

ARMY, MARINE CORPS, NAVY, AIR FORCE



JFIRE

MULTI-SERVICE TACTICS, TECHNIQUES, AND PROCEDURES FOR JOINT APPLICATION OF FIREPOWER

ATP 3-09.32

MCRP 3-31.6

NTTP 3-09.2

AFTTP 3-2.6

OCTOBER 2019

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MULTI-SERVICE TACTICS, TECHNIQUES, AND PROCEDURES

FOREWORD

This multi-Service tactics, techniques, and procedures (MTTP) publication is a project of the Air Land Sea Application Center (ALSA) in accordance with the memorandum of agreement between the Headquarters of the Army, Marine Corps, Navy, and Air Force doctrine commanders directing ALSA to develop MTTP publications to meet the immediate needs of the warfighter.

This MTTP publication has been prepared by ALSA under our direction for implementation by our respective commands and for use by other commands as appropriate.



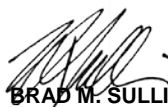
DOUGLAS C. CRISSMAN
Major General, US Army
Director
Mission Command Center of
Excellence



W. F. MULLEN, III
Major General, US Marine Corps
Commanding General
Training and Education Command



J. F. MEIER
Rear Admiral, US Navy
Commander
Navy Warfare Development
Command



BRAD M. SULLIVAN
Major General, US Air Force
Commander
Curtis E. LeMay Center for Doctrine
Development and Education

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PREFACE

1. Purpose

This Joint Application of Firepower (JFIRE) publication is a pocket-sized, quick-reference guide for requesting fire support in accordance with approved joint tactics, techniques, and procedures (TTP). JFIRE contains calls for fire, a format for joint air strike requests, close air support coordination and planning procedures, communications architecture, weapons data, and medical or casualty evacuation procedures.

2. Scope

JFIRE applies to the tactical and special operations forces of the Army, Marine Corps, Navy, and Air Force. It is a United States (US) unilateral-only document. It intentionally contains some information contained in other Service and joint directives.

3. Applicability

This MTTP publication applies to all commanders and their staffs that participate in operations that involve the JFIRE. Members of brigade, regiment, battalion, and squadron-level combat units are the primary audience.

4. Implementation Plan

Participating Service command offices of primary responsibility will review this publication; validate the information; and, where appropriate, reference and incorporate it in Service manuals, regulations, and curricula as follows:

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Marine Corps.¹ The Marine Corps will incorporate the procedures in this publication in US Marine Corps doctrine publications as directed by Commanding General, Training and Education Command (TECOM). Distribution is in accordance with the Marine Corps Publication Distribution System.

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5. User Information

- a. US Army Combined Arms Center; United States Marine Corps, Training and Education Command; NWDC; Curtis E. LeMay Center for Doctrine

¹ Marine Corps PCN: 144 000033 00

Development and Education; and Air Land Sea Application (ALSA) Center developed this publication with the joint participation of the approving Service commands. ALSA will review and update this publication as necessary.

b. This publication reflects current joint and Service doctrine, command and control organizations, facilities, personnel, responsibilities, and procedures. Changes in Service protocol, appropriately reflected in joint and Service publications, will be incorporated in revisions to this document.

c. We encourage recommended changes for improving this publication. Key your comments to the specific page and paragraph and provide a rationale for each recommendation. Send comments and recommendations directly to:

Army

Commander, US Army Combined Arms Center
ATTN: ATZL-MCD
Fort Leavenworth, KS 66027-6900
DSN 552-4885 COMM (913) 684-4885
E-mail: usarmy.leavenworth.mccoe.mbx.cadd-org-mailbox@mail.mil

Marine Corps

Commanding General, Training and Education Command
Marine Air-ground Task Force Training and Education Standards Division, Doctrine Branch
ATTN: C466
Quantico, VA 22134
DSN 278-8393 COMM (703) 432-8493
E-mail: doctrine@usmc.mil

Navy

Commander, Navy Warfare Development Command
ATTN: N5
1528 Piersey St, Building O-27
Norfolk, VA 23511-2723
DSN 341-4185 COMM (757) 341-4185
E-mail: NWDC_NRFK_DOCTRINE_AO@navy.mil

