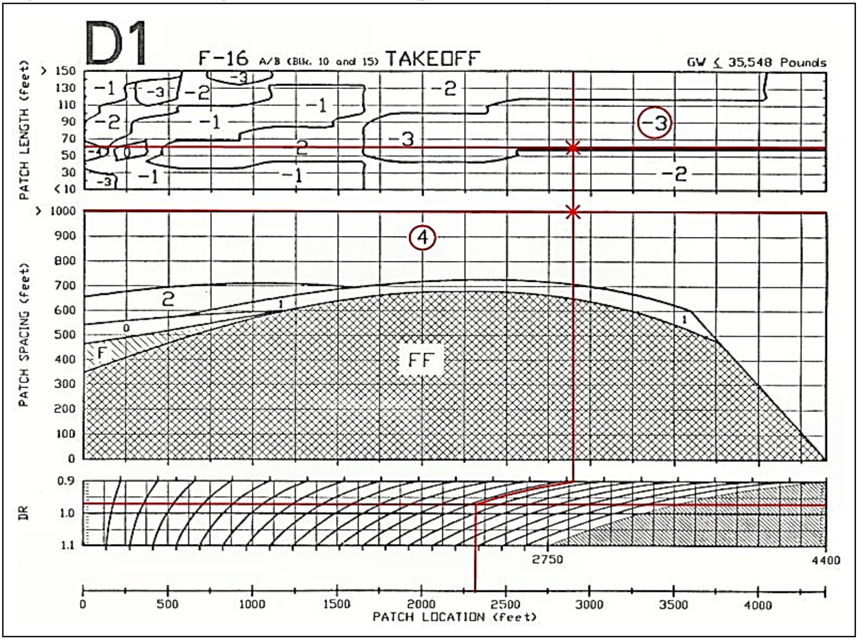
4.4.7.5. Measure each patch length parallel to the side of the MOS (in feet). Record the results in the "Patch Length" column of Worksheet 2.

4.4.7.6. Measure, in the direction of operation, the distance (in feet) from the center of each patch to the center of the next patch. If there is not a "next" patch (i.e., the patch is the last one), use the maximum value on the spacing axis of the RQC chart. Record the results in the "Patch Spacing" column of Worksheet 2.

4.4.7.7. Mark the repair patch locations, lengths, and spacing on applicable RQC charts. If the value for any length or spacing is greater than the maximum or less than the minimum shown on the RQC chart, mark the maximum or minimum.

4.4.8. Finding Repair Quality Criteria (RQC). Incorrect RQC calculations may result in aircraft damage, aircrew injury, and/or death of the aircrew. Uncertainty of any value (RQC, uncorrected RQC, or correction factor) shall be resolved by using the most conservative value (i.e., the lowest value). An intersection on a boundary line between two regions in the uncorrected RQC or correction factor areas must be treated as though it falls in the region with the lowest value. **Figure 4.10** illustrates the procedure to find RQC.

Figure 4.10. Finding Uncorrected Repair Quality Criteria on Chart D1.



4.4.8.1. Finding Uncorrected RQC.

4.4.8.1.1. Draw a horizontal line across the DR section corresponding to the DR recorded on Worksheet 1 (0.97). If there is an RSC section, draw a horizontal line across that section corresponding to the RSC recorded on Worksheet 1.

4.4.8.1.2. Draw vertical lines from the patch locations (2,300) on the location baseline until they intersect with the current DR.

4.4.8.1.3. From each intersection, follow the guidelines to the top of the DR section. Stay between the guidelines in proportion to the starting location.

4.4.8.1.4. If applicable, from the top of the DR section, draw a vertical line until it intersects with the current RSC, then follow the guidelines to the top of that section. From this point, draw a vertical line to the top of the RQC chart. If there is no RSC section, draw a vertical line from the top of the DR section to the top of the RQC chart.

4.4.8.1.5. Draw a horizontal line from each repair patch spacing on the vertical axis to the uncorrected RQC area. Continue each line until it intersects the vertical line for that patch.

4.4.8.1.6. The intersections are in the various regions of the uncorrected RQC area. The number in each region indicates the uncorrected RQC for intersections in that region. Record the uncorrected RQC values (4) for each repair patch on Worksheet 2 (**Figure 4.11**).

4.4.8.1.7. A value of “F” indicates a flush repair. A value of “FF” indicates a flush repair that must be followed by another flush repair.

4.4.8.2. Finding Correction Factor. Correction factor is always negative or zero.

4.4.8.2.1. If uncorrected RQC is in a region shaded with diagonal lines, corrected RQC equals the uncorrected RQC. All “F” and “FF” regions are shaded with diagonal lines. “FF” regions are crosshatched to contract with “F” regions.

Figure 4.11. Repair Quality Criteria Values Recorded on Worksheet 2.

WORKSHEET 2 - REPAIR QUALITY CRITERIA (RQC) VALUES WORKSHEET

MDS THRESHOLD *(Feet)*	4,000	OPERATION #		1	2	3	4	5	
DEPARTURE END *(Feet)*	9,000	DIRECTION	FROM MOS THR	X	X	X			
			FROM DEP END				X	X	
MDS LENGTH *(Feet)*	5,000	OPERATION LENGTH		3525	4400	2034	3525	4400	

CHART #	OPERATION # / PATCH #	PATCH LOCATION (Feet)	PATCH LENGTH (Feet)	PATCH SPACING (Feet)	UNCORRECTED RQC	CORRECTION FACTOR	RQC
D1	1/1	2,300	60	1,000	4	-3	1
D2	2/1	2,300	60	1,600			
D2	2/2	3,900	50	1,500			
D3	3/--	2,034	-----	-----			

4.4.8.2.2. In the Corrected RQC area, draw a horizontal line from each patch length to intersect the appropriate vertical line.

4.4.8.2.3. The intersections of these lines are in the various regions of the correction factor. The number in each region indicates the correction factor for intersections in that region.

4.4.8.2.4. Record the correction factor(s) (-3) on Worksheet 2 (**Figure 4.11**).

4.4.9. Calculating RQC. A patch with an uncorrected RQC of "F" or "FF" has an RQC of "F." The patch following a patch with an uncorrected RQC of "FF" also has an RQC of "F."

4.4.9.1. Add the uncorrected RQC (4) and correction factor (-3). RQC (1) is always less than or equal to the uncorrected RQC.

4.4.9.2. If the uncorrected RQC plus the correction factor results in a negative number, the RQC for that repair patch is "F."
4.4.9.3. Record the RQC values on Worksheet 3 (**Figure 4.11**) and in the spaced provided on Worksheet 3 (**Figure 4.12**).

Note: Arrested landing from the departure end is not listed as an operation due to the fact that if a second arresting system was installed 1,250 feet from the departure end, patch 2 would fall within the "NO REPAIRS ALLOWED" section of the RQC chart. An arresting system could not be installed at midfield due to the fact that patch 1 would be within the "NO REPAIRS ALLOWED" section of the RQC chart. Therefore, in-flight emergency landings requiring arrestment would only be performed when landing from the threshold end. When landing in the opposite direction the SAA may authorize use of the departure end (threshold end in this scenario) aircraft arresting system for aircraft experiencing braking problems and for aborted take-offs.

Note: RQC charts in **Attachment 3** were developed prior to implementing RADR. If a repair is accomplished using the crushed stone and FOD cover method, repairs should **not** be within 550 feet of the approach side of the pendent and 50 feet on the departure side of the pendent. When using the RADR flush repair method, repairs should **not** be within 200 feet of either side of the pendent.

4.4.9.4. Repeat instructions in **paragraph 4.4.5** for every operation in the same direction. Patch numbering and patch spacing remain constant.

4.4.9.5. If bi-directional operations are required, repeat the instructions for **paragraph 4.4.5** for each operation in the opposite direction. Patch numbering and patch lengths remain constant. Remember the operational threshold is now at the departure end.

4.4.10. RQC Summary. Summarize RQC for the entire MOS on Worksheet 3 (**Figure 4.12**).

4.4.10.1. List each operation from MOS threshold on the top half of Worksheet 3.

4.4.10.2. List each operation from MOS departure end on the bottom half of Worksheet 3.

Figure 4.12. Repair Quality Criteria Summary (Worksheet 3).

WORKSHEET 3 - R

OPERATION DIRECTION	FROM MOS THRESHOLD					
OPERATION #	PATCH 1	PATCH 2	PATCH 3	PATCH 4	PATCH 5	PATCH 6
1 - TAKEOFF	1	---				
2 - LANDING	3	2				
3 - LANDING ARRESTMENT	---	---				
SUMMARY	1	2				

OPERATION DIRECTION	FROM DEPARTURE END					
OPERATION #	PATCH 1	PATCH 2	PATCH 3	PATCH 4	PATCH 5	PA 6
4 - TAKEOFF	1	2				
5 - LANDING	3	4				
SUMMARY	1	2				
COMBINED	1	2				

4.4.10.3. For each operation and patch number, record the RQC from Worksheet 2 onto Worksheet 3. For patches that are on the MOS but are not within the length of *any* operation, record an “F”.

4.5. Presenting Minimum Airfield Operating Surface Candidates to Wing Commander and/or Designated Mission Commander. It is recommended that the MAOS Selection Team brief the EOC staff for feedback before briefing the wing commander and/or designated mission commander. Provide the following information when briefing the wing commander and/or mission commander:

4.5.1. Pros and cons of each candidate.

4.5.2. Estimated time to complete repairs.

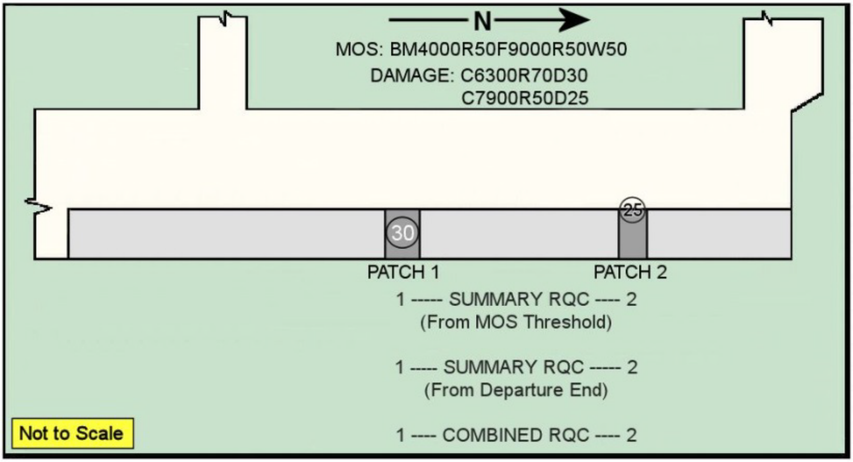
4.5.3. Repair priority recommendations.

4.5.4. Any actions concerning sortie generation to include RQC data.

4.5.5. Monitor repair and update appropriate maps to indicate status and provide updates to the EOC to keep the wing commander and/or mission commander abreast of recovery progress.

4.5.6. An example of presenting this data using a MOS map is presented in **Figure 4.13**. The RQC values for both MOS threshold and departure end operations are shown along with the combined values for each repair patch. This summary permits a quick method of informing the CE-UCC of RQC requirements so they may rapidly forward them to repair crews.

Figure 4.13. Summary Repair Quality Criteria (RQC) Presentation Format.



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Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

29 CFR 1910.133, *Eye and Face Protection*

29 CFR 1910.134, *Respiratory Protection*,

29 CFR 1926.1153, *Respirable Crystalline Silica*

DAFMAN 91-203, *Air Force Occupational Safety, Fire, and Health Standards*, 25 March 2022

AFI 10-210, *Prime Base Engineer Emergency Force (BEEF) Program*, 25 October 2023

AFI 33-322, *Records Management and Information Governance Program*, 23 March 2020

AFI 48-127, *Occupational Noise and Hearing Conservation Program*, 26 February 2016

AFI 48-137, *Respiratory Protection Program*, 12 September 2018

AFPAM 10-219, Volume 4, *Airfield Damage Repair Operations*, 28 May 2008

AFTTP 3-32.5V6, *Explosive Ordnance Disposal (EOD) Unexploded Explosive Ordnance (UXO) Response Operations*, 11 October 2023

AFTTP 3-32.11, *Airfield Damage Assessment after Major Attack*, 18 May 2022

AMCI 11-211, *Destination Airfield Suitability Analysis*, 8 June 2020

Air Force Doctrine Publication 3-34, *Engineer Operations*, 6 October 2021

GeoExPT User Manual

Adopted Forms

DAF Form 847, *Recommendation for Change of Publication*, 15 April 2022

Note: The acronyms and terms shown below may not always correspond with the *DoD Dictionary of Military and Associated Terms*, or the *Air Force Glossary* Doctrine Annex, but are included in this publication because they are common to the engineering community as a whole.

Abbreviations and Acronyms

ADAT—Airfield Damage Assessment Team

AFI—Air Force Instruction

AFPAM—Air Force Pamphlet

AFRC—Air Force Reserve Component

AFSC—Air Force Specialty Code

ANG—Air National Guard

ATO—Air Tasking Order

BEEF—Base Engineer Emergency Force

CAT—Crisis Action Team

CE—Civil Engineer

DAF—Department of the Air Force

DR—Density Ratio

EOC—Emergency Operations Center

EOD—Explosive Ordnance Disposal

FOD—Foreign Object Debris

GeoExPT—Geospatial Expeditionary Planning Tool

IR—Ice on runway

LoR—Launch or Recovery

LSR—Loose snow on runway

MAOS—Minimum Airfield Operating Surface

MOS—Minimum Operating Strip

NOTAM—Notice to Air Mission

PRMS—Pavement Reference Marking System

PSR—Packed snow on runway

RADR—Rapid Airfield Damage Recovery

RQC—Repair Quality Criteria

RSC—Runway Surface Condition

SAA—Senior Airfield Authority

SLR—Slush on runway

ToL—Takeoff or Landing

TTP—Tactics, Techniques, and Procedures

UCC—Unit Control Center

UXO—Unexploded Ordnance; Unexploded Explosive Ordnance

WR—Wet runway

Office Symbols

AF/A4CX—Air Force Directorate of Civil Engineers, Readiness Division

AFCEC—Air Force Civil Engineer Center

Terms

Airfield—An area prepared for the accommodation (including any buildings, installations, and equipment), landing, and takeoff of aircraft.

Air Tasking Order (ATO)—A method used to task and disseminate to components, subordinate units, and command and control agencies projected sorties, capabilities and/or forces to targets and specific missions. Normally provides specific instructions to include call signs, targets, controlling agencies, etc., as well as general instructions. Source: JP 3-30.

Airfield Damage Assessment—Locating, classifying, and measuring the damage (camouflet, crater, spall, and UXO) on the airfield operating surfaces.

Airfield Damage Assessment Team (ADAT)—An airfield recovery team, typically located in or near the EOC and directed by Emergency Support Function-3, used to identify and locate airfield damage and UXO following an attack. Their initial efforts are normally targeted towards the airfield proper; but can also be employed elsewhere as deemed necessary. The ADAT usually consists of one engineering technician and two EOD technicians. A CE member trained as an EOD assistant may replace one of the EOD technicians when two are unavailable for ADAT. The ADAT should be equipped with an armored vehicle and communications enabling them to report their observations to the MAOS Selection Cell. The ADAT damage reports must be accurate as this information is used in MAOS selection.

Apron/Ramp—A defined area on an airfield intended to accommodate aircraft for the purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance.

Camouflet—Craters with relatively small apparent diameters, but deep penetration and subsurface voids created by the munition puncturing through the pavement surface and exploding in the base material. **Note:** Munitions that penetrate the surface but do not explode are also treated as a camouflets.

Camouflet Field—A cluster of spalls within a defined area.

Crater—The pit, depression, or cavity formed in the surface of the earth by an explosion. It may range from saucer-shaped to conical, depending largely on the depth of burst.

Crater Field—A cluster of small craters (less than two feet apart) where their upheaval joins the neighboring crater within a defined area.

Damage Assessment—1. The determination of the effects that attacks have on targets. 2. (DOD only) A determination of the effect of a compromise of classified information on national security. 3. (AF/CE) The process of identifying and locating damage and unexploded ordnance following an attack. Damage assessment activities generally are separated into two categories: airfield pavements and facility/utility.

Emergency Operations Center (EOC)—A temporary or permanent facility where the coordination of information and resources to support domestic incident management activities normally takes place.

Explosive Ordnance Disposal (EOD)—The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded explosive ordnance. It may also include explosive ordnance which has become hazardous by damage or deterioration.

MAOS Selection—The process of plotting damage and UXO locations on an airbase runway map and using this information to select a portion of the damaged runway which can be repaired most quickly to support aircraft operations.

Minimum Airfield Operating Surface (MAOS)—The combined requirement for airfield surfaces for both runway and access routes. For example, the MOS is part of the MAOS.

Minimum Operating Strip (MOS)—1. A runway which meets the minimum requirements for operating assigned and/or allocated aircraft types on a particular airfield at maximum or combat gross weight. 2. The MOS is the smallest amount of area to be repaired to launch and recover aircraft after an attack. Selection of this MOS will depend upon mission requirements, taxi access, resources available, and estimated time to repair. For fighter aircraft, the typically accepted dimensions are 5,000 feet long by 50 feet wide.

Personnel—Those individuals required in either a military or civilian capacity to accomplish the assigned mission.

Procedures—Standard, detailed steps that prescribe how to perform specific tasks.

Ramp—see “apron.”

Runway—A defined rectangular area of an airfield, prepared for the landing and takeoff run of aircraft along its length. A runway is measured from the outer edge of the thresholds from one end of the runway to the others. The width of the runway is typically measured from the outer edge of the load-bearing pavement on one side to the outer edge of the load-bearing pavement on the other side. In some cases, the runway may be measured from the outside edge of the runway marking line on one side to the outside edge of the marking line on the other side and any remaining load bearing pavement is considered shoulder.

Runway Surface Condition (RSC)—Identifies the condition of the runway surface when covered with slush, snow, ice or water. In regards to MOS selection, Airfield Management personnel estimate to the extent or depth to the nearest 1/10 of an inch of any precipitation on the MOS and report this measurement to the MOS Selection Team prior to MOS selection.

Spall—Pavement damage that does not penetrate through the pavement surface to the underlying soil layers. A spall damage area could be up to 1.5 meters (5 feet) in diameter.

Spall Field—A cluster of spalls within a defined area.

Taxiway—A specially-prepared or designated path on an airfield or heliport, other than apron areas, on which aircraft move under their own power to and from landing, takeoff, service, and parking areas.

Techniques—Non-prescriptive ways or methods use to perform missions, functions, or tasks.

Unexploded Explosive Ordnance (UXO)—Explosive ordnance which has been primed, fused, armed, or otherwise prepared for action, and which has been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material, and remains unexploded either by malfunction or design. =

Attachment 2

BLANK WORKSHEETS FOR REPRODUCTION

Figure A2.1. Density Ratio Chart.

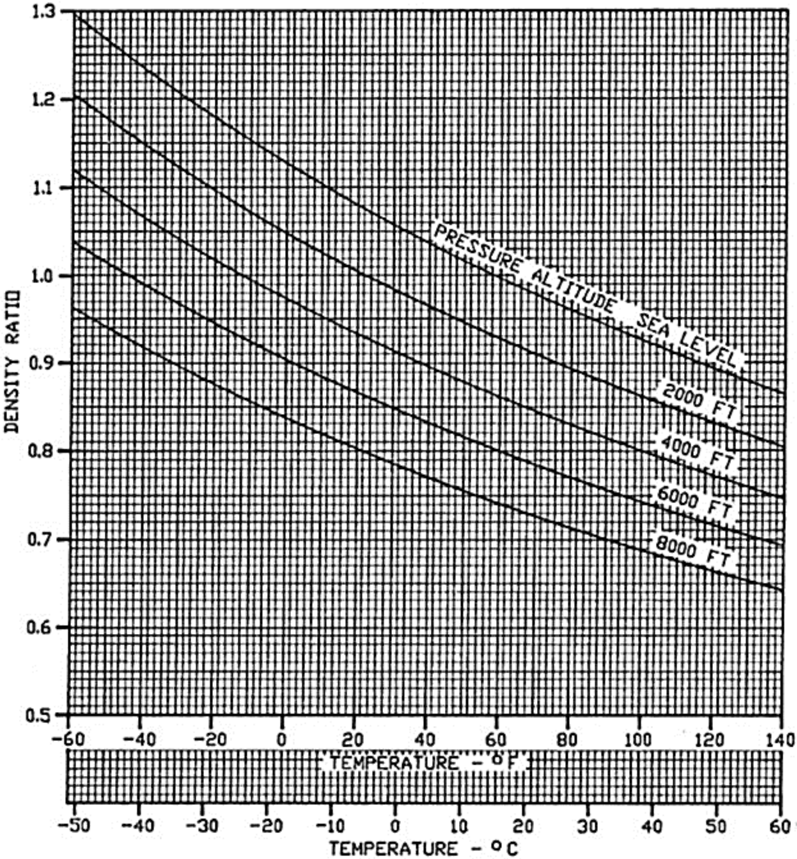


Figure A2.2. Worksheet 1.

WORKSHEET 1 - REPAIR QUALITY CRITERIA (RQC) ENVIRONMENTAL DATA

TEMPERATURE (°F)		MOS THRESHOLD *(Feet)*		RUNWAY SURFACE CONDITION (RSC)	
ALTITUDE (FT)		DEPARTURE END *(Feet)*		Condition *(Choose One)*	DRY ☐ WR ☐ SLR/LSR/PSR/IR ☐
DENSITY RATIO		MOS LENGTH *(Feet)*		Condition Depth (*Estimated to Nearest Tenth*)	___.___ Inch

OPERATION NUMBER	AIRCRAFT MODEL	GROSS WEIGHT *(Lbs)*	OPERATION	SPECIAL LANDING PROCEDURES	DIRECTION *(Choose One)*	CHART	OPERATION LENGTH *(Feet)*
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		
					☐ FROM MOS THRESHOLD ☐ FROM DEPARTURE END		

RSC: WR=WET RUNWAY SLR=SLUSH ON RUNWAY LSR=LOOSE SNOW ON RUNWAY PSR=PACKED SNOW ON RUNWAY IR=ICE ON RUNWAY

Figure A2.3. Worksheet 2.

WORKSHEET 2 - REPAIR QUALITY CRITERIA (RQC) VALUES WORKSHEET

MOS THRESHOLD (FEET)		OPERATION #					
DEPARTURE END (FEET)		DIRECTION	FROM MOS THR				
			FROM DEP END				
MOS LENGTH (FEET)		OPERATION LENGTH					

CHART #	OP # / PATCH #	PATCH LOCATION (FEET)	PATCH LENGTH (FEET)	PATCH SPACING (FEET)	UNCORRECTED RQC	CORRECTION FACTOR	RQC

Figure A2.4. Worksheet 3.

WORKSHEET 3 - REPAIR QUALITY CRITERIA (RQC) VALUE SUMMARY															
OPERATION DIRECTION	FROM MOS THRESHOLD														
OPERATION #	PATCH 1	PATCH 2	PATCH 3	PATCH 4	PATCH 5	PATCH 6	PATCH 7	PATCH 8	PATCH 9	PATCH 10	PATCH 11	PATCH 12	PATCH 13	PATCH 14	PATCH 15
SUMMARY															
OPERATION DIRECTION	FROM DEPARTURE END														
OPERATION #	PATCH 1	PATCH 2	PATCH 3	PATCH 4	PATCH 5	PATCH 6	PATCH 7	PATCH 8	PATCH 9	PATCH 10	PATCH 11	PATCH 12	PATCH 13	PATCH 14	PATCH 15
SUMMARY															
COMBINED															

Attachment 3

AIRCRAFT MINIMUM OPERATING STRIP (MOS) REQUIREMENT CHARTS

Figure A3.1. F-4 C/D, MQ-9 Takeoff.

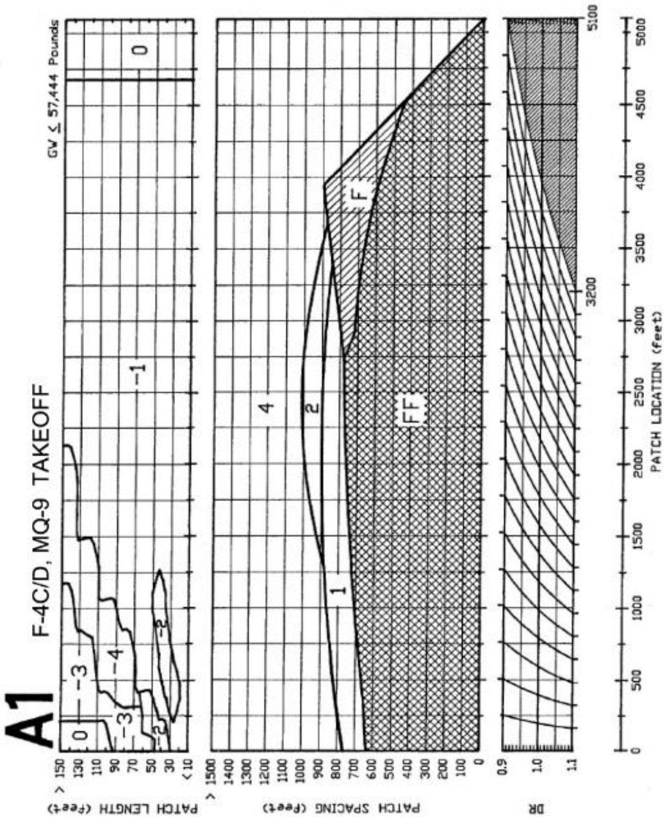
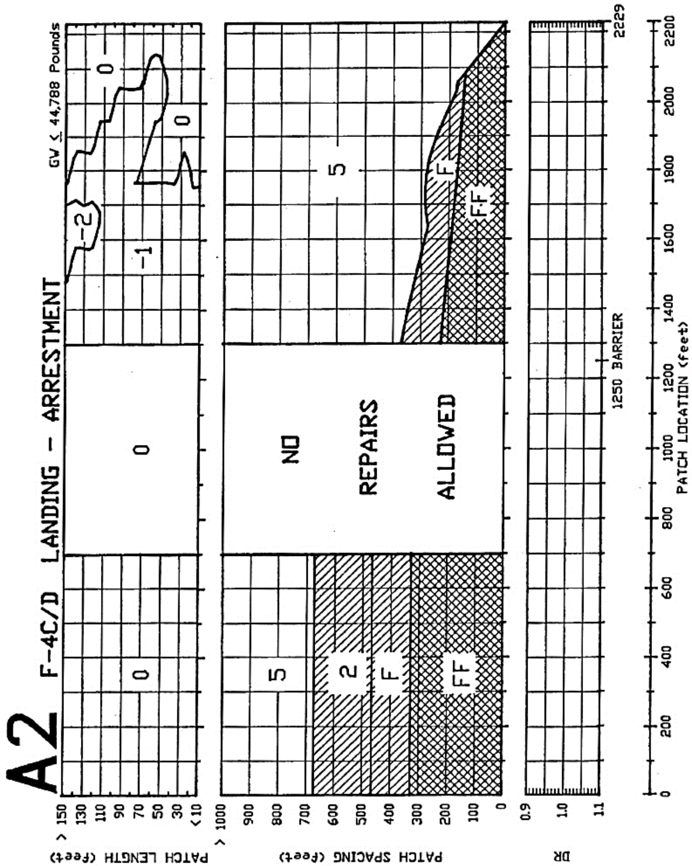


Figure A3.2. F-4 C/D Landing – Arrestment.



Note: This chart reflects a 979 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 221 ft to arrestment landing operational length.

Figure A3.3. F-4 C/D Landing – With Chute.

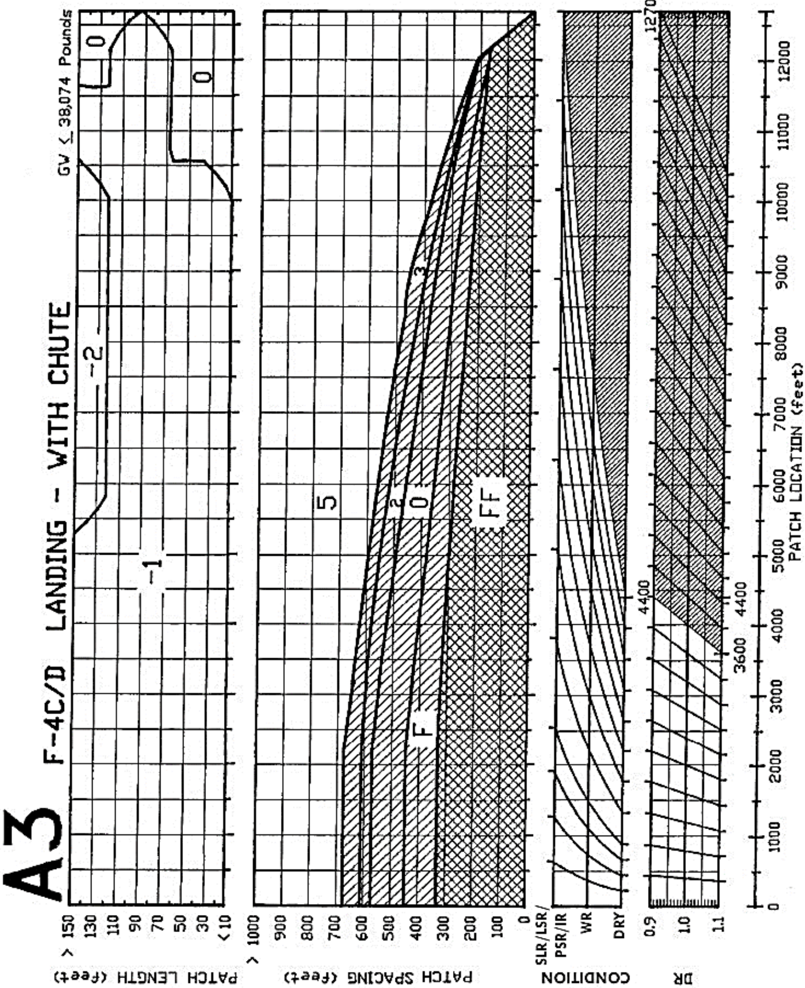


Figure A3.4. F-4 C/D Landing (Without Chute), MQ-9 Landing.

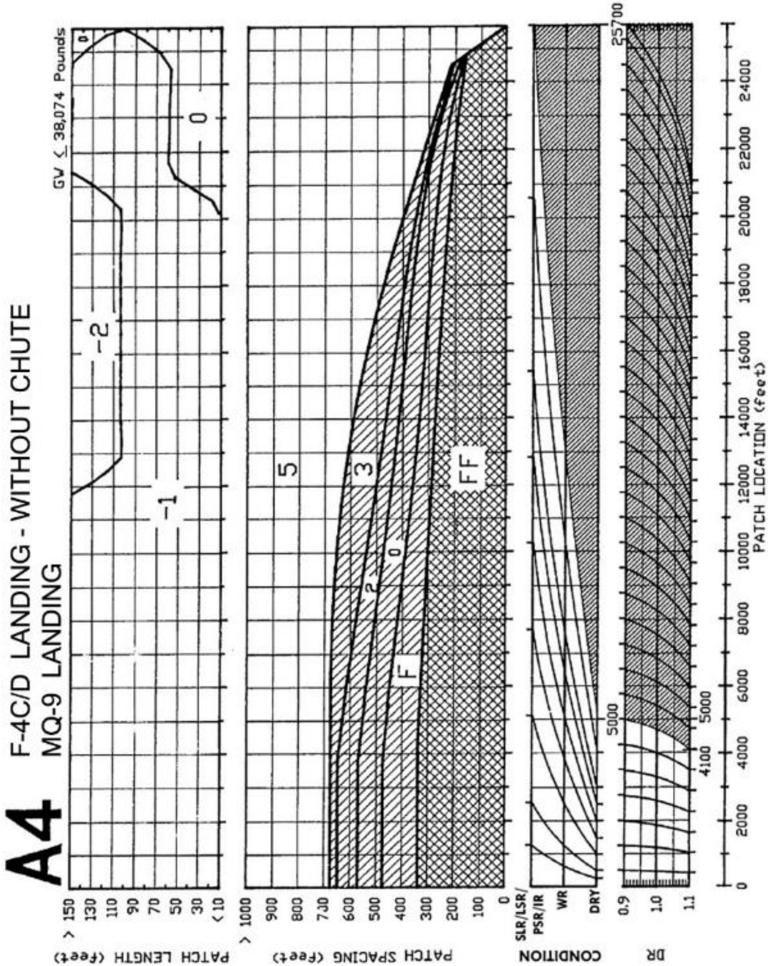


Figure A3.5. F-4 C/D Evacuation.

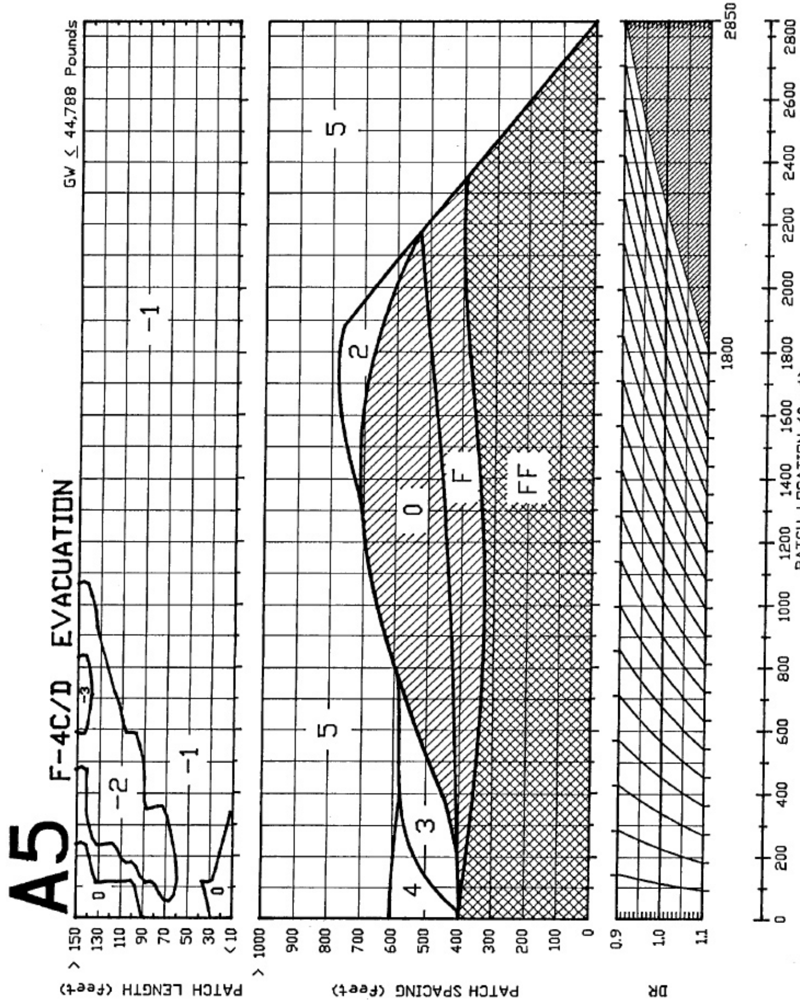


Figure A3.6. F-4 E Takeoff.

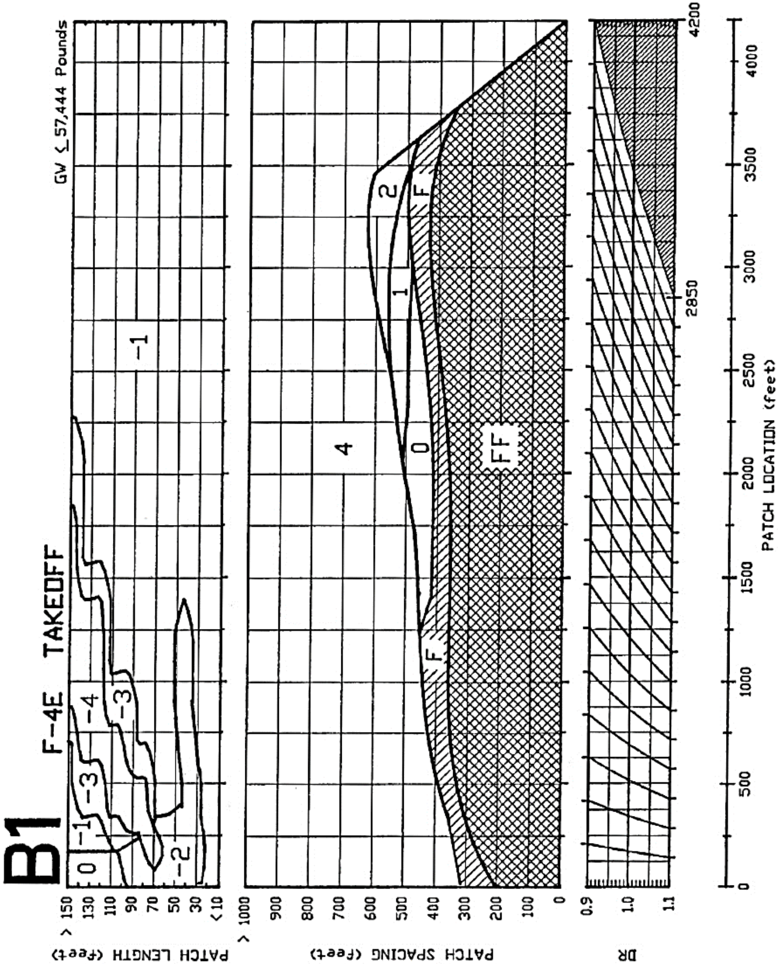
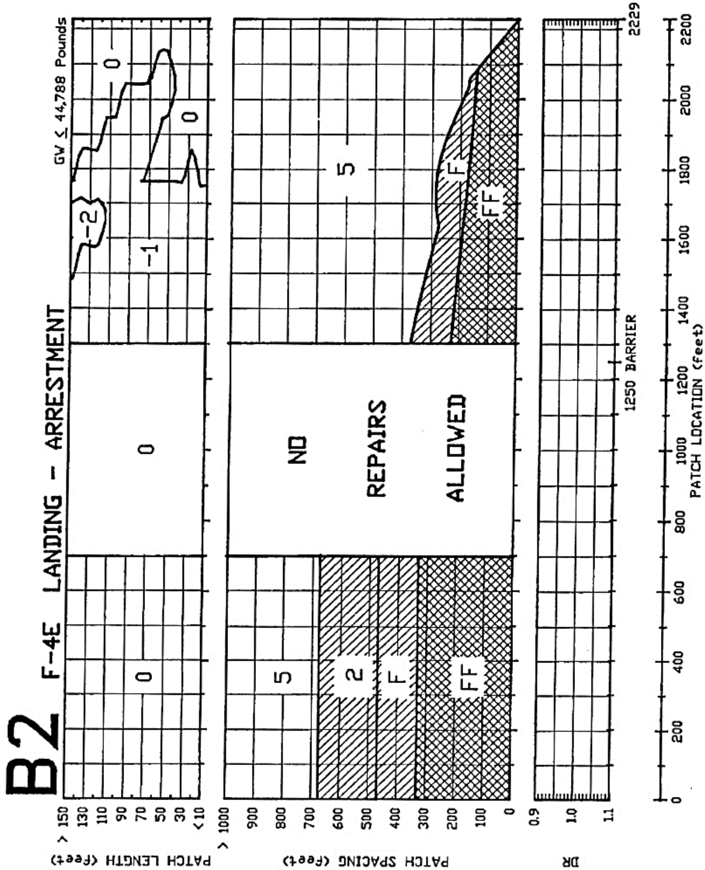


Figure A3.7. F-4 E Landing – Arrestment.



Note: This chart reflects a 979 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 221 ft to arrestment landing operational length.

Figure A3.8. F-4 E Landing – With Chute.

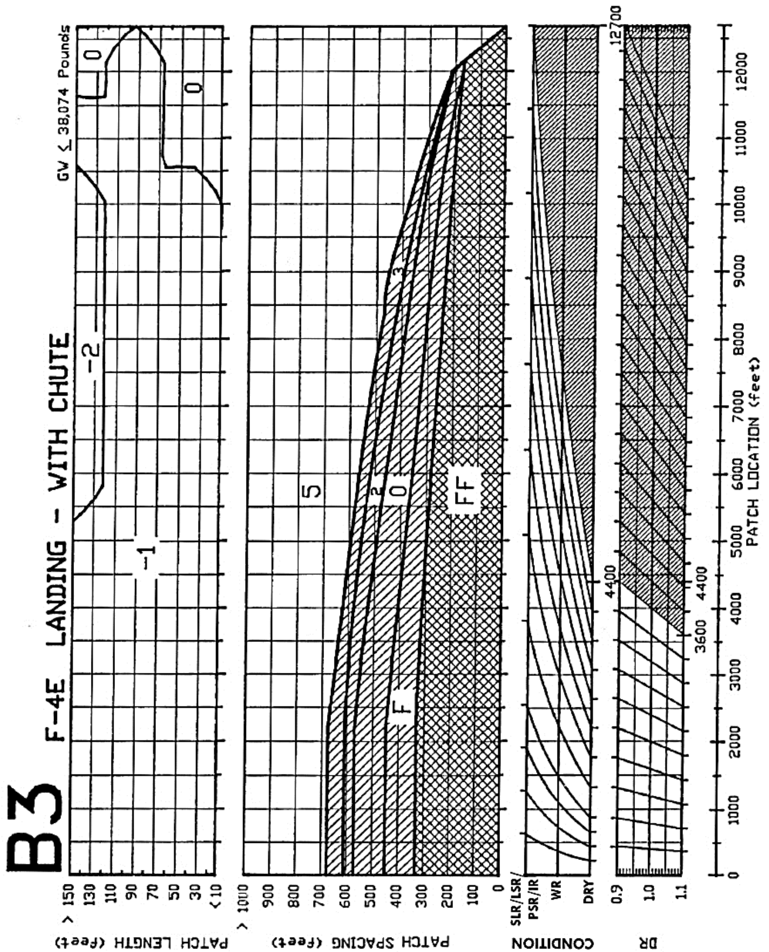
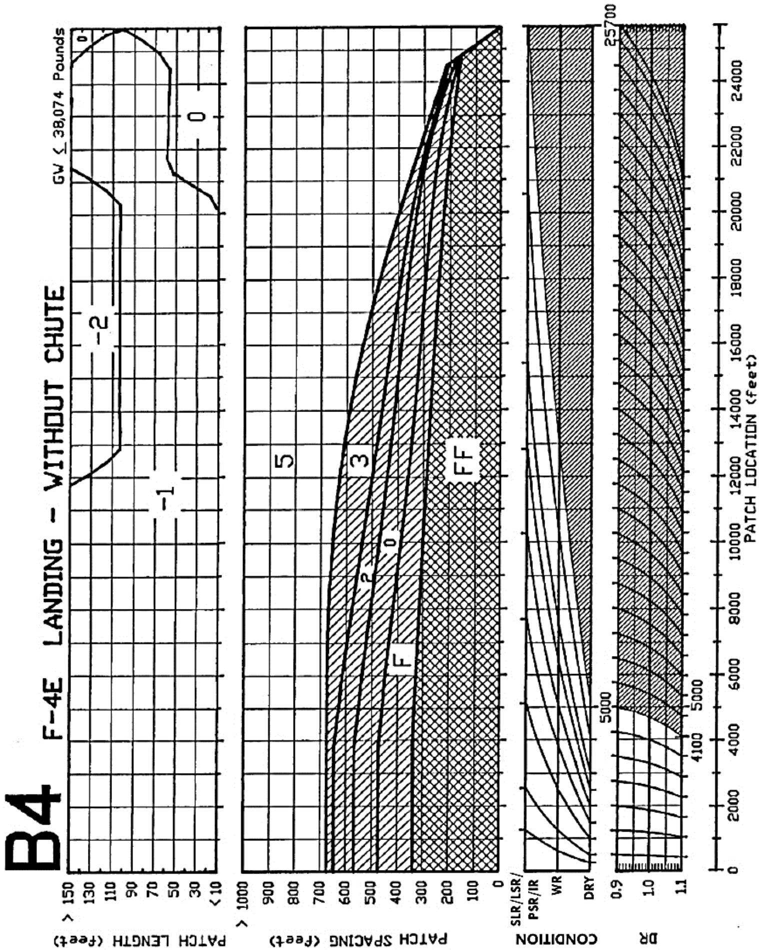


Figure A3.9. F-4 E Landing Without Chute.



A3.10. F-4 E Evacuation.

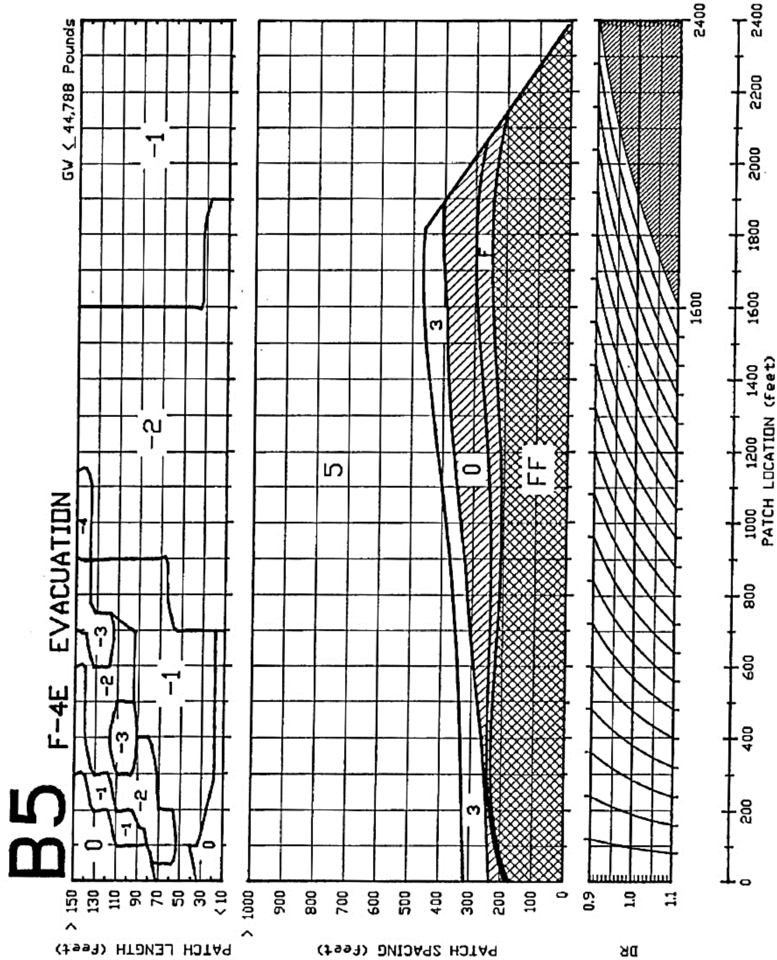


Figure A3.11. F-15 A/B Takeoff.

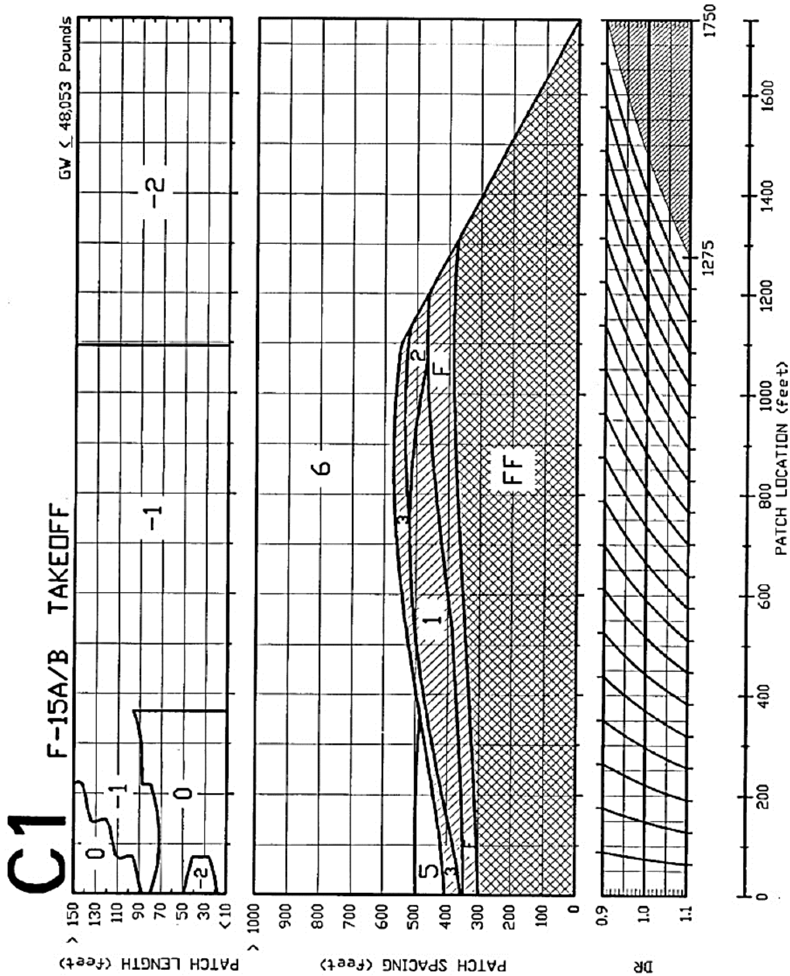


Figure A3.12. F-15 A/B Landing – Aerobraking.

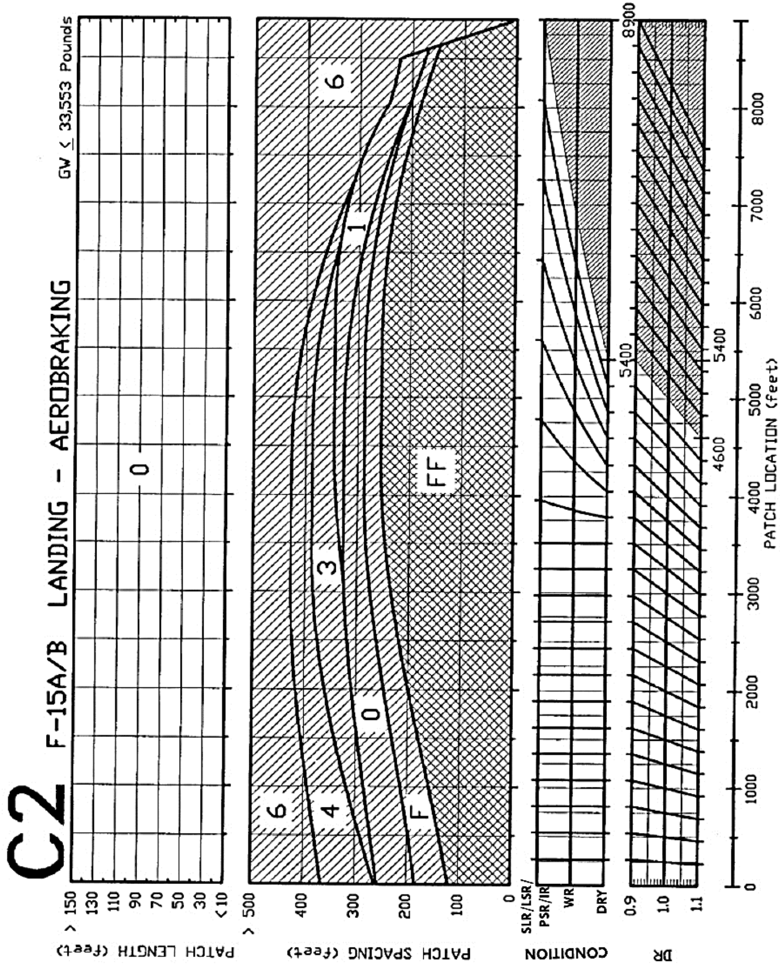


Figure A3.13. F-15 A/B Landing – Wheel Braking.