Air Force

Commander, Curtis E. LeMay Center for Doctrine Development and Education
ATTN: DDJ
401 Chennault Circle
Maxwell AFB, AL 36112-6428
DSN 493-7864/1681 COMM (334) 953-7864/1681
E-mail: afddec.ddj@us.af.mil

ALSA

Director, ALSA Center
114 Andrews Street
Joint Base Langley-Eustis, VA 23665-2785
DSN 575-0902 COMM (757) 225-0902
E-mail: alsadirector@us.af.mil

SUMMARY OF CHANGES

ATP 3-09.32/MCRP 3-31.6/NTTP 3-09.2/AFTTP 3-2.6, *Multi-Service Tactics, Techniques, and Procedures for the Joint Application of Firepower*.

This revision updates the following sections.

Preface

Removed the reference to Army "mission command".

Chapter I

Removed:

- Table 70, "Collateral Damage Estimate (CDE) Levels of the Joint Collateral Damage Estimation Methodology".
- The discussion on the five basic questions of CDE.

Updated:

- The former Appendix E, "Collateral Damage". It moved to chapter I.
- CDE methodology considerations.
- Digitally aided close air support (DACAS) moved to appendix E.

Chapter II

Added:

- A surface-to-surface fires integration section.
- A surface based fire support definitions section.

Removed:

- Figure 3, "Tomahawk Land-Attack Missile Loiter Geometry".

Updated:

- By moving brevity terms to appendix B.
- Streamlining Tomahawk land-attack missile discussions.

Chapter III

Added:

- A joint air-to-surface fires section.
- An air interdiction and strike coordination and reconnaissance section.
- A strike coordination and reconnaissance (SCAR) check-in brief table.
- A SCAR situation update and battle handover table.
- A description, location, elevation, remarks, and restrictions attack brief table.
- Rotary-wing keyhole procedures discussions and graphic.

Removed:

- The joint air attack team (JAAT) section.

- Figure 9, "Bomber CAS Considerations".

Chapter IV

Added a joint electronic attack capabilities table.

Updated and significantly expanded electronic attack operations information.

Chapter V

Updated cyberspace effects request and planning information details.

Appendix B

Added several applicable brevity terms.

Removed non-brevity terms.

Appendix C

Removed RQ-7B fixed-wing, laser-guided bomb designation.

Appendix D

Added a significant guided bombs section.

Appendix E

Added:

- DACAS briefing flow for variable message format over combat net radio.
- DACAS briefing flow for situation awareness data link/Link 16.
- DACAS briefing flow for a joint fires observer using line of sight communication.

Appendix F

Added:

- Ttarget location error categories table.
- Surface-to-surface threat capability tables including indirect fire, rocket, tank, armor, and antitank.

Appendix G

Added rotary-wing and tilt-rotor litter and ambulatory capacity table.

Updated helicopter landing zone and landing zone considerations.

Appendix H and I

Updated risk-estimate distances and minimum safe distances tables using newer software models.

Appendix J (SECRET) and K (SECRET)

Removed the classified appendices and incorporated the unclassified content into chapters IV and V.

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18 October 2019

JFIRE

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PROGRAM PARTICIPANTS

The following commanders and agencies participated in creating this publication:

Joint

Joint Test and Evaluation, Suffolk, Virginia
United States (US) Joint Staff (JS), J6, Joint Fires Division, Suffolk, Virginia
US JS, J7, Suffolk, Virginia

Army

Army Joint Support Team, Nellis Air Force Base (AFB), Las Vegas, Nevada
Army Materiel Systems Analysis Activity, Aberdeen Proving Grounds, Maryland
Army Multi-Domain Targeting Center, Fort Sill, Oklahoma
Aviation Center of Excellence, Fort Rucker, Alabama
Fires Center of Excellence, Fort Sill, Oklahoma
US Army Combined Arms Center, Fort Leavenworth, Kansas
US Army Special Operations Command, Fort Bragg, North Carolina
US Army Training and Doctrine Command, Joint Base Langley-Eustis, Virginia

Marine Corps

Marine Aviation Weapons and Tactics Squadron One, Marine Corps Air Station,
Yuma, Arizona
Marine Corps Artillery Detachment, Fort Sill, Oklahoma
Marine Air-ground Task Force Training and Education Standards Division,
Doctrine Branch, Quantico, Virginia
Marine Raider Regiment, Camp Lejeune, North Carolina

Navy

Expeditionary Warfare Training Group Atlantic, Joint Expeditionary Base Little
Creek-Fort Story, Virginia
Naval Aviation Warfighting Development Center, Naval Air Station Fallon,
Nevada
Navy Warfare Development Command, Norfolk, Virginia

Air Force

6th Combat Training Squadron, Nellis AFB, Nevada
18th Air Support Operations Group, Pope Army Air Field, North Carolina
57th Operations Group, Nellis AFB, Nevada
720th Operational Support Squadron, Hurlburt Field, Florida
724th Special Tactics Group, Pope Army Air Field, North Carolina
Air Force Life Cycle Management Center, Eglin AFB, Florida
Close Air Support Integration Group, Nellis AFB, Nevada
Curtis E. LeMay Center for Doctrine Development and Education, Maxwell AFB,
Alabama
US Air Force Weapons School, Nellis AFB, Nevada

Chapter I
PLANNING CONSIDERATIONS

1. General Planning for Joint Fire Support

Table 1 is a list of general planning considerations for joint fire support. This list follows the five-paragraph operation order format as a standardized, premission briefing.

Table 1. General Planning for Joint Fire Support	
Orientation and Situation	
Terrain	<ul style="list-style-type: none">a. Map datum, gridded reference graphics, common geographic reference system or global area reference system, and imagery.b. Observation and fields of fire.c. Avenues of approach.d. Key terrain.e. Obstacles.f. Cover and concealment.g. Urban environment and lighting.h. Sea state and hydrography.i. Target area crests.j. Communication or laser line-of-sight considerations (urban/mountain).
Weather	<ul style="list-style-type: none">a. Ceiling and visibility.b. Temperature.c. Winds (surface and at altitude).d. Sunrise and sunset.e. Solar elevation and azimuth.f. Moon data (rise and set, elevation, azimuth, percent illumination, lux).g. Thermal crossover.h. Effects of density altitude on aircraft performance.i. Relative and absolute humidity.
Enemy	<ul style="list-style-type: none">a. Target type, size, activity, location, and priorities.b. Strengths and weaknesses.c. Courses of action (most likely and most dangerous).d. Observed tactics, techniques, and procedures.e. Air, air defense, and surface threat (type and location).f. Intelligence collection plan and products request.

Table 1. General Planning for Joint Fire Support (Cont'd)
Friendly <ul style="list-style-type: none"> a. Organization for combat and command relationships. b. Higher headquarters scheme of maneuver. c. Friendly marking. d. Adjacent units. e. Available supporting assets.
Civil <ul style="list-style-type: none"> a. Collateral objects and no-strike list. b. Pattern of life. c. Civil aviation considerations.
Mission
Mission Statement
Execution
Commander's Intent
Concept of Operations
Scheme of Maneuver
Scheme of Fires and Fire Support Tasks
Aviation Fires/Close Air Support <ul style="list-style-type: none"> a. Number of aviation sorties expected, including approved or disapproved aviation requests. b. Type of aircraft (fixed-wing, rotary-wing, remotely piloted). c. Weapons load information. d. On-station times. e. Preplanned targets. f. Coordination products (maps, gridded reference graphics, imagery, concept of operations). g. Airspace coordinating measures (ACMs)/fire support coordination measures (FSCMs): contact points, initial points, holding areas, battle positions, suppression of enemy air defenses (SEAD) plan. h. Sensor management plan. i. Target marking plan and laser considerations. j. Tactical air control party battlefield employment: joint terminal attack controller, forward air controller (airborne), and joint fires observer location, roles, responsibilities, and communications plan. k. Tactical risk assessment: risk mitigation measures request process (planned versus immediate).