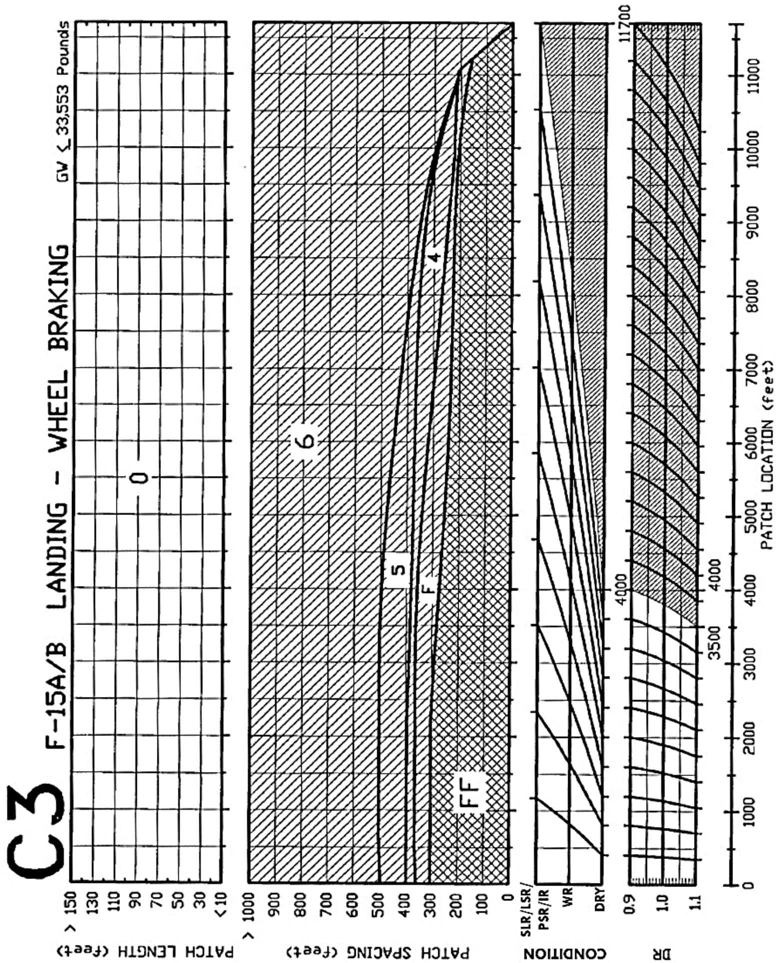
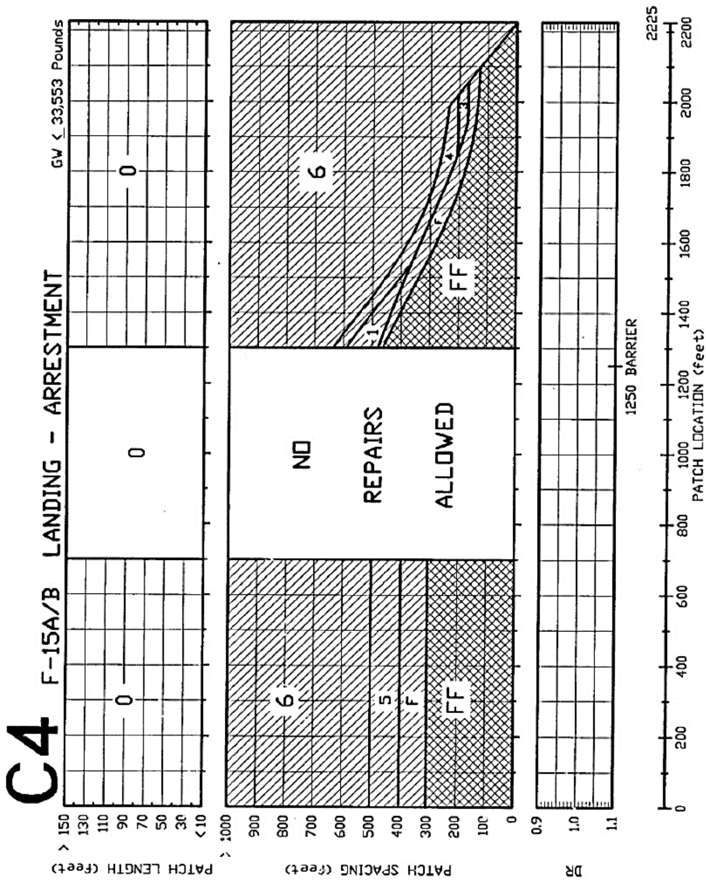


Figure A3.14. F-15 A/B Landing – Arrestment.



Note: This chart reflects a 975 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 225 ft to arrestment landing operational length.

Figure A3.15. F-15 A/B Evacuation.

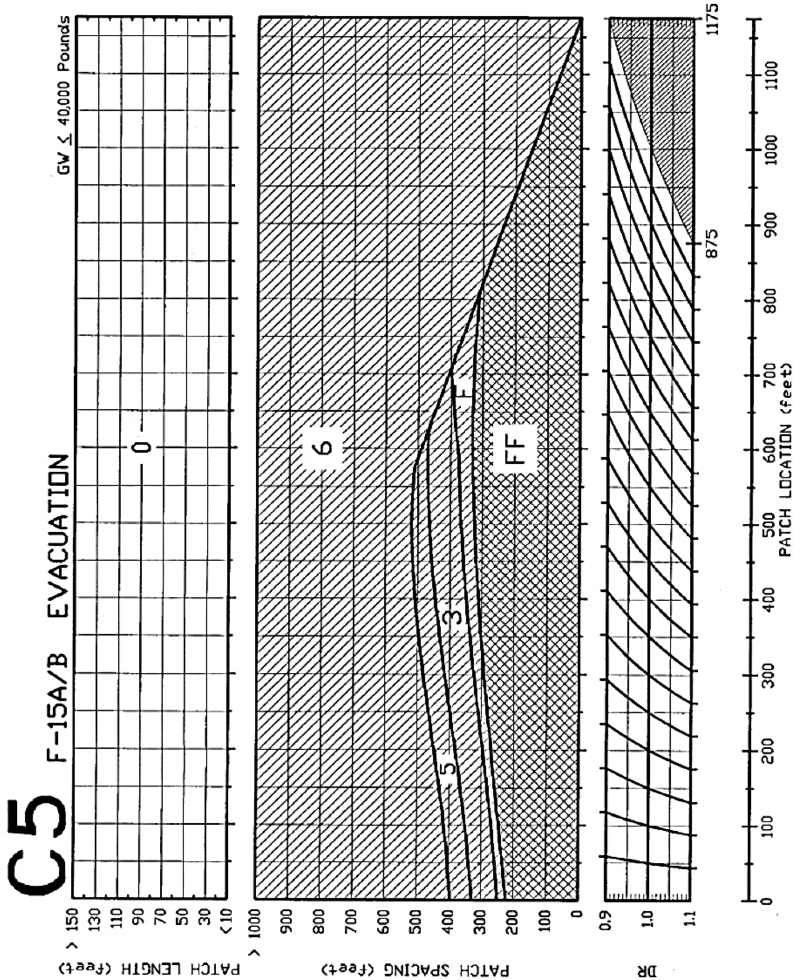


Figure A3.16. F-15 C/D Takeoff.

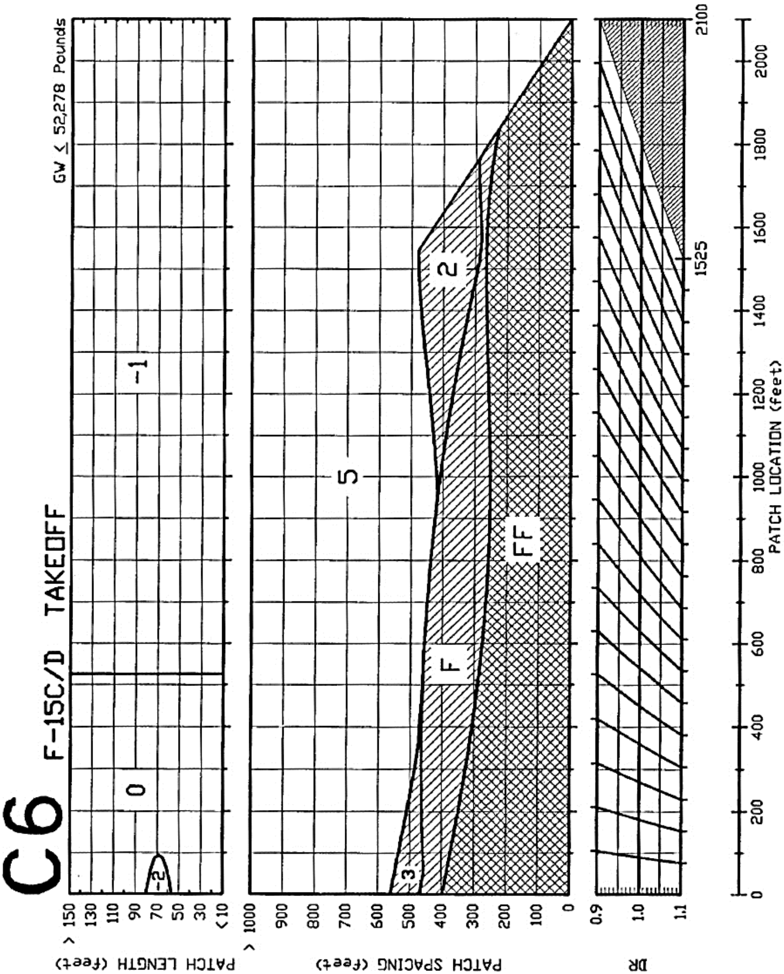


Figure A3.17. F-15 C/D Landing – Aerobraking.

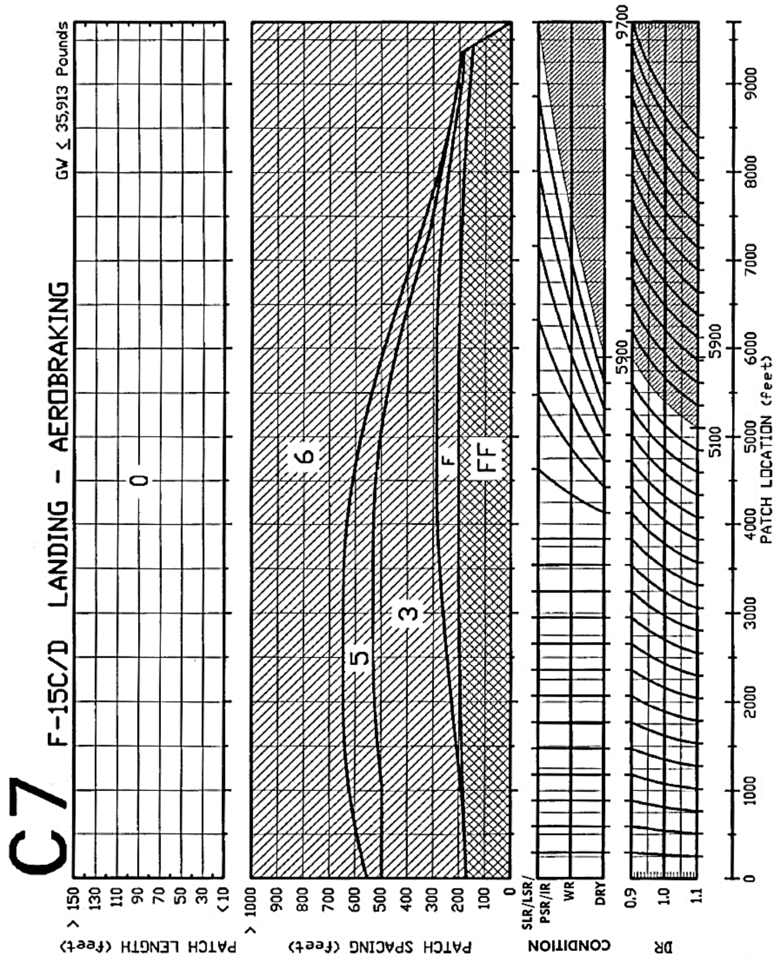


Figure A3.18. F-15 C/D Landing – Wheel Braking.

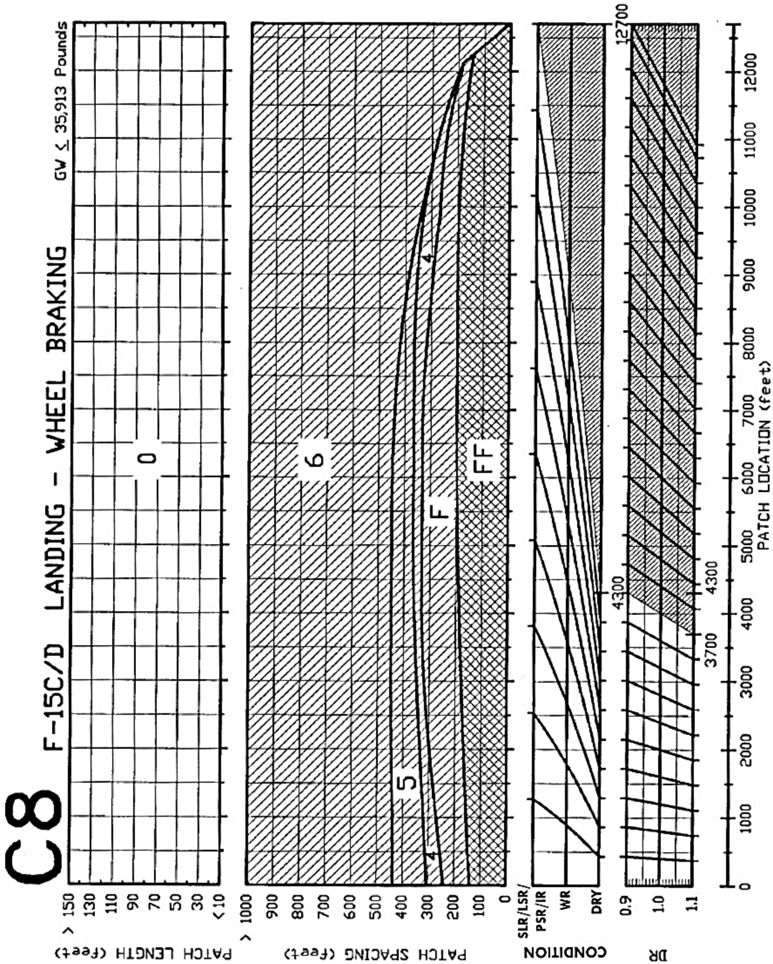
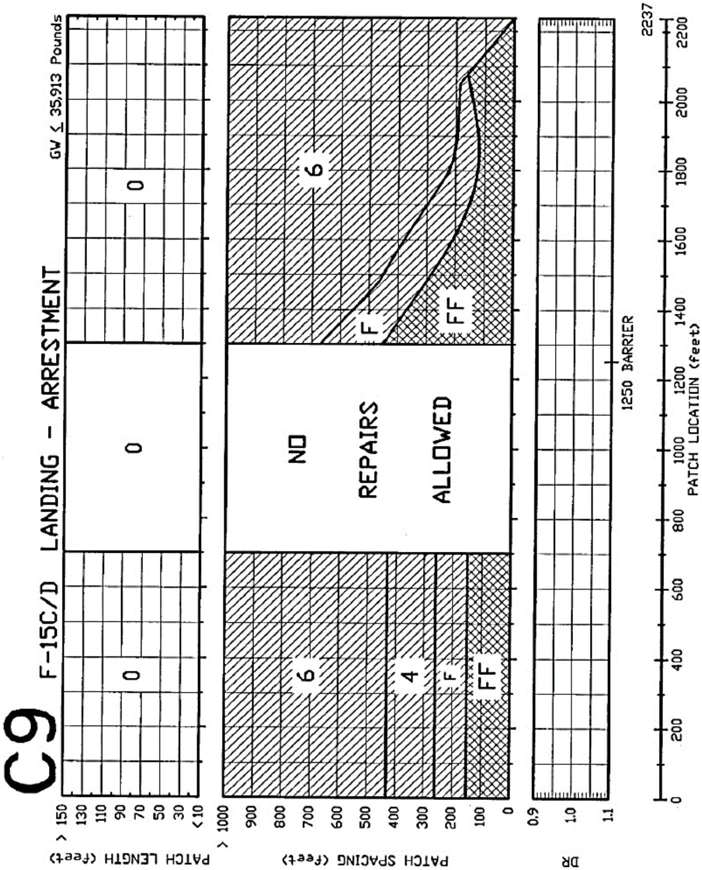


Figure A3.19. F-15 C/D Landing – Arrestment.



Note: This chart reflects a 987 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 213 ft to arrestment landing operational length.

Figure A3.20. F-15 C/D, F-22, F-35, F-14, and F/A-18 Evacuation.

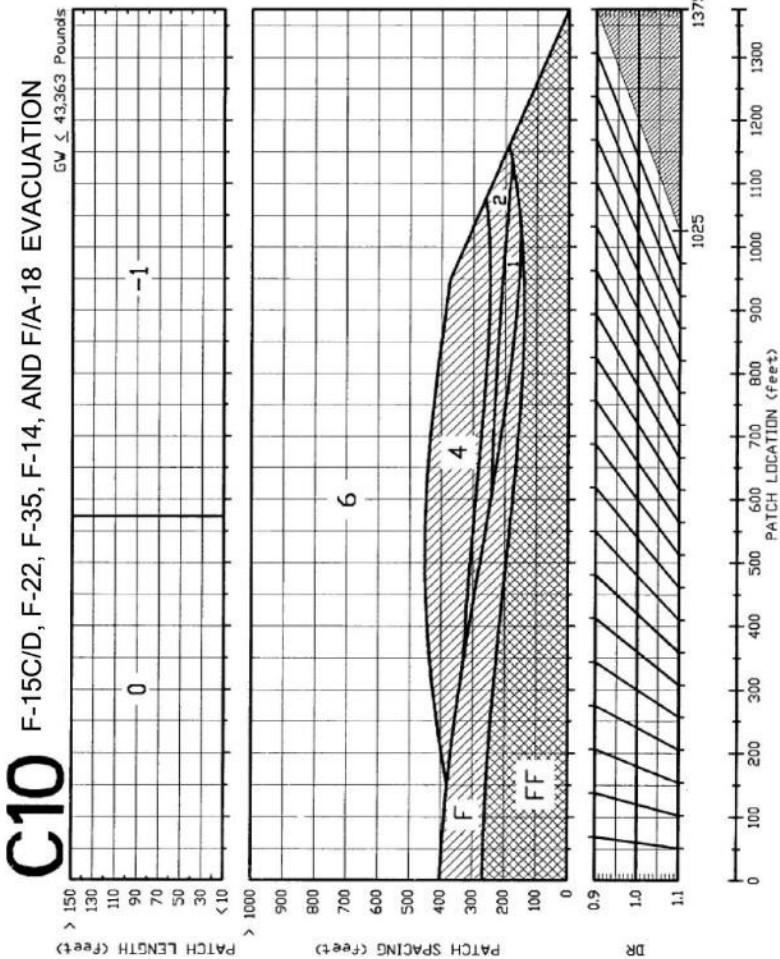


Figure A3.21. F-15 E, F-22, F-35, F-14, and F/A-18 Takeoff.

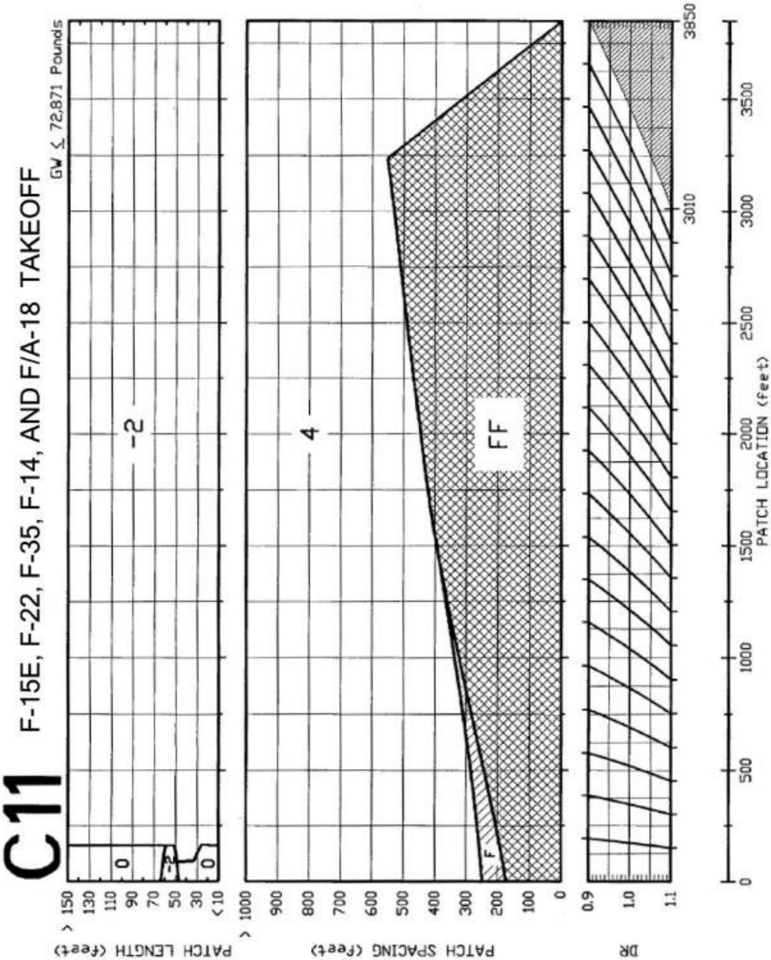


Figure A3.22. F-15 E, F-22, F-35, F-14, and F/A-18 Landing.

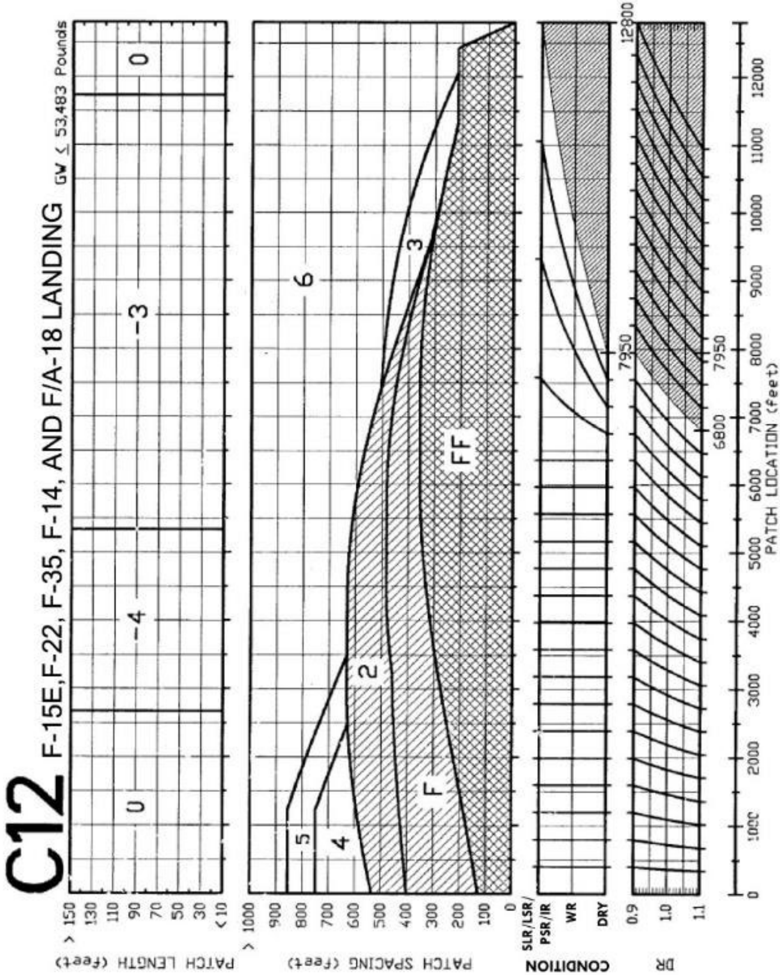
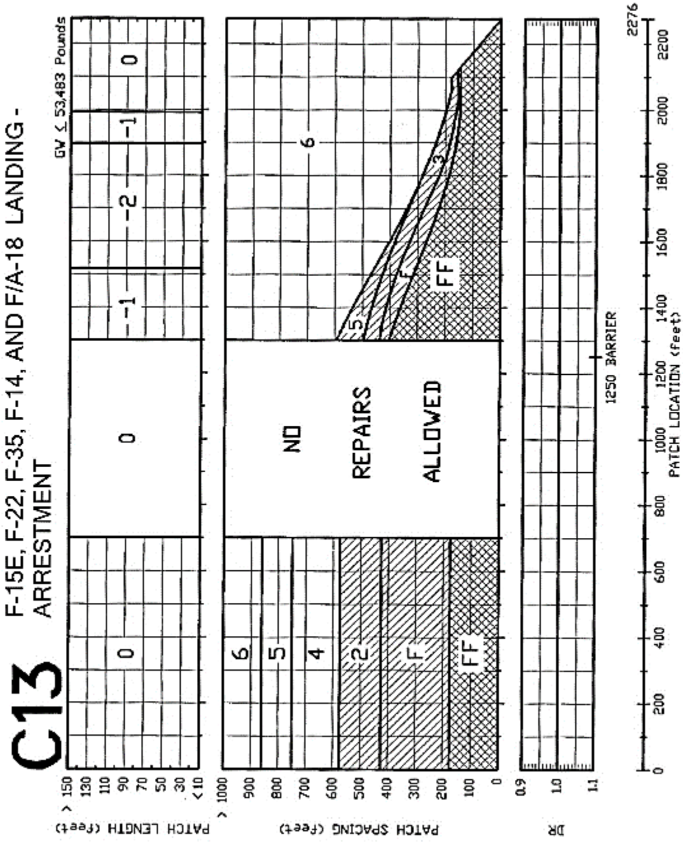


Figure A3.23. F-15 E, F-22, F-35, F-14, and F/A-18 Landing – Arrestment.



Note: This chart reflects a 1,026 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 174 ft to arrestment landing operational length.

Figure A3.24. F-15 E, F-22, F-35, F-14, and F/A-18 Evacuation.

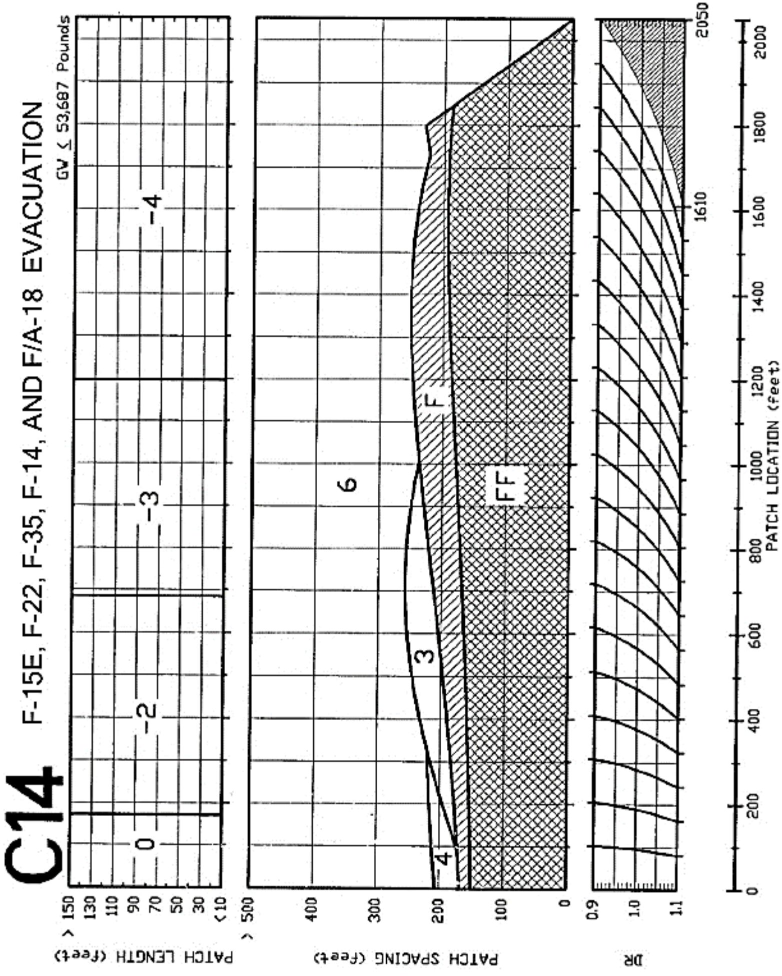


Figure A3.25. F-16 A/B Block 10 and 15 Takeoff.

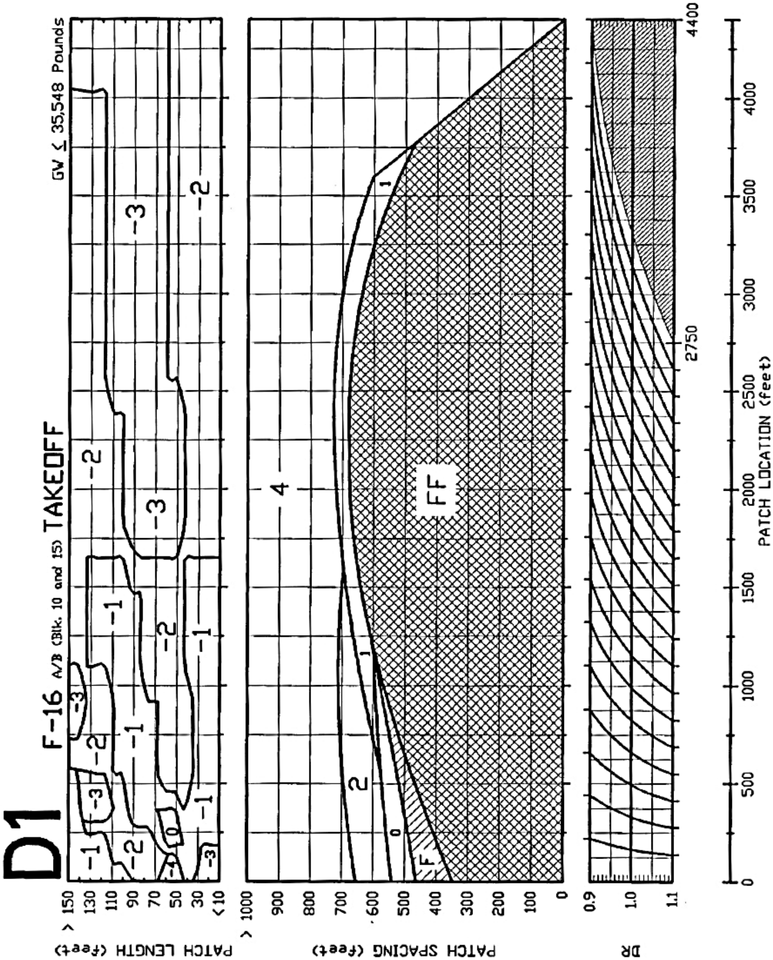


Figure A3.26. F-16 A/B Block 10 and 15 Landing.

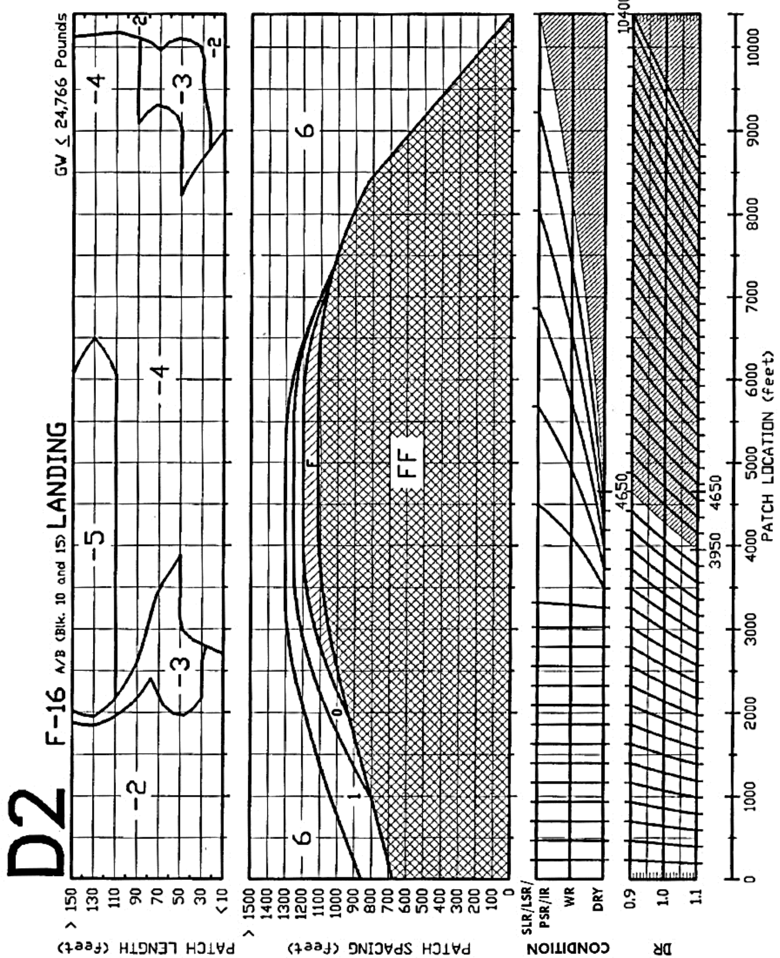
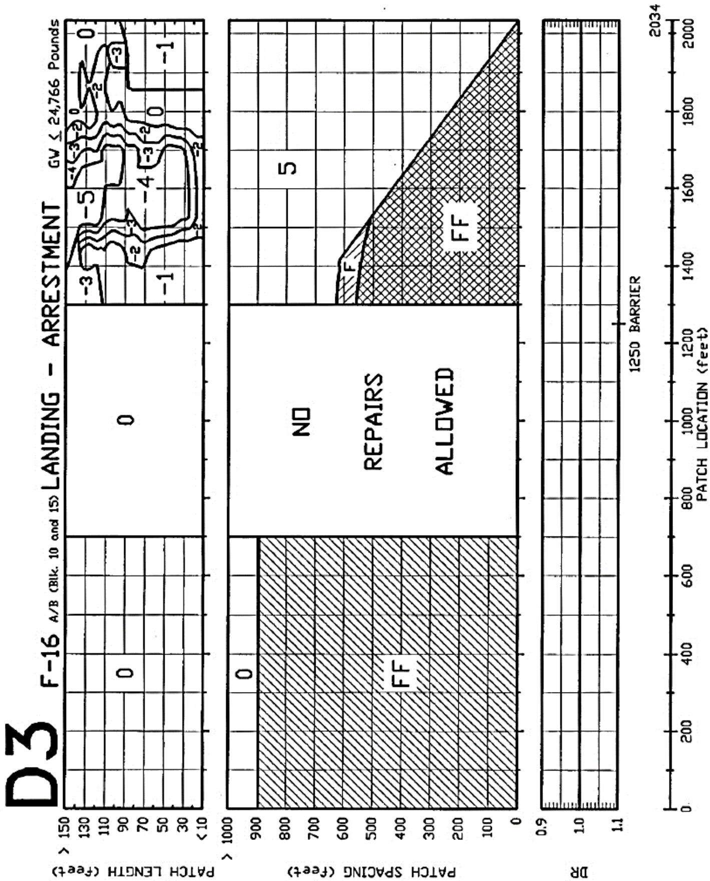


Figure A3.27. F-16 A/B Block 10 and 15 Landing – Arrestment.



Note: This chart reflects a 784 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 416 ft to arrestment landing operational length.

Figure A3.28. F-16 A/B Block 10 and 15 Evacuation.

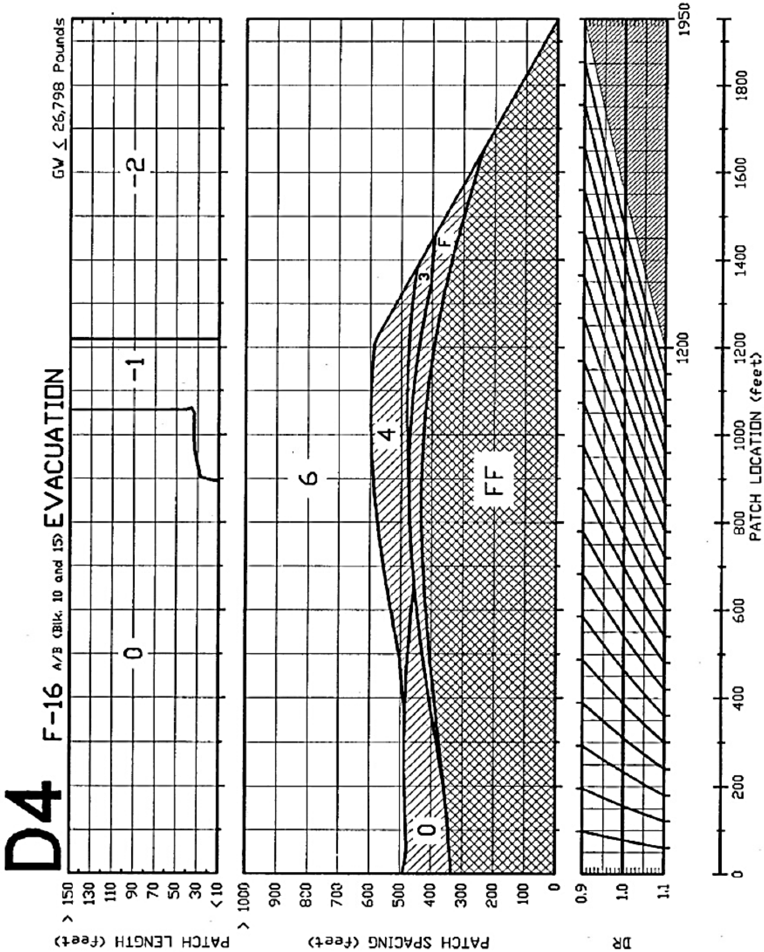


Figure A3.29. F-16 C/D Block 25, 30, 32 Takeoff.

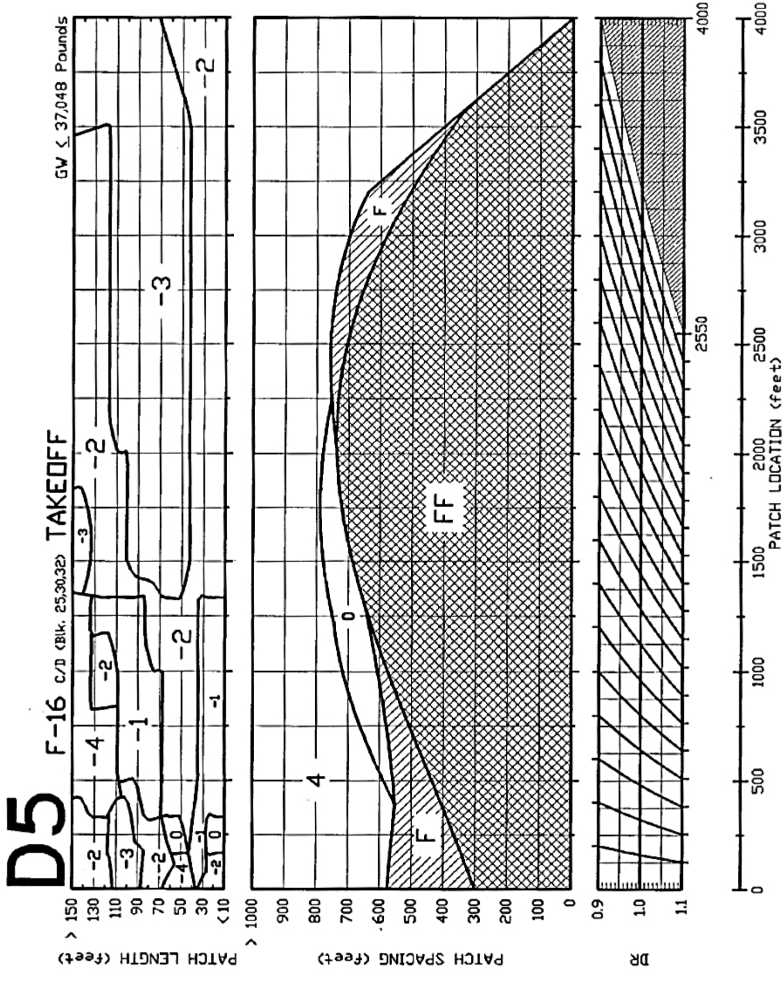


Figure A3.30. F-16 C/D Block 25, 30, 32 Landing.

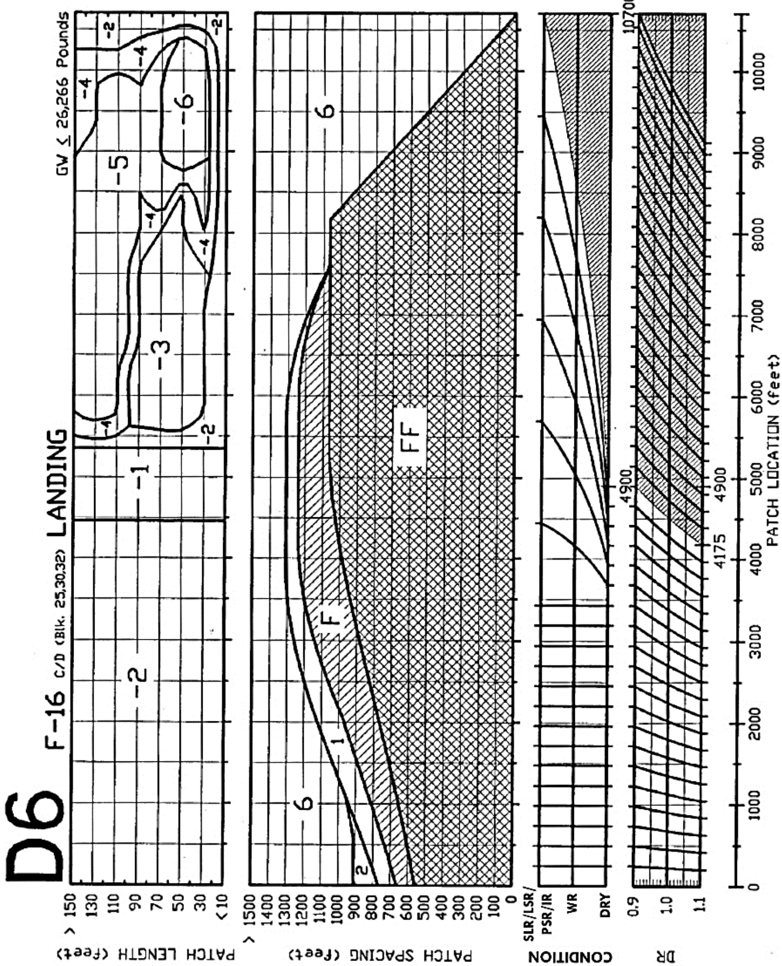
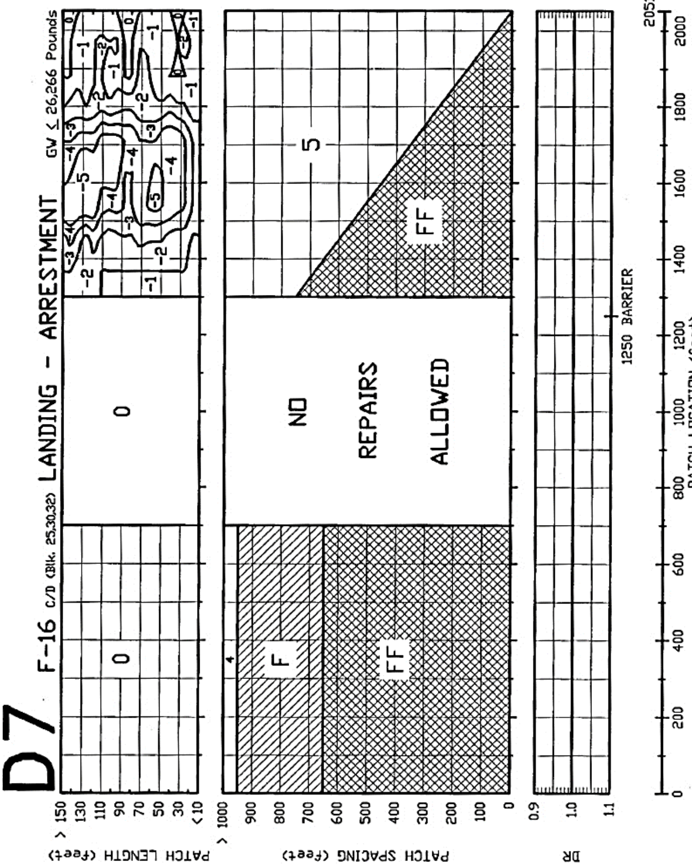


Figure A3.31. F-16 C/D Block 25, 30, 32 Landing – Arrestment.



Note: This chart reflects an 801 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 399 ft to arrestment landing operational length.

Figure A3.32. F-16 C/D Block 25, 30, 32 Evacuation.

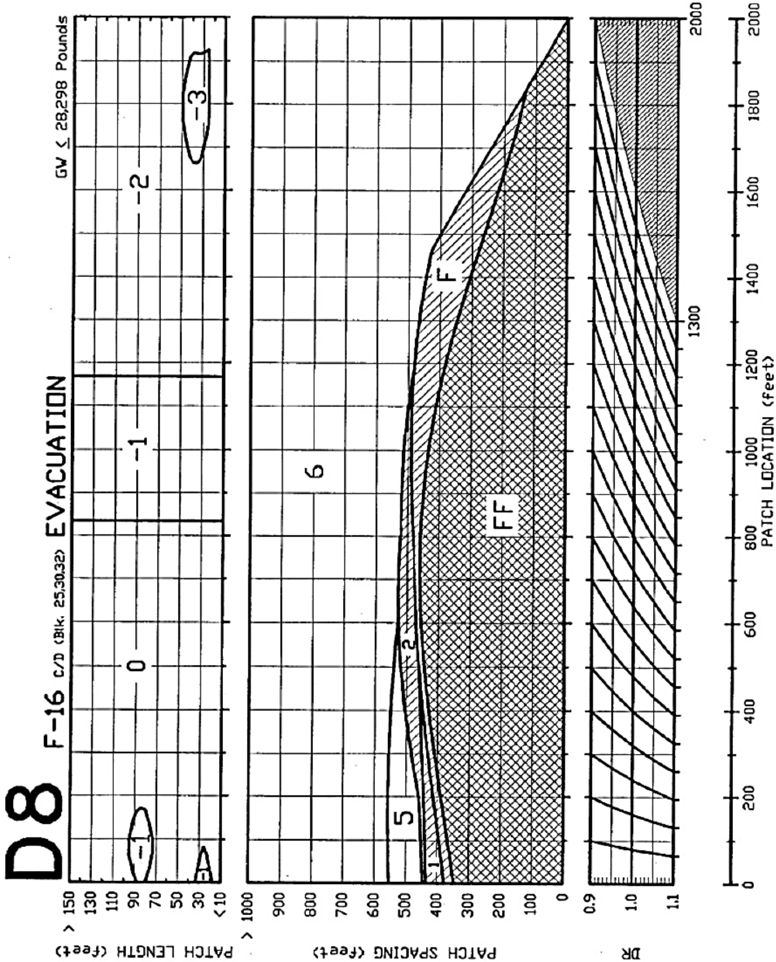


Figure A3.33. F-16 C/D Block 40, 42 Takeoff.

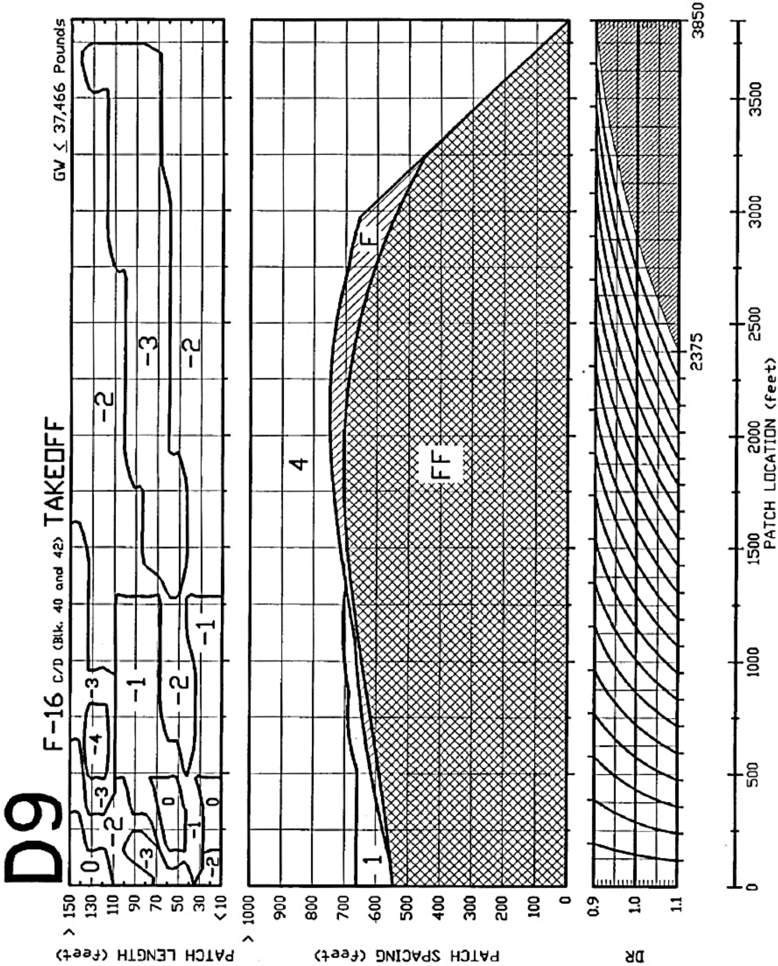


Figure A3.34. F-16 C/D Block 40, 42 Landing.