Table 1. General Planning for Joint Fire Support (Cont'd)	
Artillery Fires	<ul style="list-style-type: none"> a. Direct support: organic cannon or mortar units. b. Other supporting units (reinforcing, general support reinforcing, and general support): cannon, rocket, or mortar units. c. Priority of fires. d. Available ammunition. e. Precision munitions capabilities. f. Firing unit locations. g. Airspace coordinating requirements. h. Forward observer (location, capabilities, and employment). i. Primary and alternate observers. j. Communication plan.
Naval Surface Fires	<ul style="list-style-type: none"> a. Fire support area or station. b. Zone of fire. c. Volume of fire and ammunition availability. d. Range of the weapon system. e. Maritime threat and situation. f. Naval gunfire liaison officer position and availability. g. Defilade engagements (high-angle fires).
Electronic and Cyberspace Effects	<ul style="list-style-type: none"> a. Target system. b. Target component. c. Joint restricted frequency list (jam/do not jam). d. Desired effect.
Fire Support Coordination	<ul style="list-style-type: none"> a. ACMs and FSCMs. b. Artillery and mortar position areas. c. Gun-target line and maximum ordinate. d. Preplanned fires worksheet. e. High-payoff target list. f. Attack guidance matrix. g. Fire support execution matrix. h. No-strike list. i. Restricted target list. j. Dual-use targets (targets that serve military and civilian purposes). k. Target marking (smoke, laser, or illumination). l. Target acquisition zones (call for fire zones, critical friendly zones, and artillery target intelligence zones) m. SEAD plan. n. Branches and sequels.

Table 1. General Planning for Joint Fire Support (Cont'd)
Coordinating Instructions and Additional Information <ul style="list-style-type: none"> a. Airspace control order. b. Air tasking order. c. Air operations directive. d. Special instructions. e. Operation order and standard operating procedures. f. Operational tasking data link. g. Rules of engagement. h. Named areas of interest. i. Target areas of interest. j. Fire support tactical and technical rehearsal plan.
Administration and Logistics
Medical evacuation (MEDEVAC) plan.
Landing zone plan.
Airdrop plan.
Command and Signal
Aviation Command and Control <ul style="list-style-type: none"> a. Connectivity and interface: Air support operations center, direct air support center, joint air operations center, tactical operations center (TOC), control and reporting center, and Airborne Warning And Control System. b. Liaison officers: Civilian air traffic and deconfliction with military operations.
Communication Networks and Call signs <ul style="list-style-type: none"> a. Command net. b. Call sign of target engagement authority. c. Fires request net(s) (including the joint air request net). d. MEDEVAC requests. e. Primary, alternate, contingency, and emergency net plan.
Communications Systems <ul style="list-style-type: none"> a. Frequency band: satellite communications, ultrahigh frequency, very high frequency, high frequency, internet relay chat, satellite phone. b. Frequency hopping capabilities: HAVEQUICK II, single-channel ground and airborne radio system, or Joint Tactical Information Distribution System. c. Type of encryption: unencrypted, frequency hopping, cipher text, etc.
Cryptologic Changeover
Digital and Automated Systems
Global Positioning System Status and Cryptology

2. Collateral Damage

- a. Collateral damage is the unintentional or incidental injury or damage to persons or objects that would not be lawful military targets in the circumstances ruling at the time. The collateral damage methodology (CDM) is one of several means for assisting the commander in determining if a strike is legally proportional when balanced against the military necessity.
- b. There are five levels of collateral damage estimation (CDE). CDE levels 1–4 refine targeting and weaponeering to assess and reduce the possibility of collateral damage and still generate the desired effect. CDE level 5 assesses the amount of collateral damage that will occur if the target is destroyed.
- c. Field CDE is a degraded form of CDM conducted by joint terminal attack controllers, forward observers, or aircrews in accordance with authorities established by the combatant commander. Field CDE is not conducted in joint operations centers, air operations centers, or command posts with available CDE analysts and CDE tools.

Note: A verbal field CDE call should be documented for future review and analysis.

- d. For detailed information on CDE methodology, refer to Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3160.01C, *No-Strike and the Collateral Damage Estimation Methodology*. Classified collateral damage tables can be found on the Air Land Sea Application Center's classified website at: <https://intelshare.intelink.sgov.gov/sites/alsa>.

3. Joint Tactical Air Strike Request

Joint Publication (JP) 3-09.3, *Close Air Support*, prescribes Department of Defense (form) (DD) 1972, *Joint Tactical Air Strike Request* (JTAR), for use at battalion level and above, to submit air support requests when automated request systems are not available. DD Form 1972 is available at: http://www.esd.whs.mil/Directives/forms/dd1500_1999.

Note: DD Form 1972, shown in figure 1, was adopted from JP 3-09.3. Detailed preparation instructions can be found in the JP. Command and control agencies provide sections II and III.