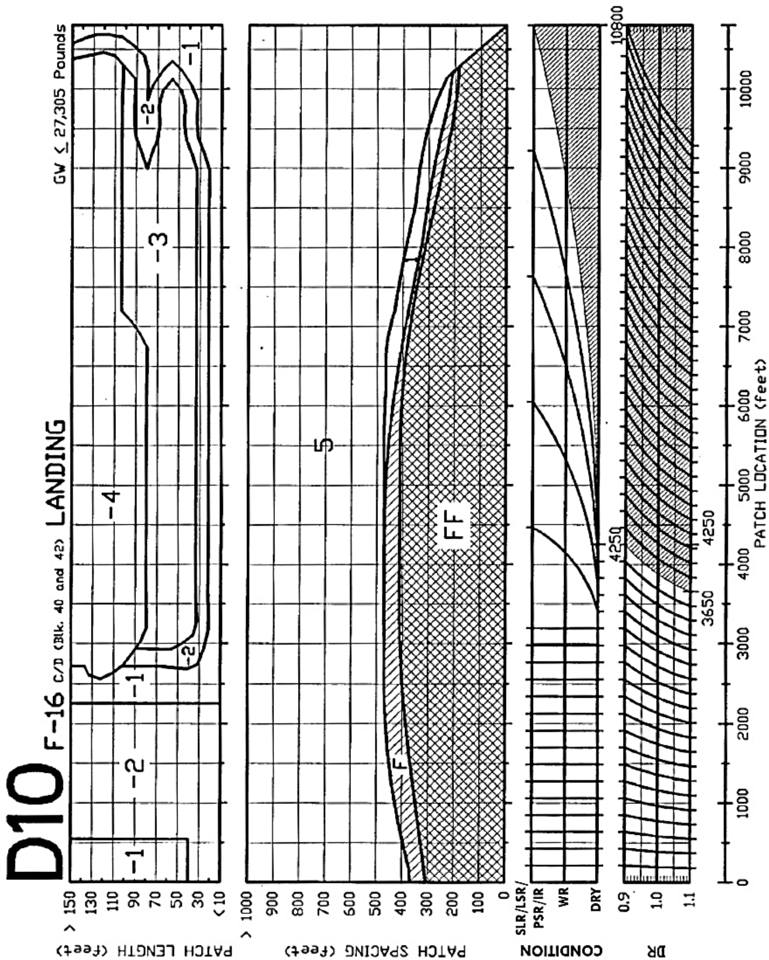
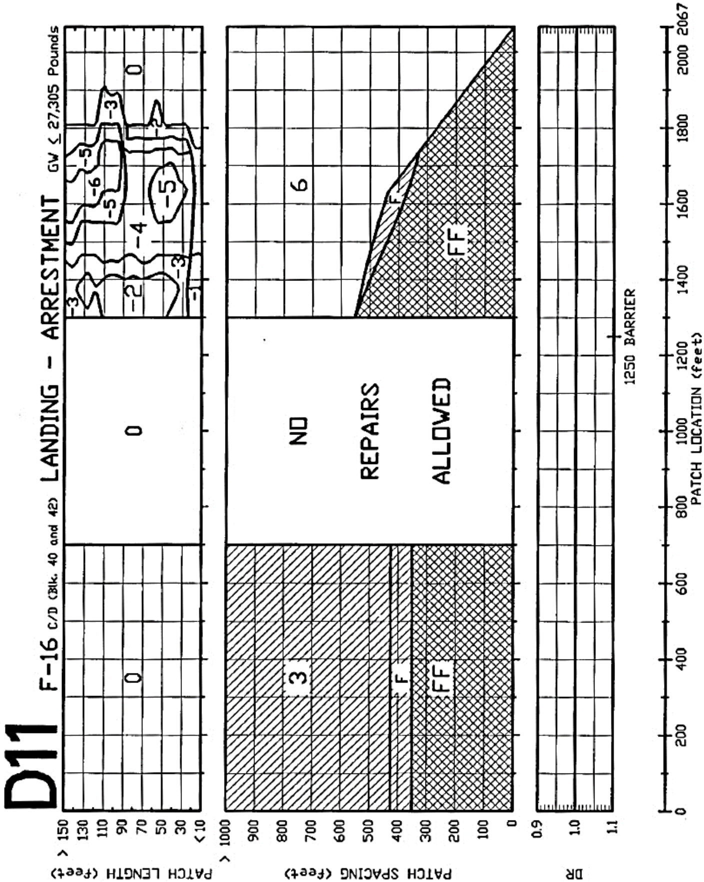


Figure A3.35. F-16 C/D Block 40, 42 Landing – Arrestment.



Note: This chart reflects an 817 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 383 ft to arrestment landing operational length.

Figure A3.36. F-16 C/D Block 40, 42 Evacuation.

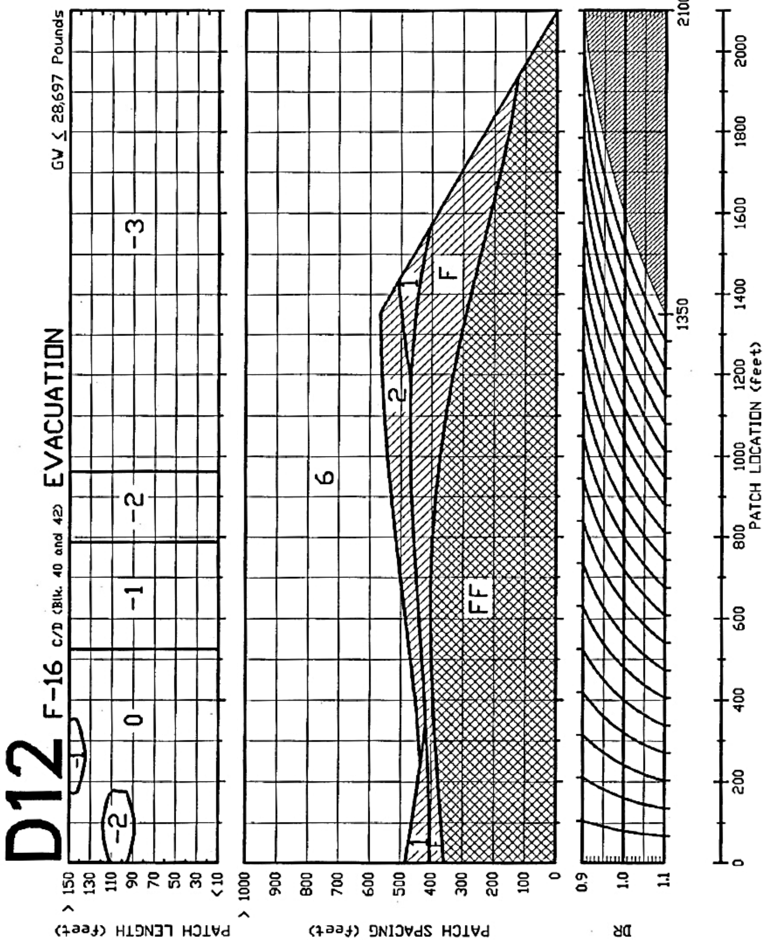


Figure A3.37. F-111 A/E Takeoff.

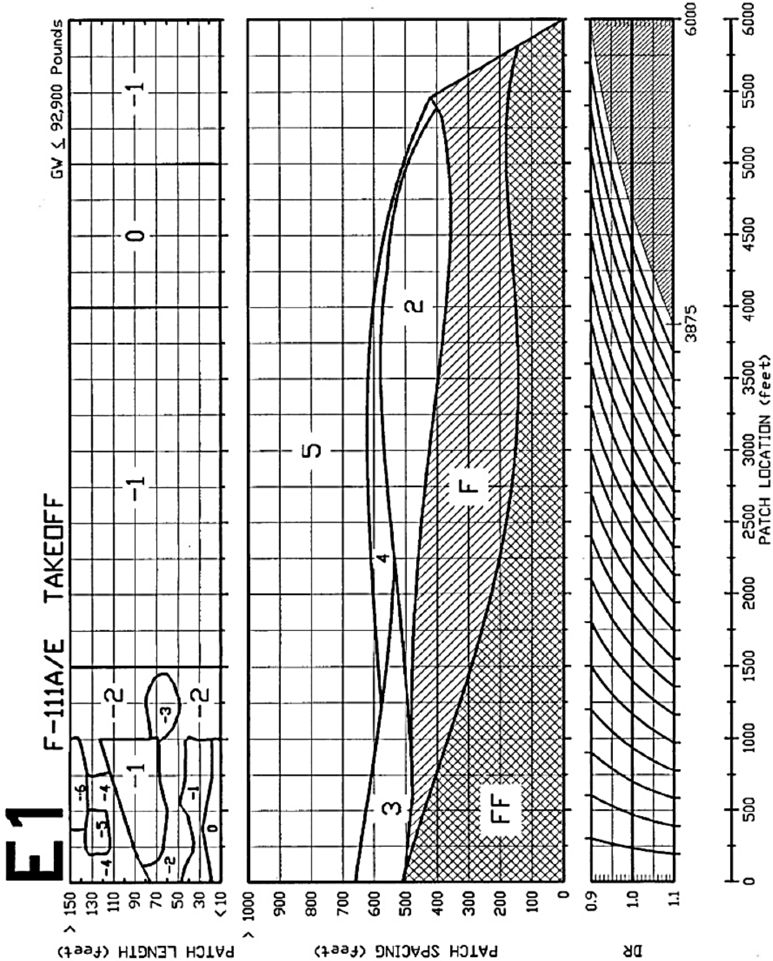


Figure A3.38. F-111 A/E Landing –Wheel Braking.

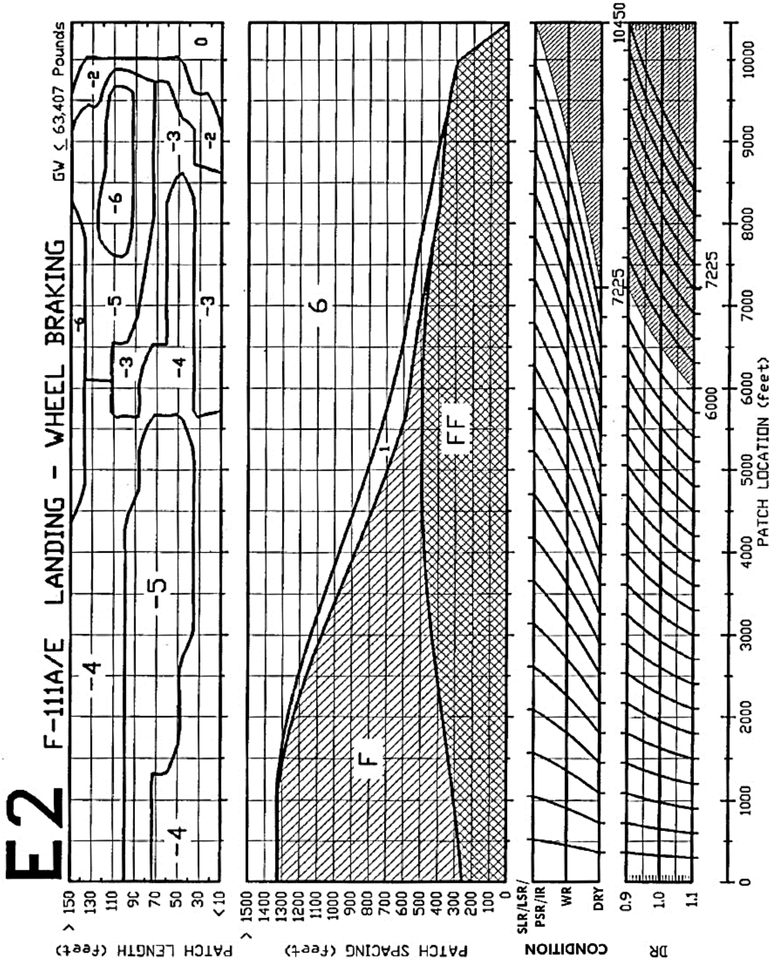


Figure A3.39. F-111 A/E Landing – Short Field.

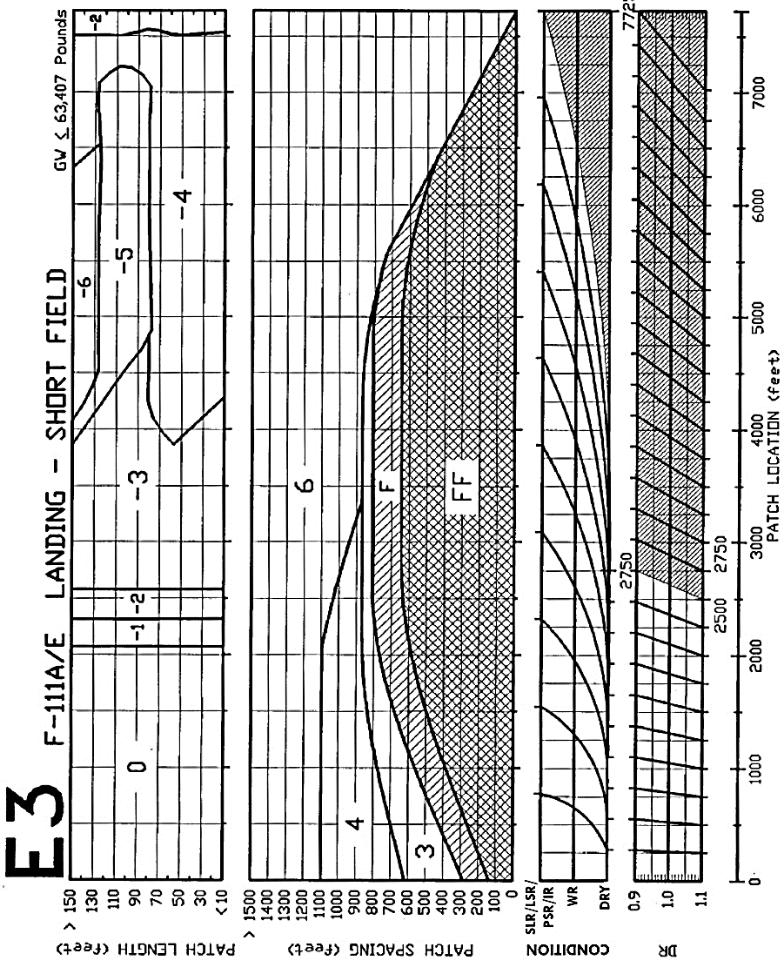
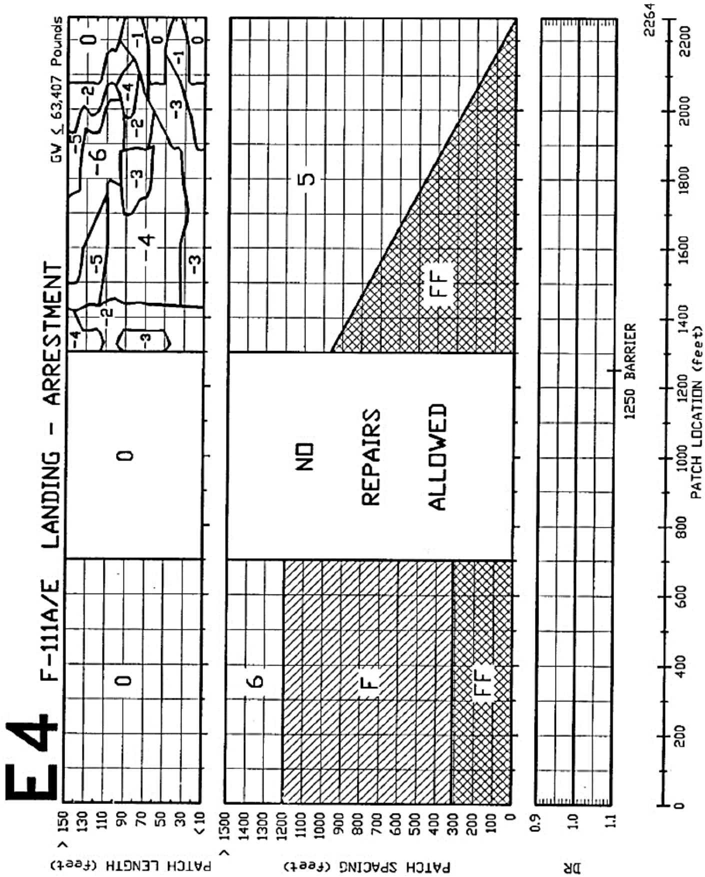


Figure A3.40. F-111 A/E Landing – Arrestment.



Note: This chart reflects a 1,014 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 186 ft to arrestment landing operational length.

Figure A3.41. F-111 A/E Evacuation.

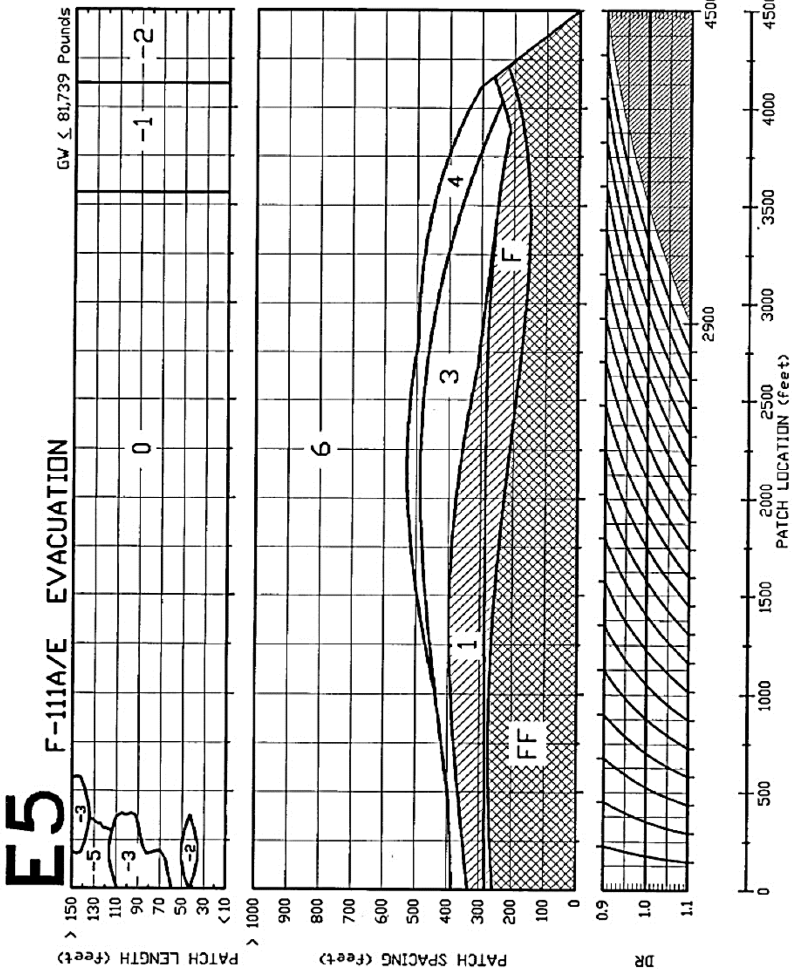


Figure A3.42. C-5 B Takeoff.

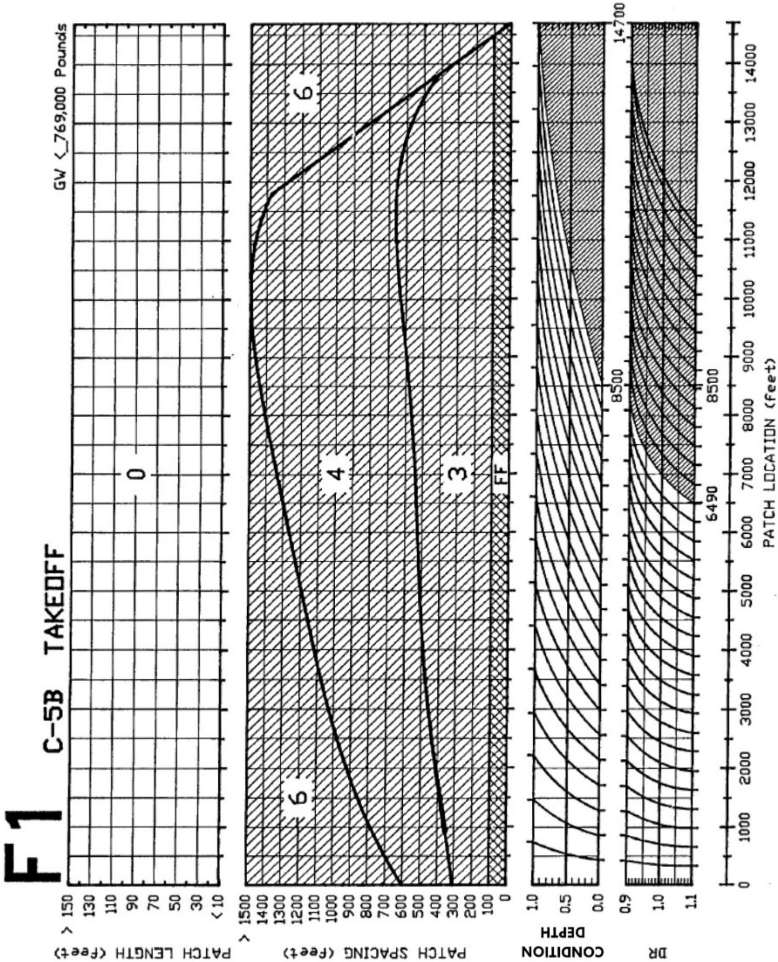


Figure A3.43. C-5 B Landing.

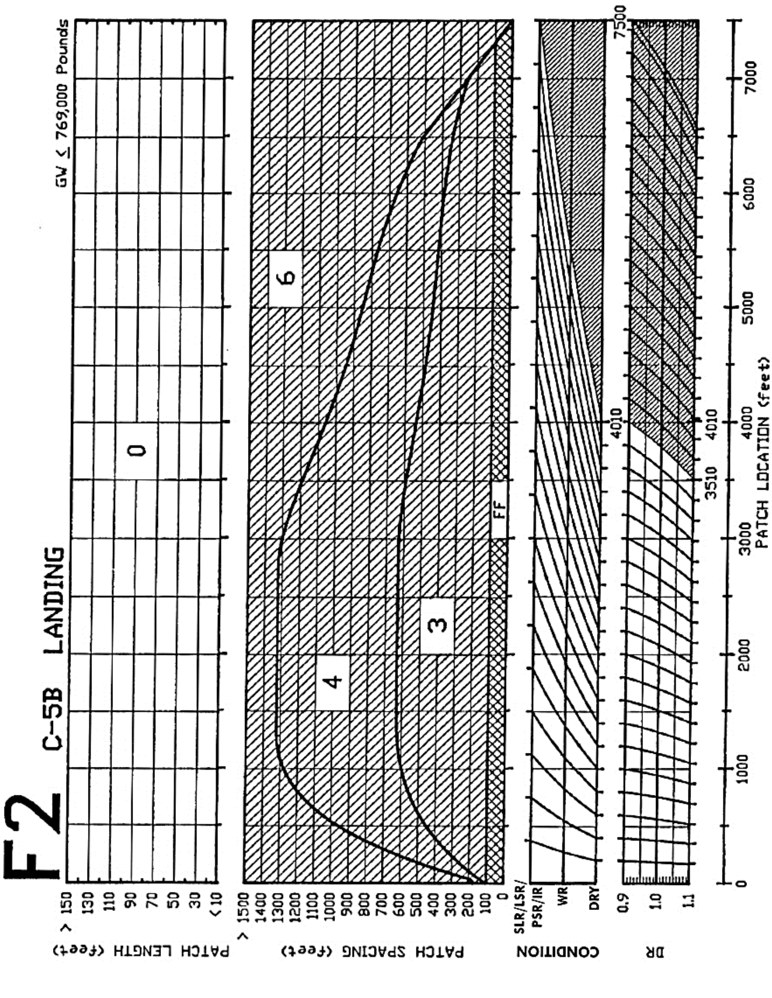


Figure A3.44. C-130 E/H/B/J, AC-130, EC-130, HC-130, MC-130, WC-130, E-2C, and P-3 Takeoff.

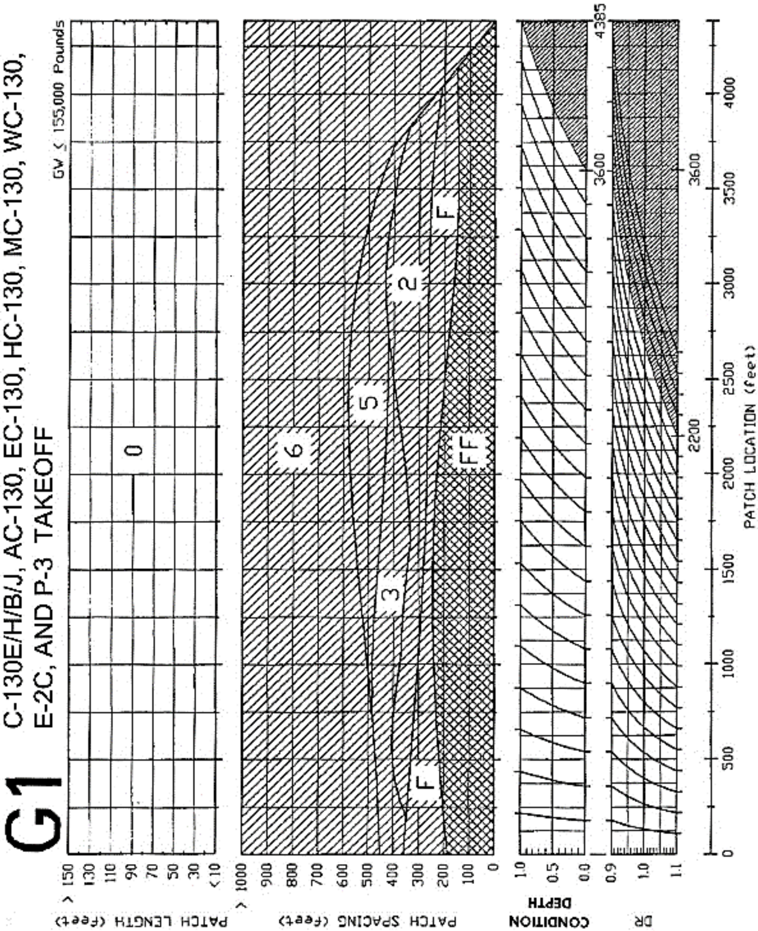


Figure A3.45. C-130 E/H/B/J, AC-130, EC-130, HC-130, MC-130, WC-130, KC-130, C-135, E-2C, and P-3 Landing.

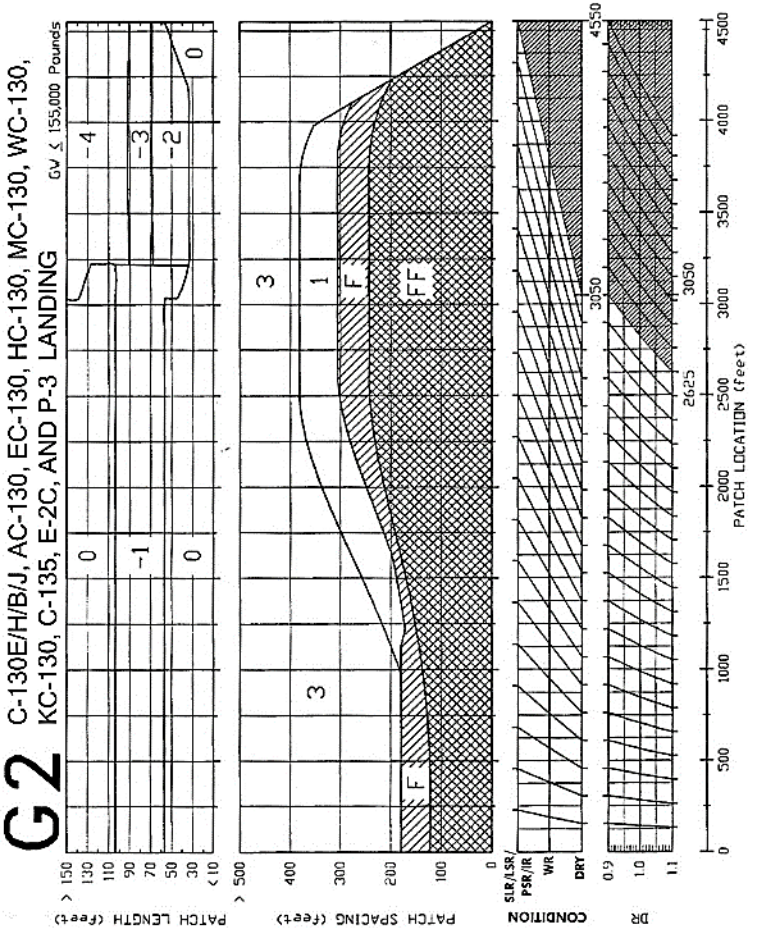


Figure A3.46. C-141 A/B Heavy Weight Takeoff.

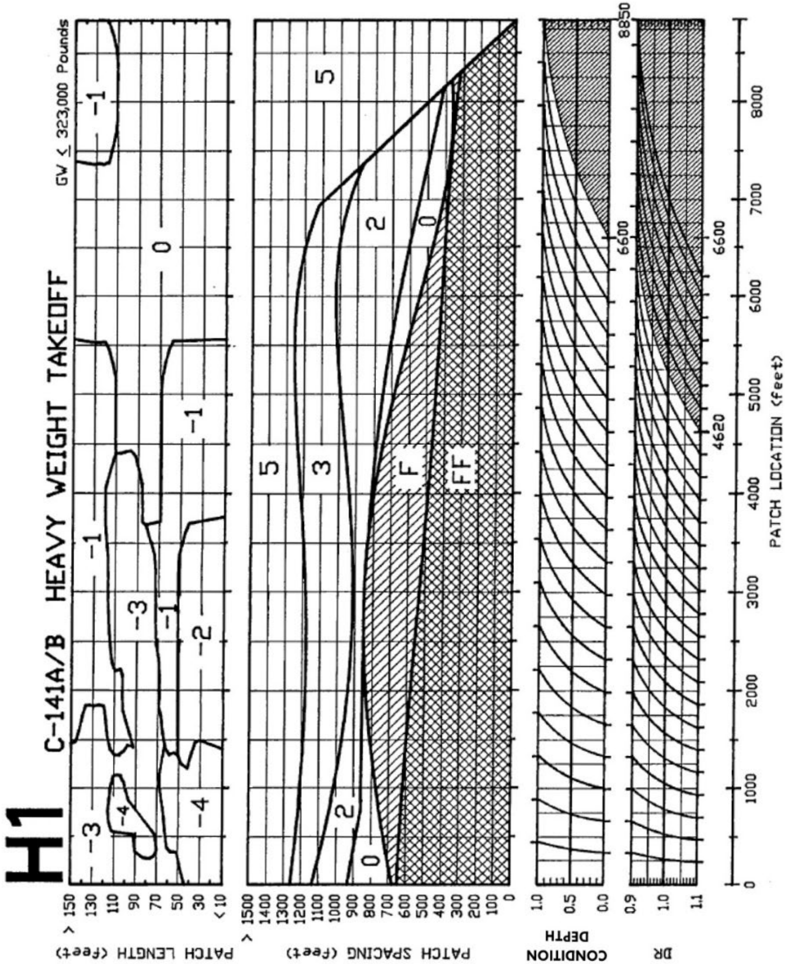


Figure A3.47. C-141 A/B Heavy Weight Landing.

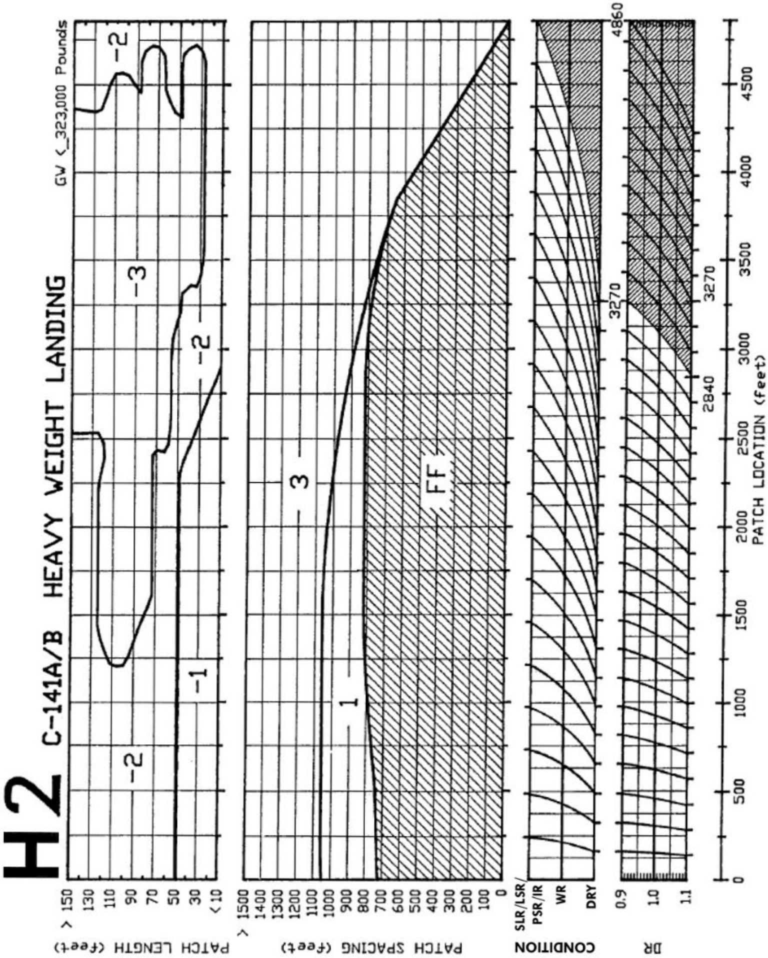


Chart A3.48. C-141 A/B Medium Weight Takeoff.

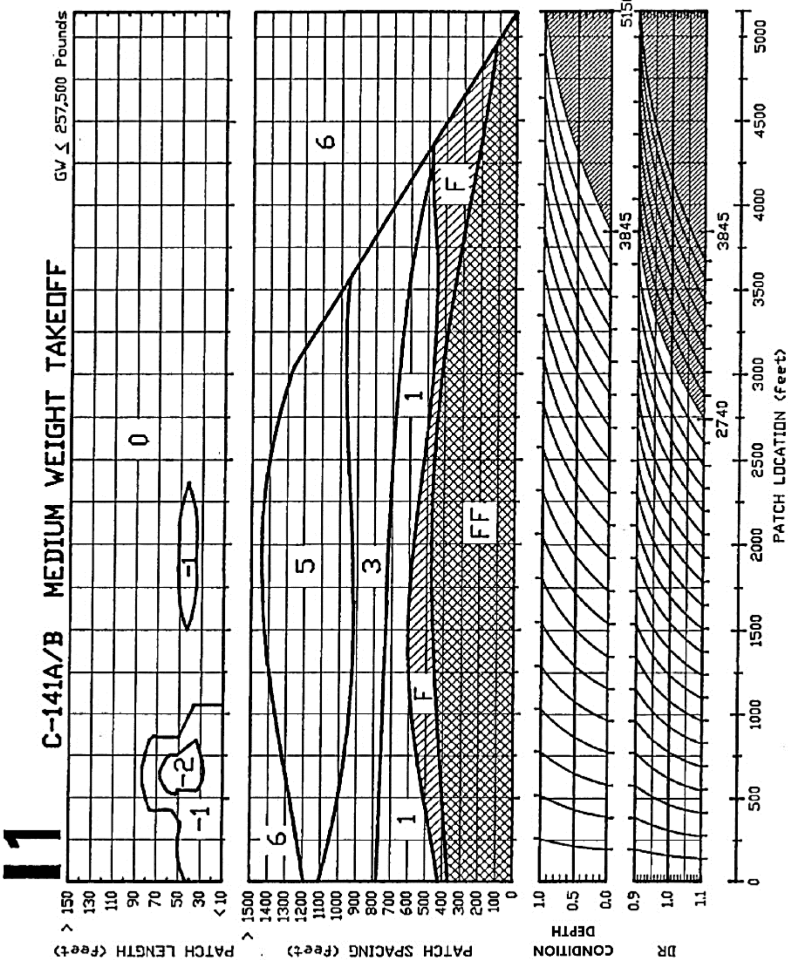


Figure A3.49. C-141 A/B Medium Weight Landing.

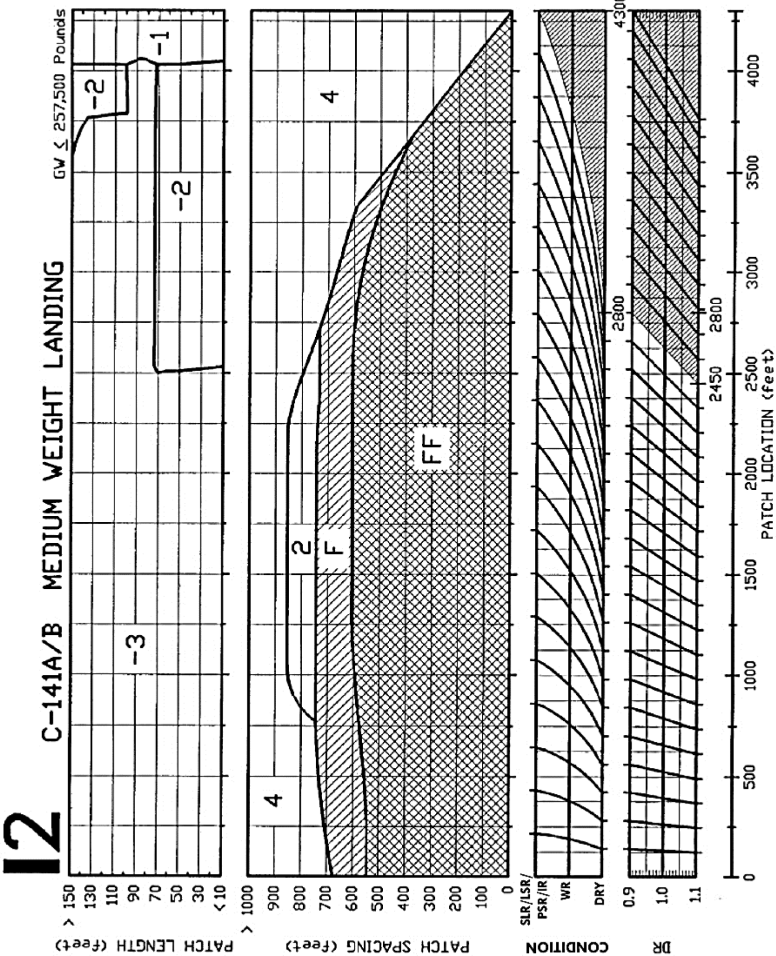


Figure A3.50. A-7 D Takeoff.

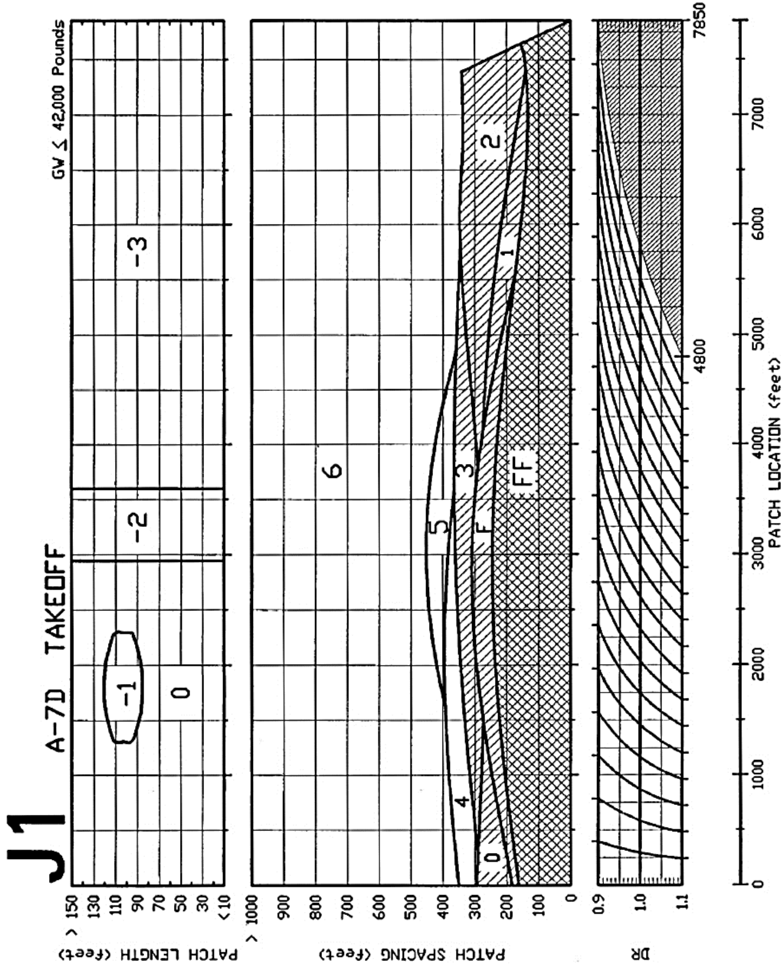


Figure A3.51. A-7 D Landing.

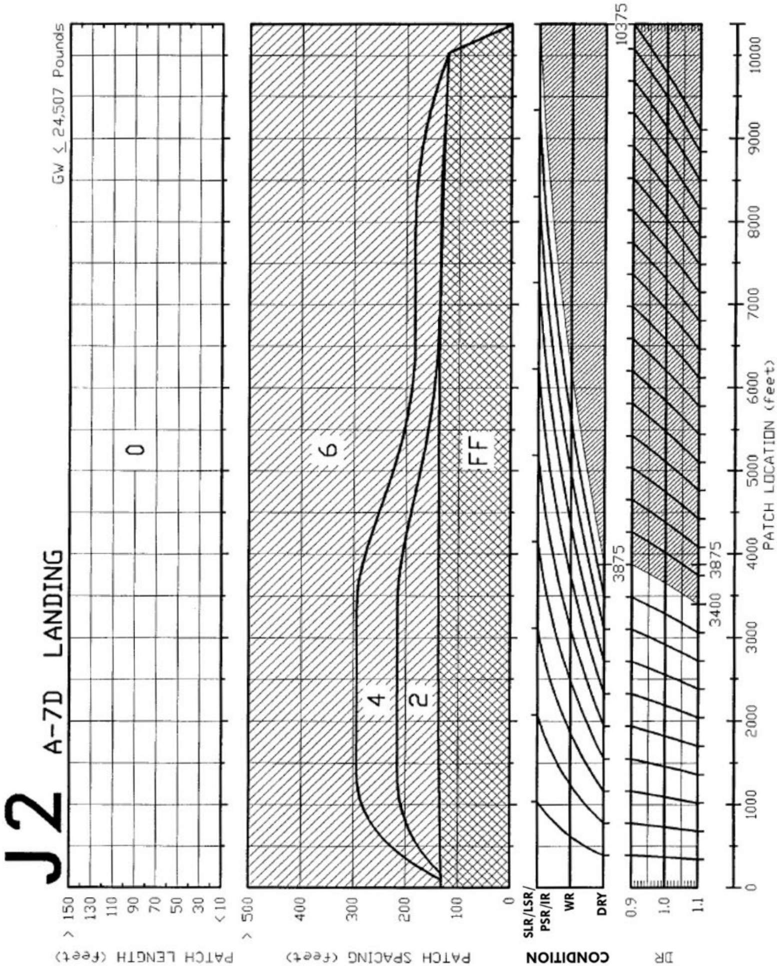
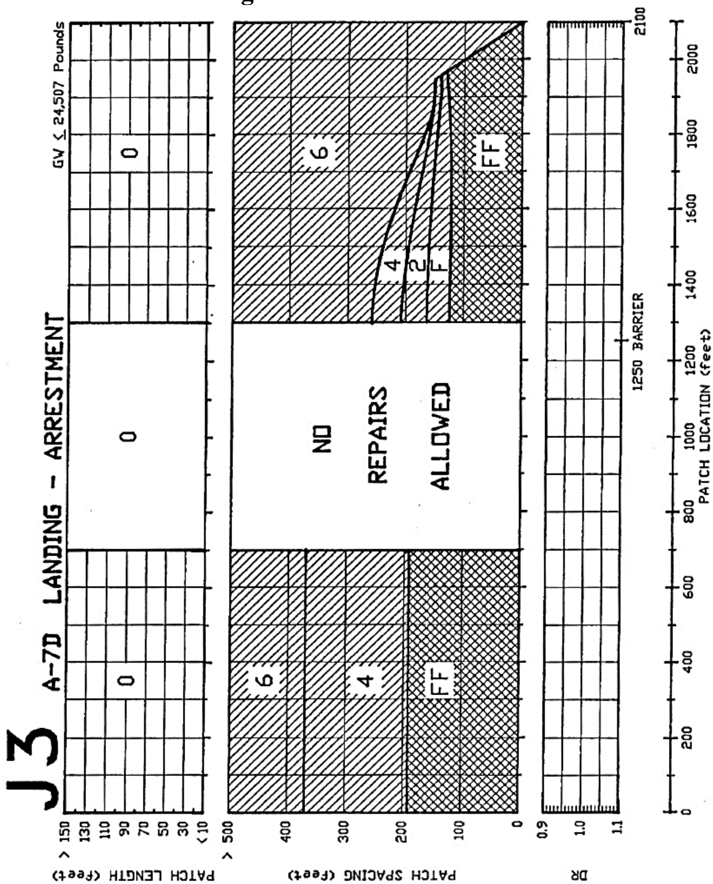


Figure A3.52. A-7 D Landing – Arrestment.



Note: This chart reflects an 850 ft maximum runout for an arrestment landing. Current maximum runout is 1,200 ft, which requires adding an additional 350 ft to arrestment landing operational length.

Figure A3.53. A-7 D Evacuation.

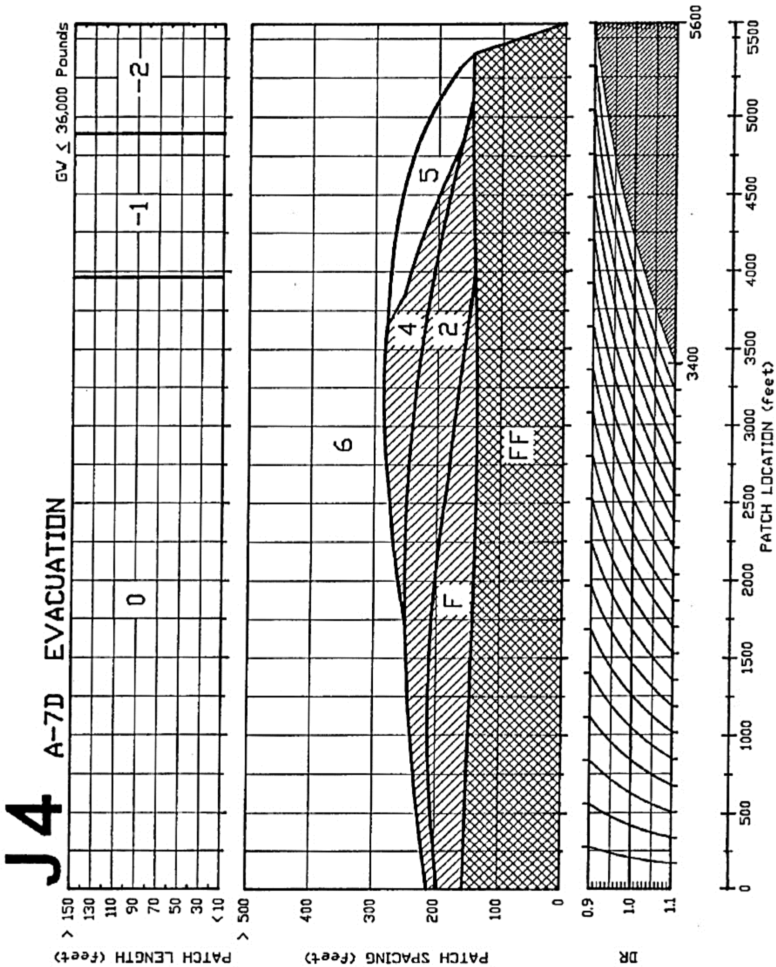


Figure A3.54. A-10 A, OA-10 Takeoff.

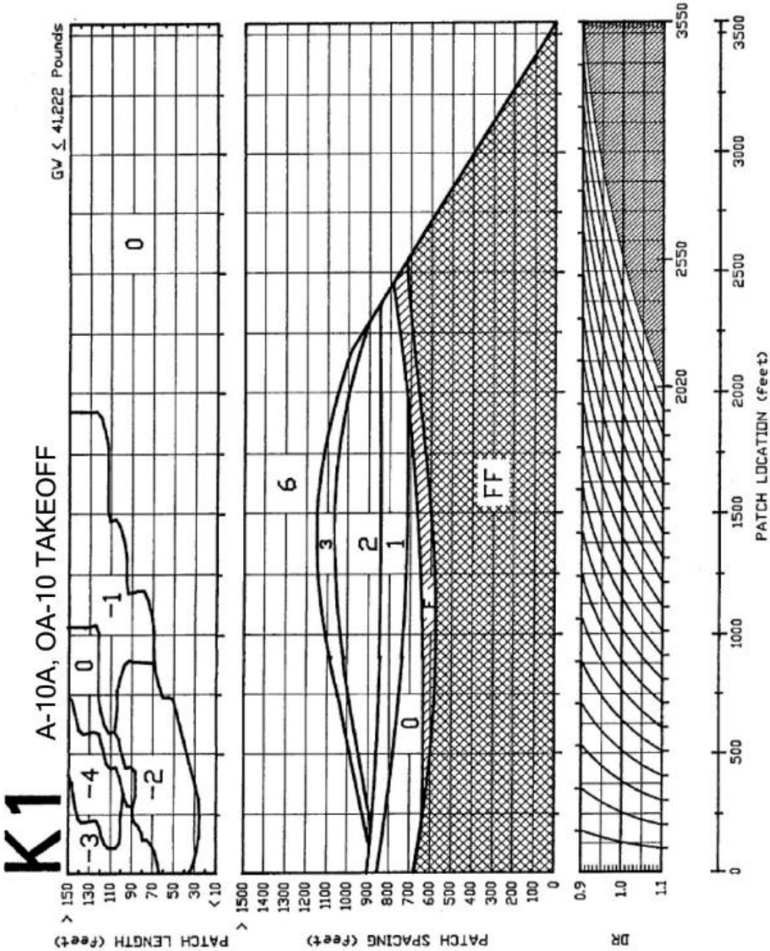


Figure A3.55. A-10 A, OA-10 Landing.

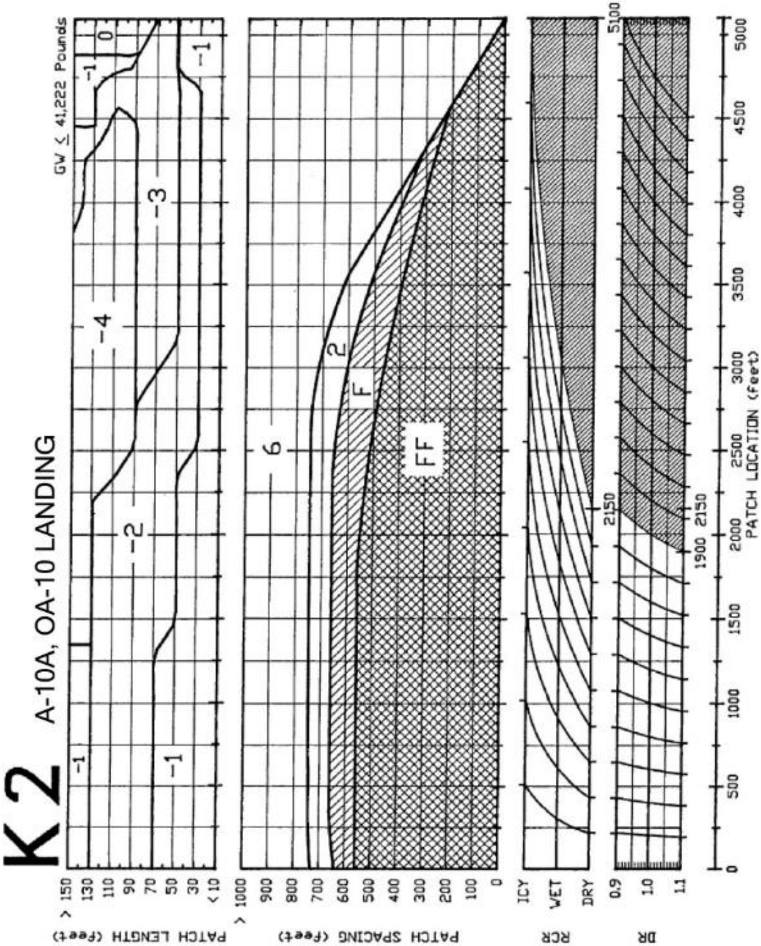


Figure A3.56. KC-135 R Heavy Weight Takeoff.