JOINT TACTICAL AIR STRIKE REQUEST				See Joint Pub 3-09.3 for preparation instructions.			
SECTION I - MISSION REQUEST							
1. UNIT CALLED		THIS IS		REQUEST NUMBER		DATE	
Chieftain		Gator 01		1A9501-A		TIME 1615 BY Maj Smith	
2. PREPLANNED:		PRECEDENCE 4		PRIORITY II		TIME 1615 BY SrA Ford	
IMMEDIATE:		C PRIORITY					
3. TARGET IS/NUMBER OF							
A PERS IN OPEN 20-30		B PERS DUG IN		C WPNS/MG/RR/AT		D MORTARS, ARTY	
E AAA ADA		F RKT'S MISSILE		G ARMOR 3xBTR in a line		H VEHICLES 4 stationary	
I BLDGS 2		J BRIDGES		K PILLBOX, BUNKERS		L SUPPLIES, EQUIP	
M CENTER (CP, COM)		N AREA		O ROUTE		P MOVING N E S W	
Q REMARKS							
4. TARGET LOCATION IS							
A 11SUG8005		B (COORDINATES)		C (COORDINATES)		D (COORDINATES)	
E TGT ELEV 10		F SHEET NO. 2857 II		G SERIES V795S		H CHART NO.	
5. TARGET TIME/DATE							
A ASAP		B NLT 1600		C AT		D TO	
6. DESIRED ORD/RESULTS							
A		ORDNANCE LGH/Guns					
B DESTROY		C NEUTRALIZE X		D HARASS/INTERDICT			
7. FINAL CONTROL							
A FAC/RABFAC II		B CALL SIGN GATOR 20		C FREQ ORANGE 17			
D CONT PT JACKS							
8. REMARKS							
SECTION II - COORDINATION							
9. NSFS		10. ARTY		11. AIO/G-2/G-3			
4XTLAM FSA 1 SSGN-728							
12. REQUEST		13. BY		14. REASON FOR DISAPPROVAL			
X APPROVED		Maj Hughes					
DISAPPROVED							
15. RESTRICTIVE FIRE/AIR PLAN		16. IS IN EFFECT		17. LOCATION			
A IS NOT IN EFFECT		B NUMBER		A (FROM TIME)		B (TO TIME)	
A		B		A		B	
(FROM COORDINATES)		(TO COORDINATES)		18. WIDTH (METERS)		19. ALTITUDE/VERTEX	
				A		B	
				(MAXIMUM/VERTEX)		(MINIMUM)	
SECTION III - MISSION DATA							
20. MISSION NUMBER		21. CALL SIGN		22. NO. AND TYPE AIRCRAFT		23. ORDNANCE	
3021/3022		Razor 51/52 Vnom 16/17		(2) FA-18D (2) AH-1Z		SCL 1/3	
24. EST/ACT TAKEOFF		25. EST TOT		26. CONT PT (COORDS)		27. INITIAL CONTACT	
1425		1438		Breaker			
28. FAC/FAC(A)/TAC(A) CALL SIGN/ FREQ		29. AIRSPACE COORDINATION AREA		30. TGT DESCRIPTION		31. TGT COORD/ELEV	
32. BATTLE DAMAGE ASSESSMENT (BDA) REPORT (USMTF INFLTREP)							
LINE 1/CALL SIGN		LINE 4/LOCATION		2x BTR destroyed, 3 vehicles/1 bldg damaged, ~20 enemy combatants KIA, Expended (3) GBU-38, (4) AGM 114, (400) 20mm.			
Razor 51/52 Vnom 16/17		18SUG8005					
LINE 2/MSN NUMBER		LINE 5/TOT					
3021/3022		1454					
LINE 3/REQ NUMBER		LINE 6/RESULTS					
1A9501-A		Neutralize/Destroy					
		REMARKS		*TRANSMIT AS APPROPRIATE			

DD FORM 1972, MAY 2019

PREVIOUS EDITION MAY BE USED.