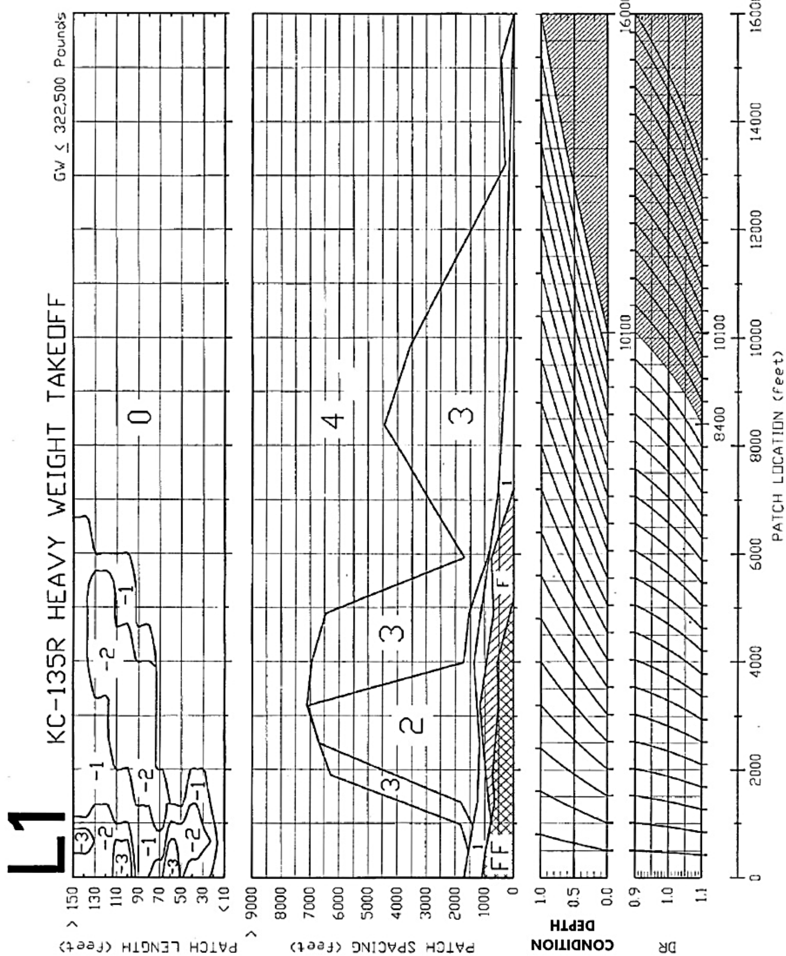


Figure A3.57. KC-135 R Nominal Weight Takeoff.

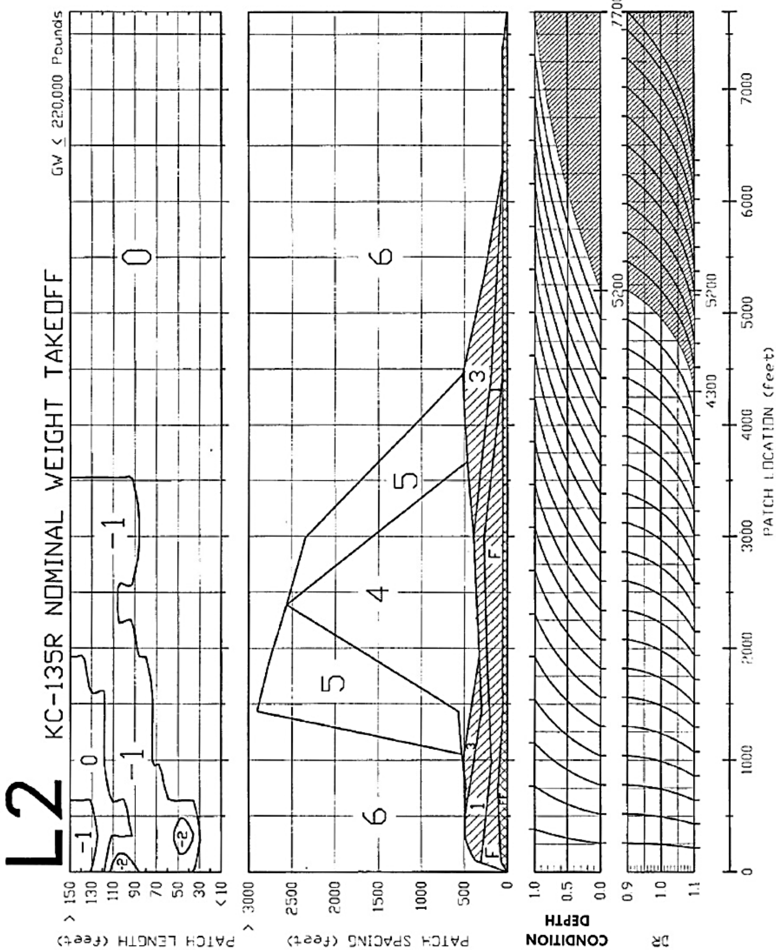


Figure A3.58. KC-135 R Landing.

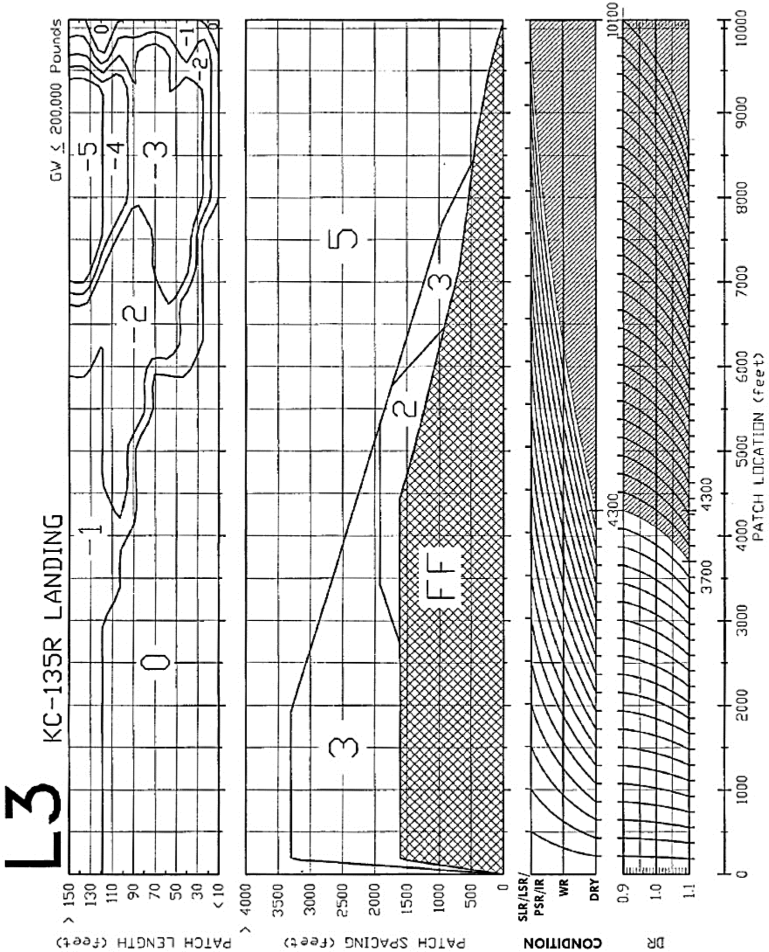


Figure A3.59. KC-10, KC-767 Heavy Weight Takeoff.

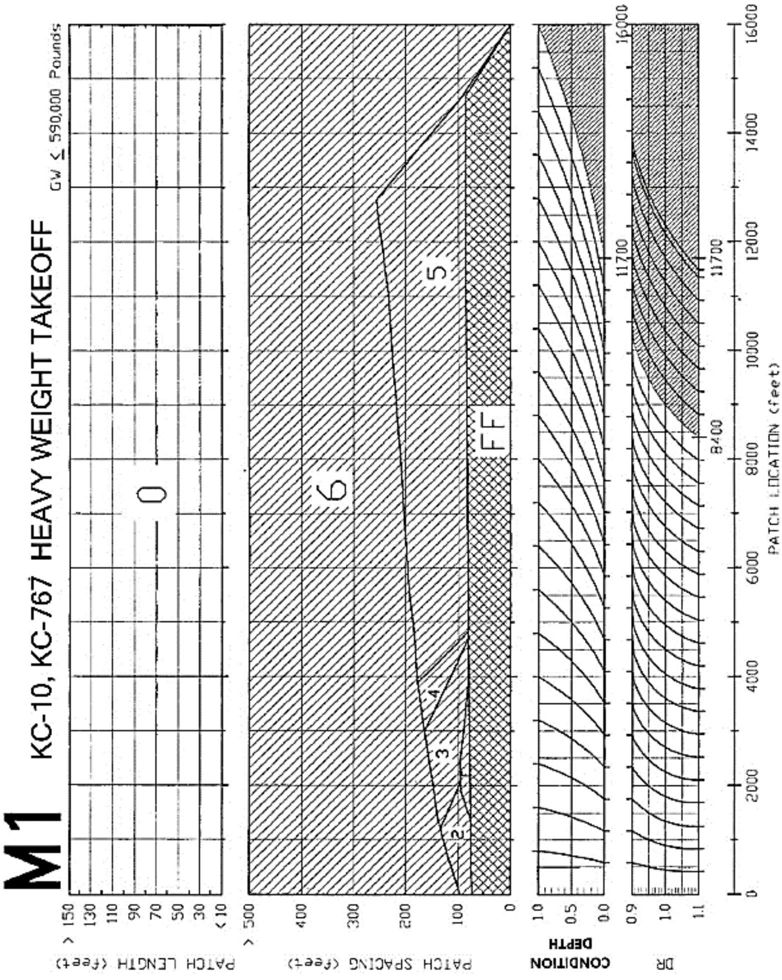


Figure A3.60. KC-10, KC-767 Nominal Weight Takeoff.

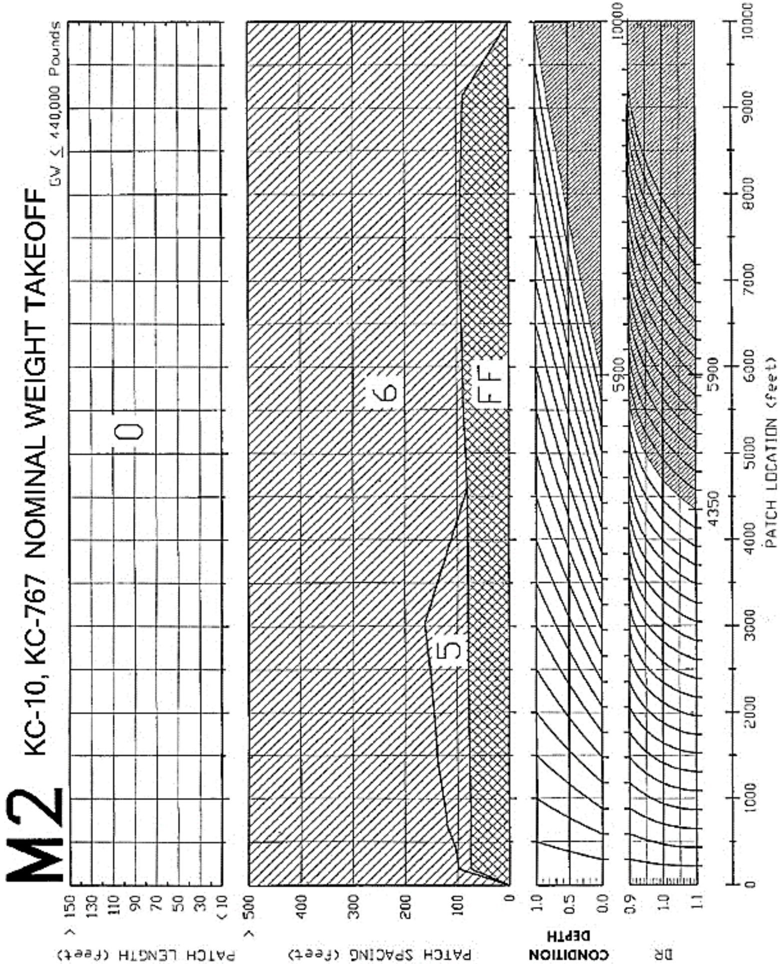


Figure A3.61. KC-10, KC-767 Landing.

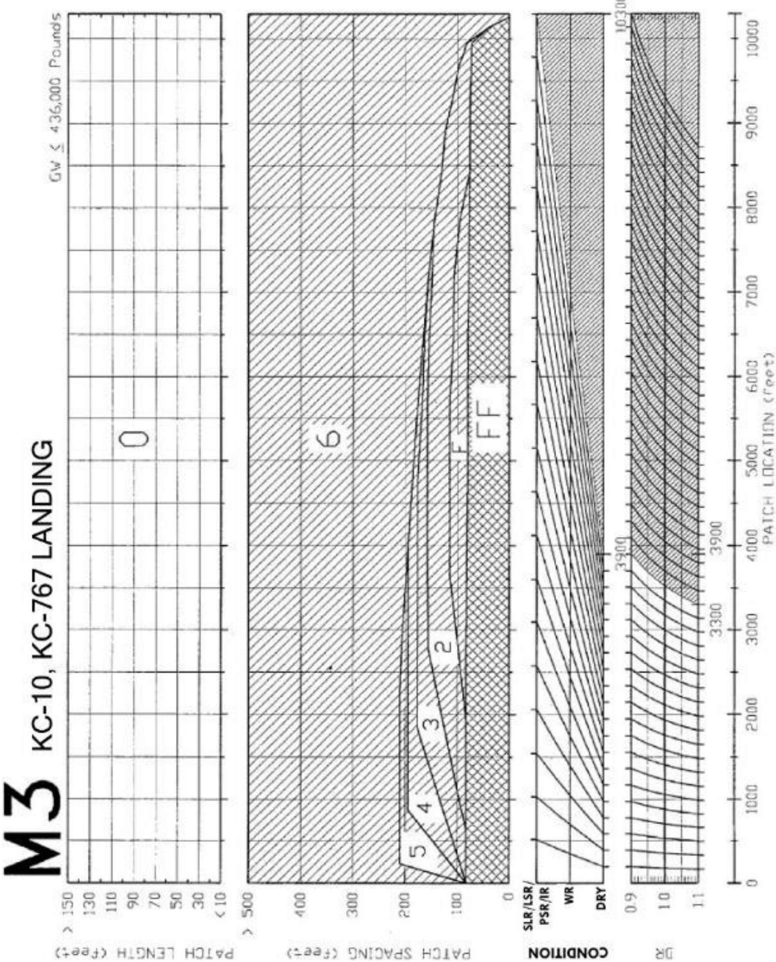


Figure A3.62. C-9 Heavy Weight Takeoff.

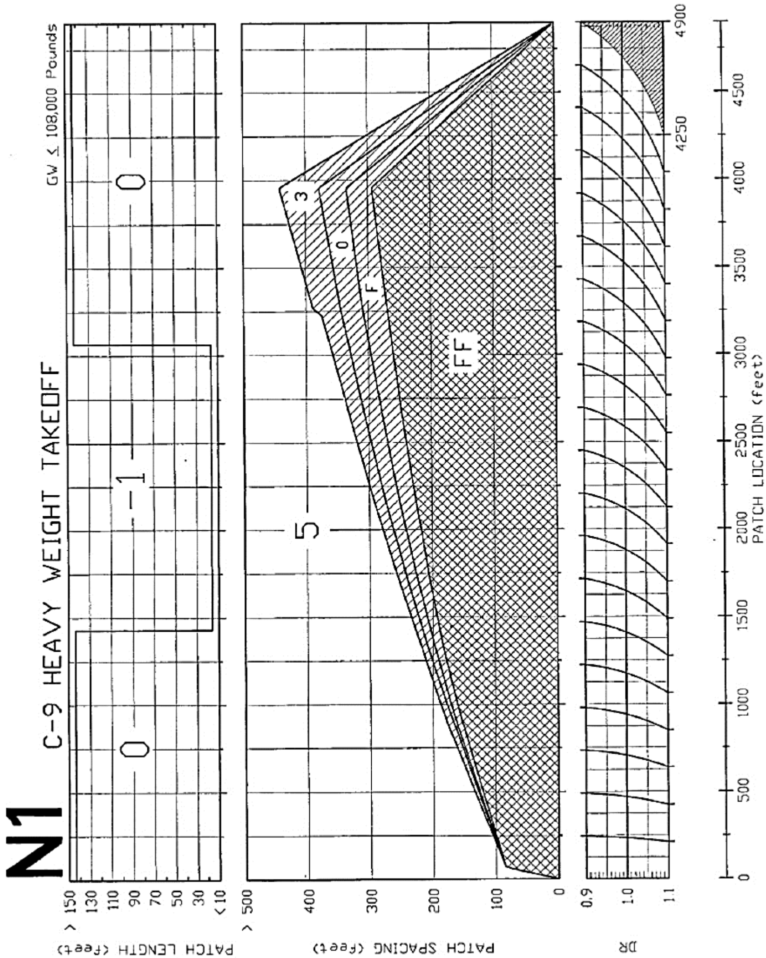


Figure A3.63. C-9 Nominal Weight Takeoff.

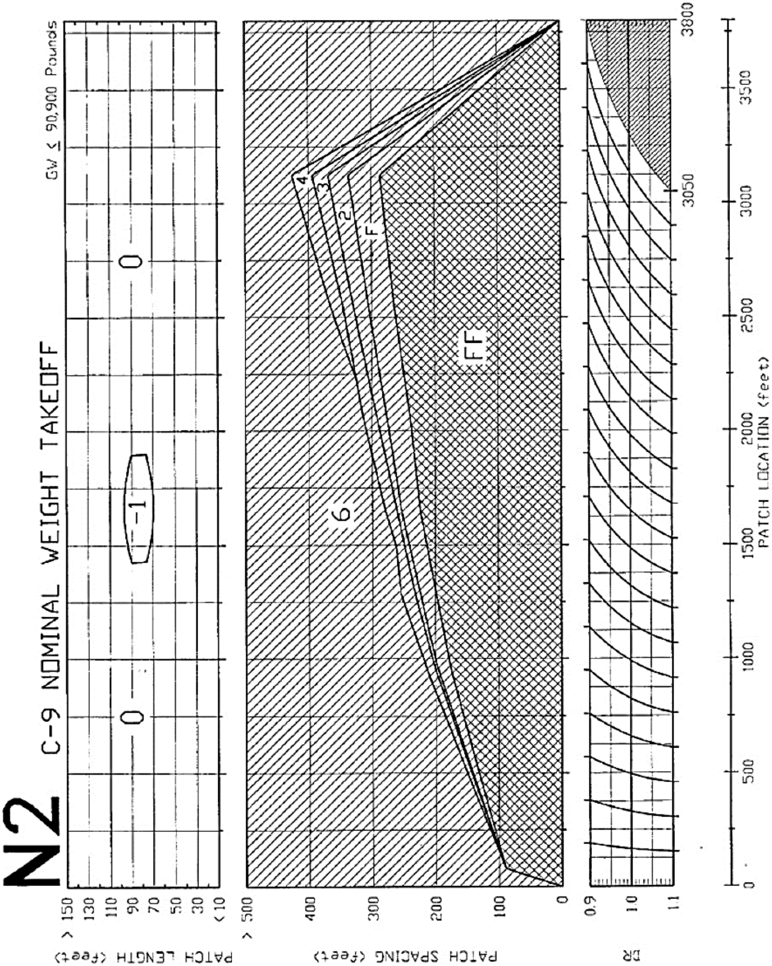


Figure A3.64. C-9 Landing.

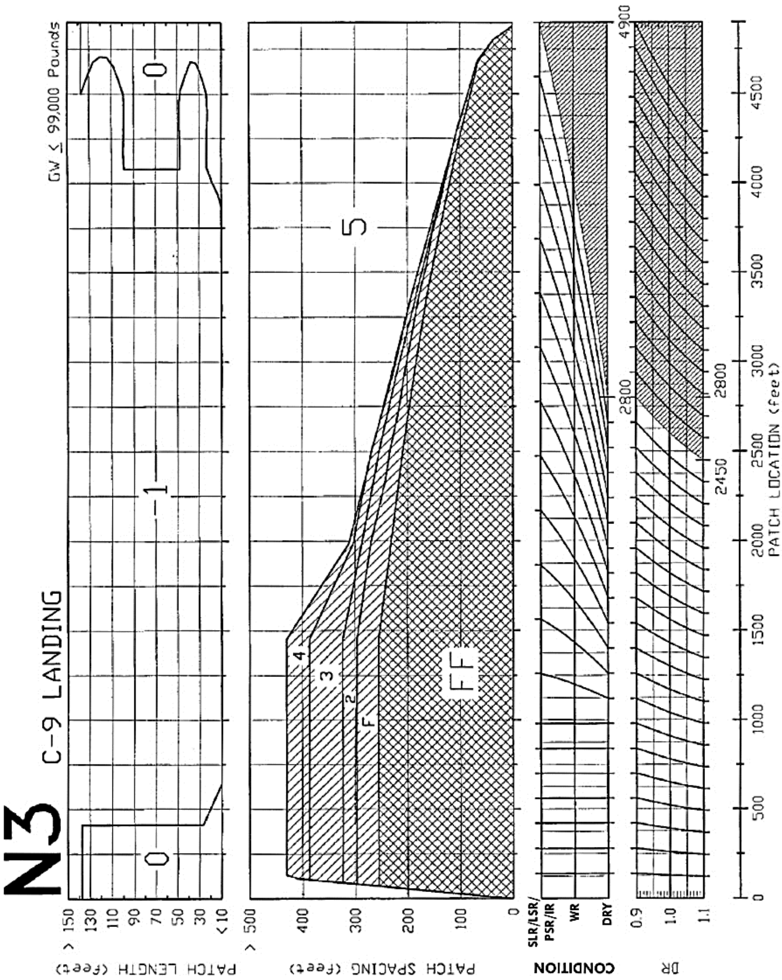


Figure A3.65. Disclaimer.

01

DISCLAIMER

REPAIR QUALITY CRITERIA CHARTS FOR THE C-17

NOTE

The data used to create the following C-17 Repair Quality Criteria charts were developed using information provided by the manufacturer and were not based on instrumented taxi tests conducted by ASC/WMO.

Figure A3.66. C-17, B-1, B-2 Heavy Weight Takeoff.

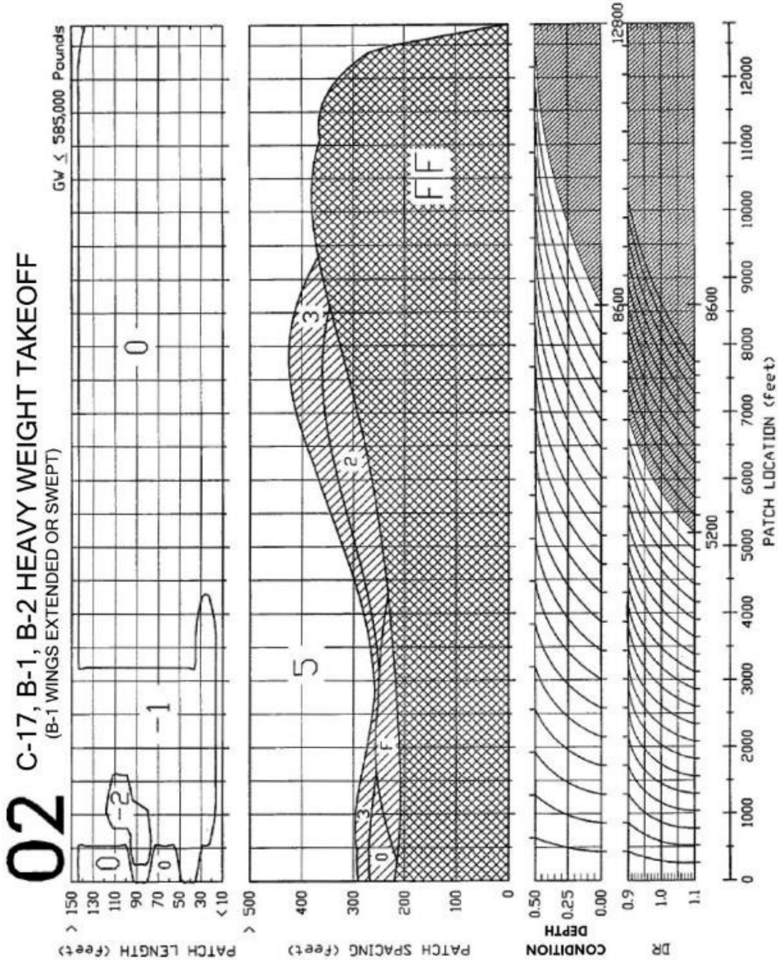


Figure A3.67. C-17, B-1, B-2 Nominal Weight Takeoff.

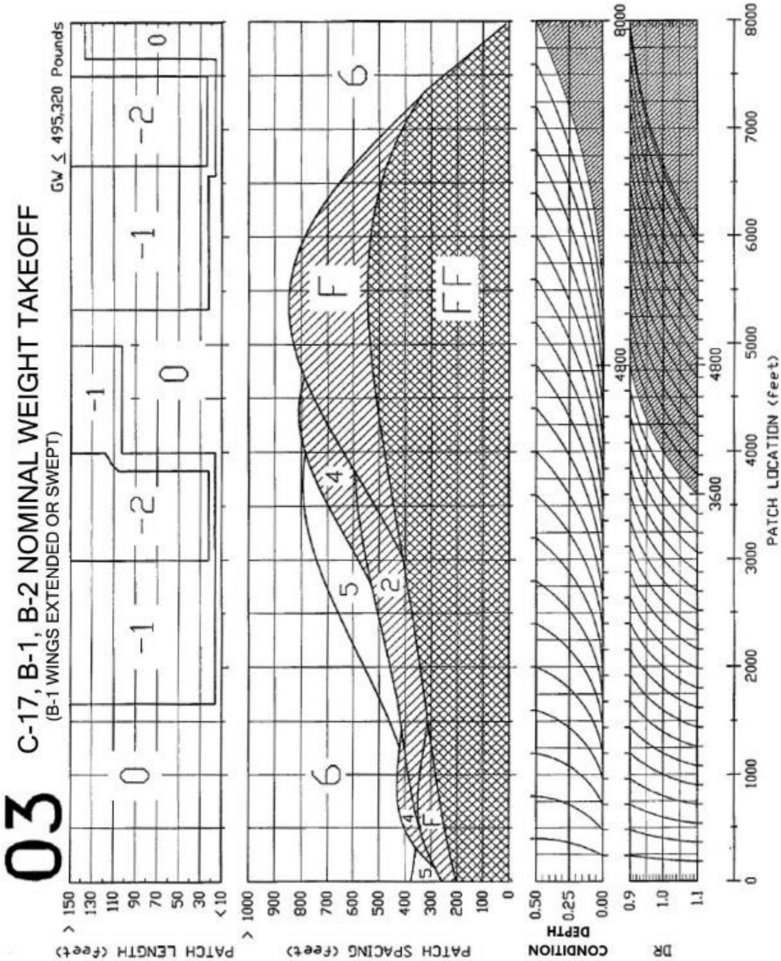


Figure A3.68. C-17, B-1, B-2, Heavy Weight Landing – Steep Approach.