Adobe Professional 7.0

Figure 1. DD Form 1972

Chapter II

SURFACE-BASED FIRE SUPPORT

1. Surface-to-surface Fires Integration

- a. A sound airspace control construct is the foundation for rapid and effective surface-to-surface fires. Airspace clearance to allow fires can be prohibitively slow without appropriate measures. It is vital that surface fires planners work with aviation fires planners to build an airspace control plan appropriate for the situation.
- b. Warfighters should familiarize themselves with the tactical airspace plan and airspace control methods. Refer to Army Techniques Publication (ATP) 3-52.1, Marine Corps Reference Publication (MCRP) 3-20.F4, Navy Tactics, Techniques, and Procedures (NTTP) 3-56.4, Air Force Tactics, Techniques, and Procedures (AFTTP) 3-2.78, *Multi-Service Tactics, Techniques, and Procedures (MTTP) for Airspace Control*, for descriptions of airspace control methods that might apply.

2. Artillery and Mortar Fires

- a. Call for Fire (CFF). The CFF has six elements communicated in three distinct transmissions to the fire direction center (FDC). Table 2 shows the three transmissions and six elements in a CFF.

Table 2. Elements and Transmissions of a CFF
1st Transmission
1. Observer identification (call sign). 2. Warning order.
2nd Transmission
3. Target location.
3rd Transmission
4. Target description. 5. Method of engagement. 6. Method of fire and control.

(1) Observer Identification (ID). This first element of the CFF lets the receiving unit know who is calling for fire. The observer uses a call sign.

(2) Warning Order. The warning order clears the net for the fire mission. The warning order consists of the type of mission, the size of the element to fire for effect, and the method of target location. It is a request for fire unless prior authority has been given to order fire.

(a) Adjust Fire. When the observer believes the situation requires an adjusting round (because of a questionable target location), the observer announces "adjust fire".

(b) Fire for Effect (FFE). The observer announces "fire for effect" when the observer is certain the target location is accurate for a desired effect on the first volley.

- (c) Suppress. Suppressive fires degrade a threat's weapons system below the level needed to disrupt friendly fire from achieving their mission objectives. Suppression missions are fired on preplanned targets and the duration is associated with the CFF.
 - (d) Immediate Suppression or Immediate Smoke. When engaging a planned target or target of opportunity that is, or is about to, engage friendly forces, the observer announces "immediate suppression" or "immediate smoke" followed by the target location. This is sent in a single transmission.
 - (e) Suppression of Enemy Air Defenses (SEAD). SEAD fires neutralize, destroy, or temporarily degrade surfaced-based enemy air defenses by a destructive or disruptive means. Ground or aviation forces provide SEAD.
- (3) Target Location. The observer provides the receiving unit the target location data using the grid, polar, or shift from a known point method. The most common method uses grid coordinates. In a grid mission, a standard of six-digit grids are sent. Five requirements for accurate fires are:
- (a) An accurate target location and size.
 - (b) An accurate firing unit's location.
 - (c) Accurate weapon and ammunition information.
 - (d) Accurate meteorological information.
 - (e) Accurate computational procedures.
- (4) Target Description. This element contains sufficient detail (i.e., type, size, activity and degree of protection) for the receiving unit to determine the amount and type of ammunition to use.
- (5) Method of Engagement. Observers use this element to describe how they desire to attack their target. The standard is area fire and high explosives/fuze quick. Elements to consider are listed below:
- (a) Type of adjustment (area or precision fire).
 - (b) Danger close.
 - (c) Mark.
 - (d) Trajectory (low or high angle).
 - (e) Ammunition (projectile, fuze, or volume of fire).
 - (f) Distribution (converged, open, linear, rectangular, or irregular sheaf).
- (6) Method of Fire and Control. In this element, the observer indicates the desired manner of attack and who has fire control authority. The observer also indicates the ability to directly observe the target. The methods are listed in table 3.

Table 3. Methods of Fire and Control	
Fire when ready	Cease loading
At my command	Check firing
Cannot observe	Continuous fire
Time on target	Repeat
Time to target	Request splash
Coordinated illumination	Do not load
Continuous illumination	Duration

Note: The observer should be prepared for the receiving unit to authenticate the observer after the read back in the CFF.

- b. Message to Observer (MTO). The supporting FDC sends this information to the observer. The observer will read back the entire MTO. The MTO should include the items listed in table 4 (asterisk (*) items are required).

Table 4. Message to Observer	
1. Units to fire* (firing unit, adjusting unit).	5. Time of flight (in seconds).
2. Changes to call for fire* (if any).	6. Maximum ordinate altitude.
3. Number of rounds* (per tube).	7. Information.
4. Target number*.	
Legend: *Required item.	