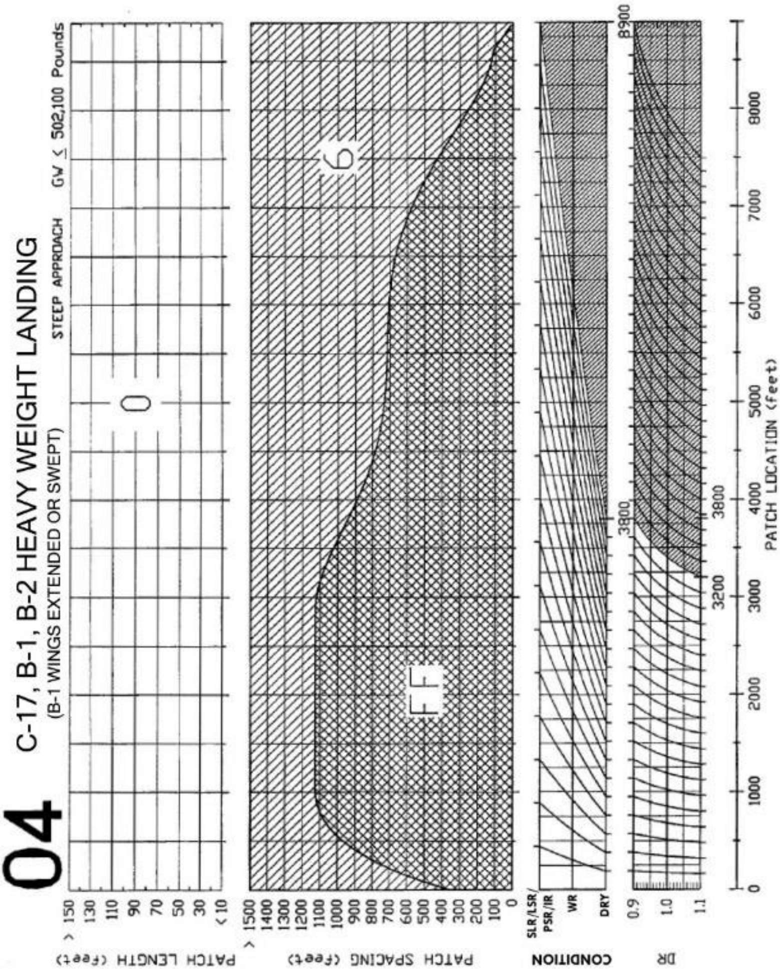


Figure A3.69. C-17, B-1, B-2 Heavy Weight Landing – Normal Approach.

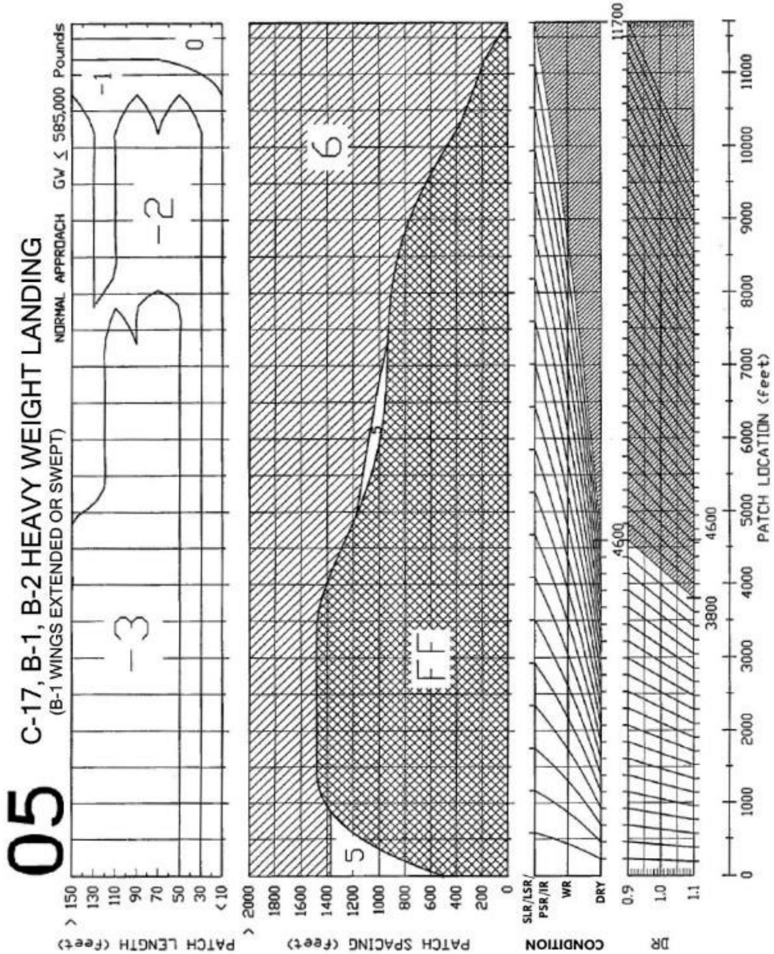


Figure A3.70. C-17, B-1, B-2 Nominal Weight Landing – Normal Approach.

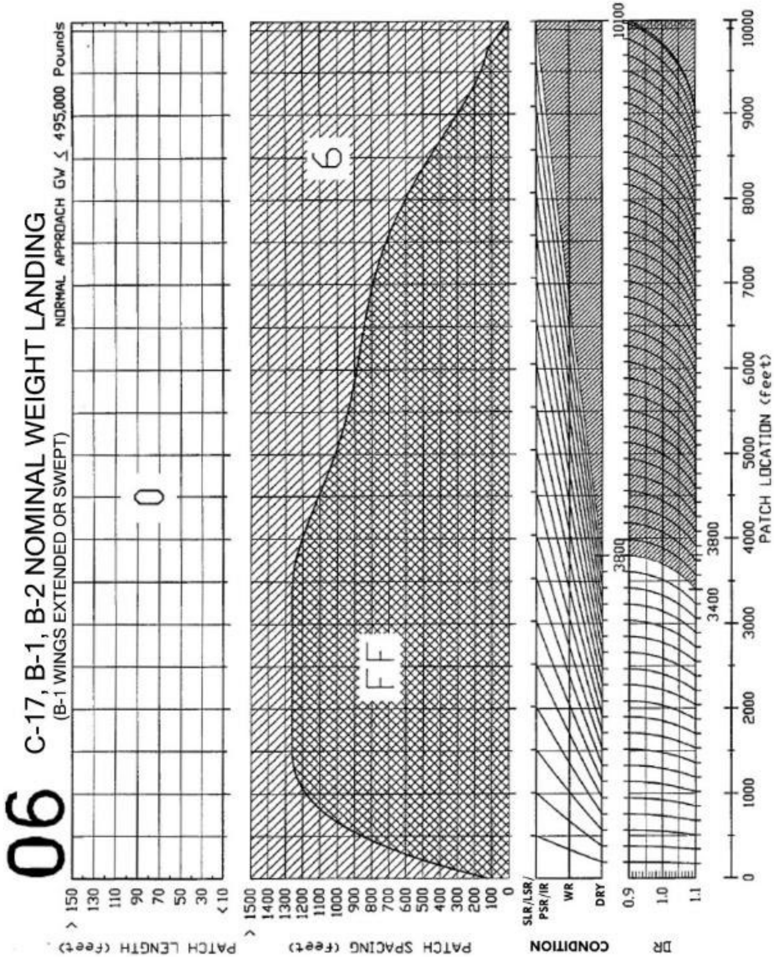


Figure A3.71. F-117 Heavy Weight Takeoff.

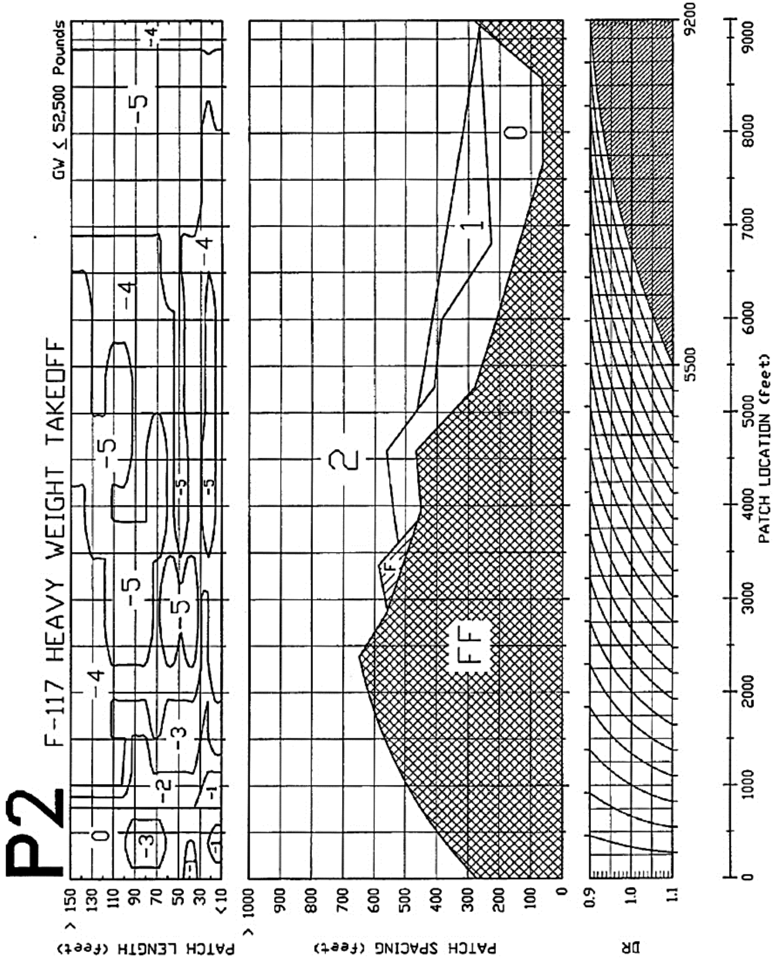


Figure A3.72. F-117 Nominal Weight Takeoff.

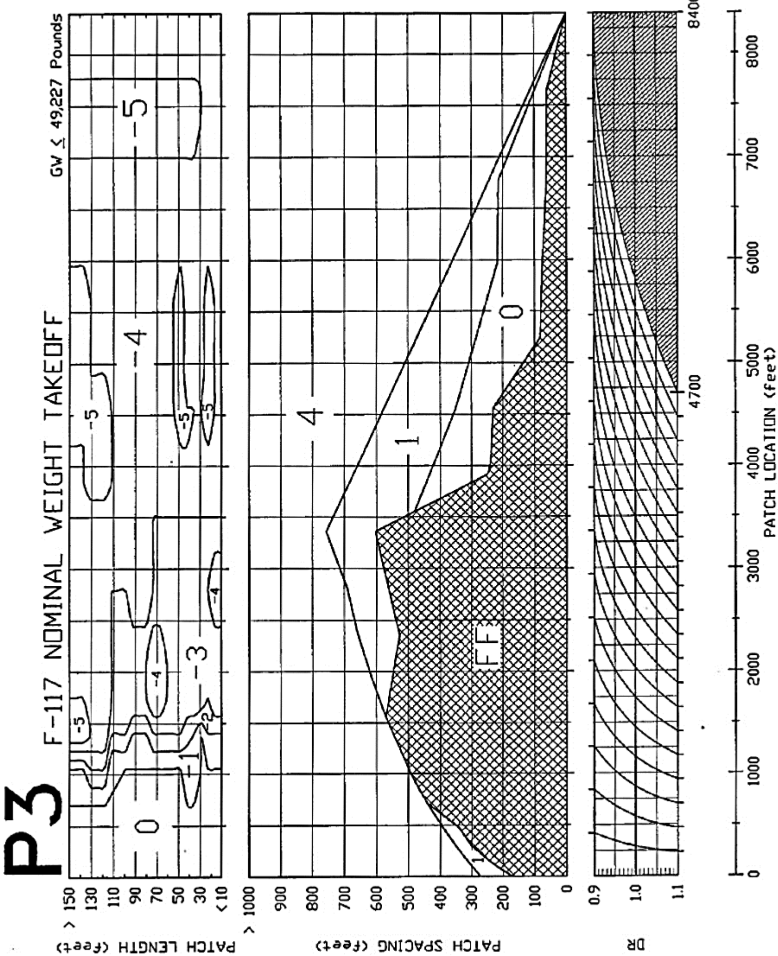


Figure A3.73. F-117 Light Weight Takeoff.

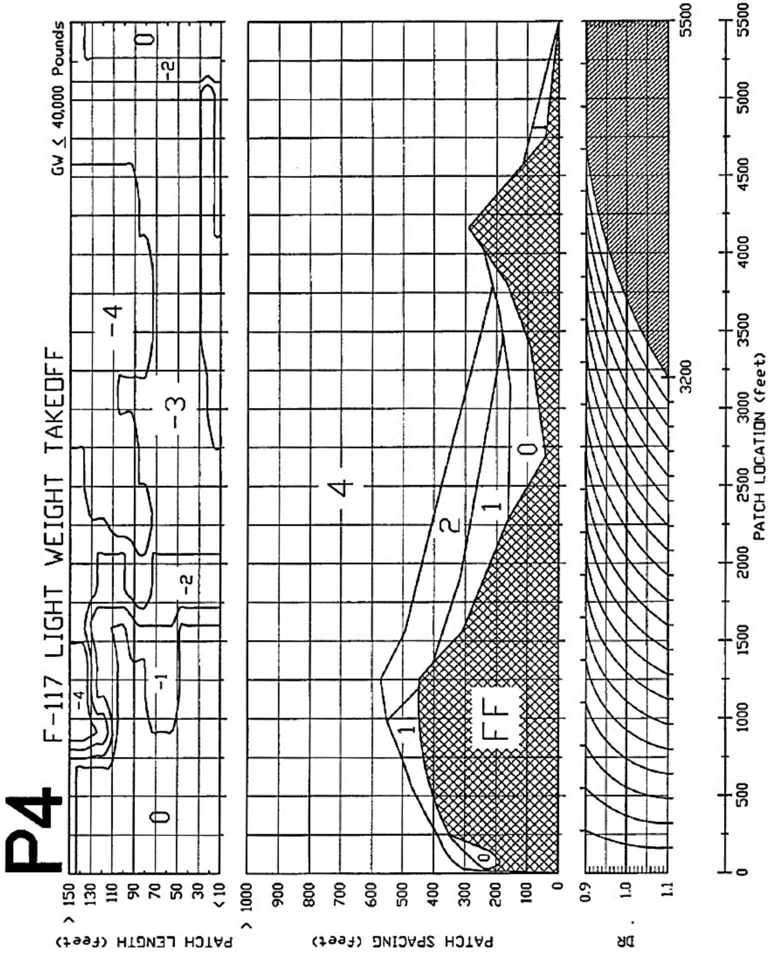


Figure A3.74. F-117 Nominal Weight Landing – No Chute.

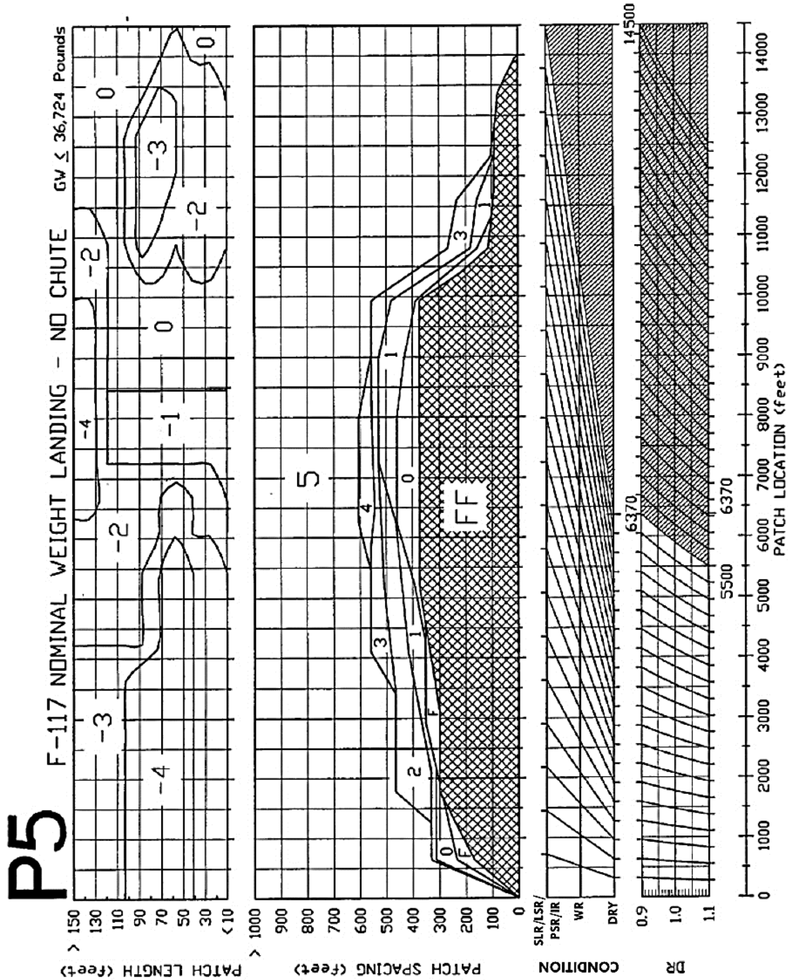


Figure A3.75. F-117 Nominal Weight Landing – Chute.

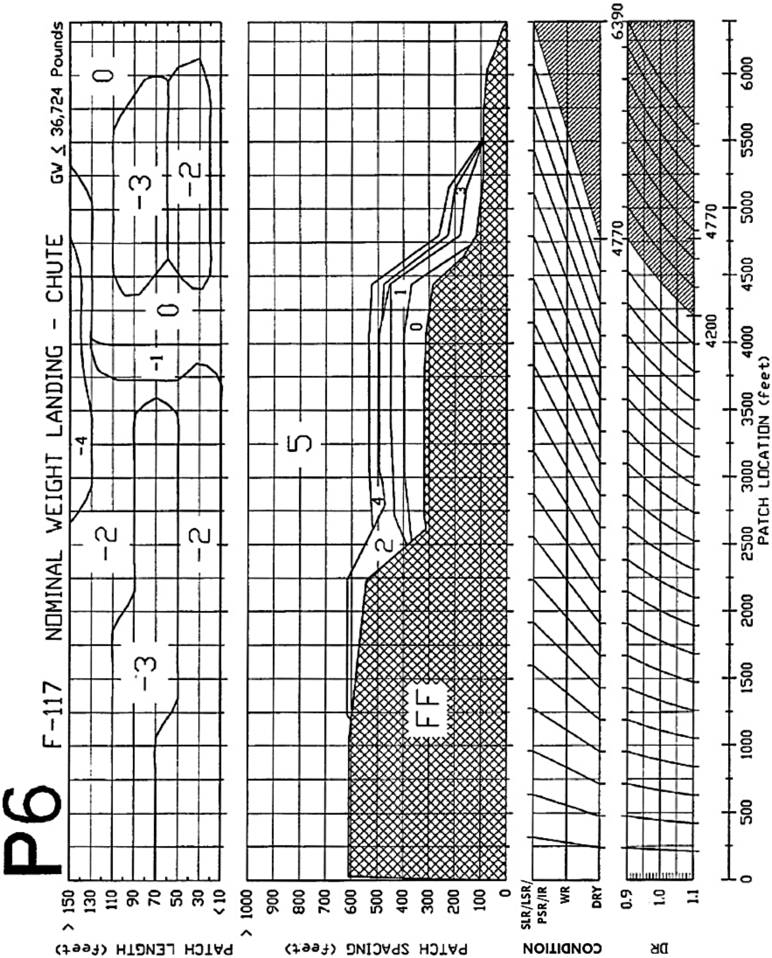


Figure A3.76. F-117 Heavy Weight Landing – No Chute.

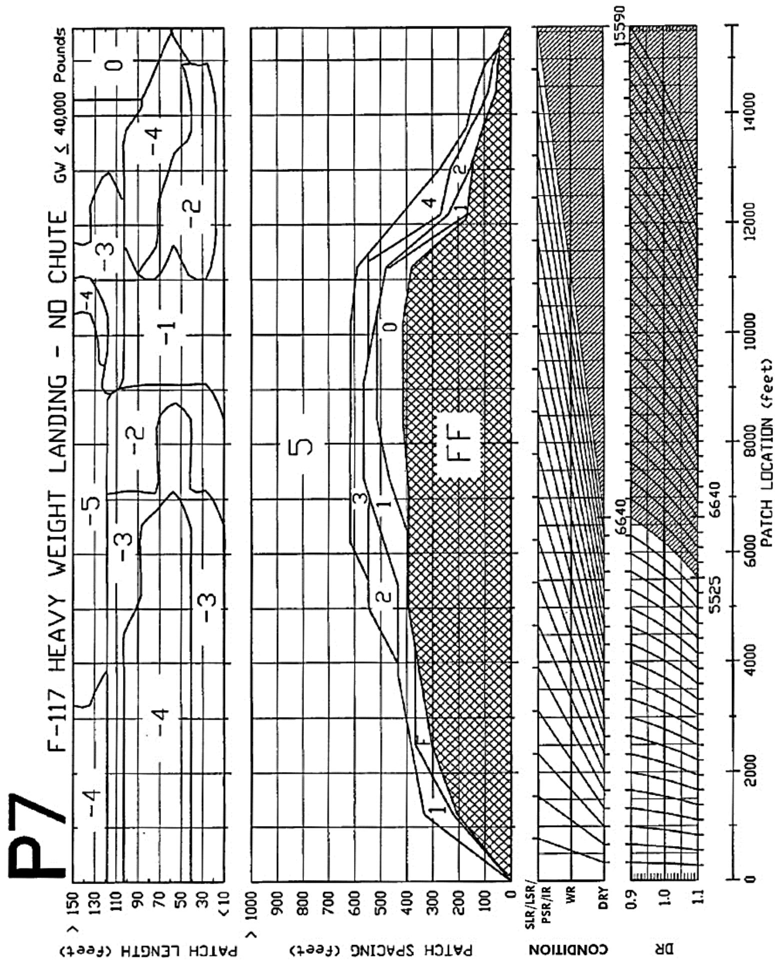
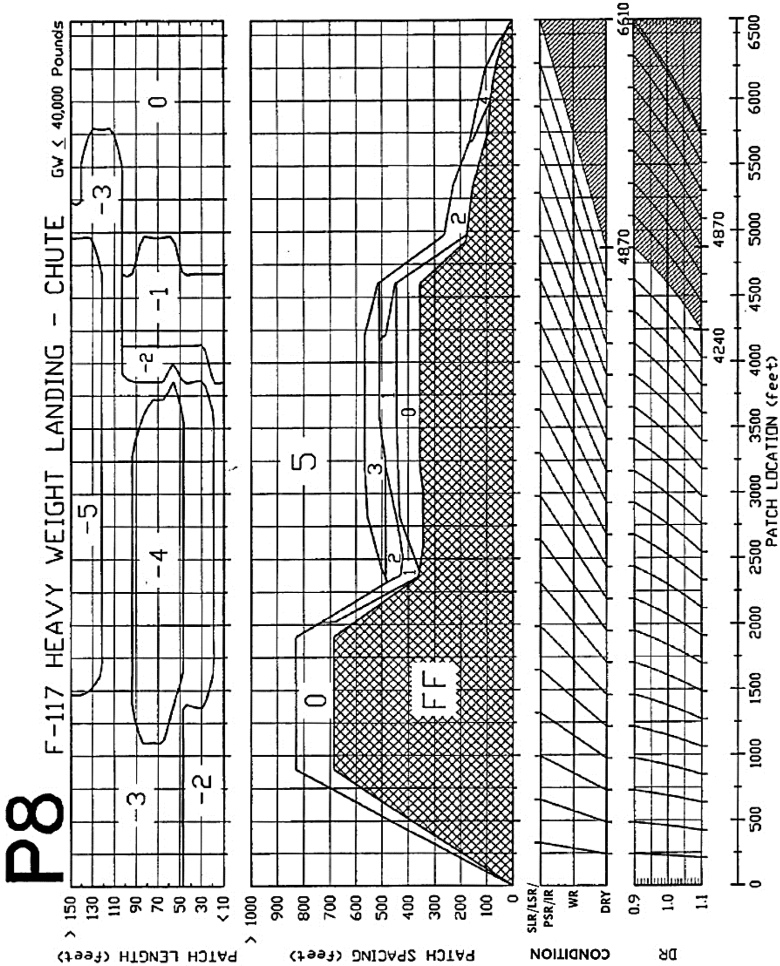


Figure A3.77. F-117 Heavy Weight Landing – Chute.



Attachment 4

ENGINEER REACHBACK AND OTHER USEFUL LINKS

Table A4.1. Useful Organizational and Product Links.

Organization and Products Links
Air Force Civil Engineer Center (AFCEC): https://www.afcec.af.mil/
CE DASH (AFCEC Technical Support Portal): https://usaf.dps.mil/teams/CEDASH/scripts/homepage/home.aspx
CE Playbooks: https://www.ceplaybooks.com.
AFCEC Reachback Center: contact via email at AFCEC.RBC@us.af.mil
DAF Publications and Forms: https://www.e-publishing.af.mil/
AF Design Guides (AFDG): https://www.wbdg.org/ffc/af-afcec
Whole Building Design Guide (WBDG): https://www.wbdg.org/
US Army Corp of Engineers Official Publications, http://www.publications.usace.army.mil/Home.aspx
Unified Facilities Criteria (UFC): https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc
Unified Facilities Guide Specifications (UFGS): https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs
USACE Reachback Operations Center (UROC): https://uroc.usace.army.mil
USACE Protective Design Center: https://intelshare.intelink.gov/sites/pdc/SitePages/Home.aspx
Army Publications and Forms: https://armypubs.army.mil/
Navy Doctrine Library System: https://doctrine.navy.mil/
DOD Issuances: https://www.esd.whs.mil/DD/DoD-Issuances/
Joint Publications: https://jdeis.js.mil/my.policy