- c. If conducting a grid mission, the observer may include "break, direction xxx" (observer target direction) after the MTO. This must be transmitted for the first adjustment.

- d. Corrections. The observer should send corrections to the FDC to move the burst onto an adjusting point. The observer sends corrections, in meters, in reverse order of that used in spotting (i.e., deviation, range, and height of burst). If a forward air controller (airborne) (FAC(A)) is the observer, expect "burst grid" location for corrections (see table 5).

Table 5. Adjustments
"Left/right _____; (meters, distance from impact to observer-target line)
Add/drop _____; (meters, distance from impact to target)
Up/down _____, over." (meters, distance from height of burst (HOB) to desired HOB)
"Fire for effect, over." (Sent with the final correction, when effects on target are observed)

e. Completion. At mission completion, the CFF concludes with a mission complete transmission in table 6.

Table 6. End of Mission Statement
<p>“Target # XXXX, _____, over.” (Refinement, record as target, end of mission, and surveillance)</p>

f. Mission Formats. Tables 7–14 contain standard formats for transmitting the essential information related to call for fire missions.

Table 7. Grid or Laser Grid Mission
<p>Observer: “_____ this is _____, (FDC’s call sign) (observer’s call sign) (adjust fire, fire for effect), over.”</p> <p>“Grid _____, over.” (minimum 6 digits)</p> <p>Target Description: “_____.” (target description, size, activity)</p> <p>Method of engagement (optional): _____</p> <p>Method of fire and control (optional): _____</p> <p>“Over.”</p> <p>Note: The observer announces a “laser grid” mission in the warning order. Send the target grid to a greater level of accuracy (8 or 10 digits, depending on observation post location accuracy). In an adjust fire mission, send corrections in the form of a grid to the burst location and announce “burst grid”.</p>
Message to Observer
Adjustments
Mission Completion
<p>Legend: FDC—fire direction center</p>

Table 8. Adjust Fire Mission (Polar Plot or Laser Polar)	
Observer: “ _____ this is _____ , adjust fire polar, over.” (FDC’s call sign) (observer’s call sign)	
“Direction _____.” (OTL to the nearest 10 milliradians or 1 degree)	
Note: Specify degrees to the FDC only if the direction is given in degrees.	
“Distance _____.” (to the nearest 100 m)	
“Up/down _____.” (to the nearest 5 m)	
Note: Up/Down is not given with less than a 35 m elevation difference between the observer and target. The difference in target altitude is from the observer’s perspective. For polar missions, the FDC must know the observer’s location.	
Target description: “ _____.” (target description, size, activity)	
Method of engagement (optional): _____	
Method of fire and control (optional): _____	
“Over.”	
Note: Laser polar differs from a polar mission in that laser data is sent to the nearest one milliradian for direction and vertical angle and the nearest 10 m for distance. The observer announces “laser polar” in the warning order.	
Message to Observer	
Adjustments	
Mission Completion	
Legend: FDC—fire direction center OTL—observer-target line m—meter	

Table 9. Adjust Fire Mission (Shift from a Known Point)
Observer: “ _____ this is _____ , adjust fire, (FDC’s call sign) (observer’s call sign) shift _____ , over.” (Identify the known point; for example: target AA7733) “Direction _____ ” (observer-target line to the nearest 10 mils or 1 degree grid to the new target)
Note: Specify degrees to the FDC only if the direction is given in degrees.
“Left/right _____ ; (lateral shift to the nearest 10 m)
“Add/drop _____ ; (range shift to the nearest 100 m)
“Up/down _____ , over.” (vertical shift to the nearest 5 m)
Note: Up/Down is not given with less than a 35 m elevation difference between observer and target. The difference in target altitude is with respect to a known point. For a shift from a known point mission, the location of the known point must be known to the observer and the FDC.
Target description: “ _____ .” (target description, size, and activity)
Method of engagement (optional): _____
Method of fire and control (optional): _____
“Over.”
Message to Observer
Adjustments
Mission Completion
Legend: FDC—fire direction center mil—milliradian m—meter

Figure 2 provides a graphical depiction and the milliradian-relation formula used in table 9.

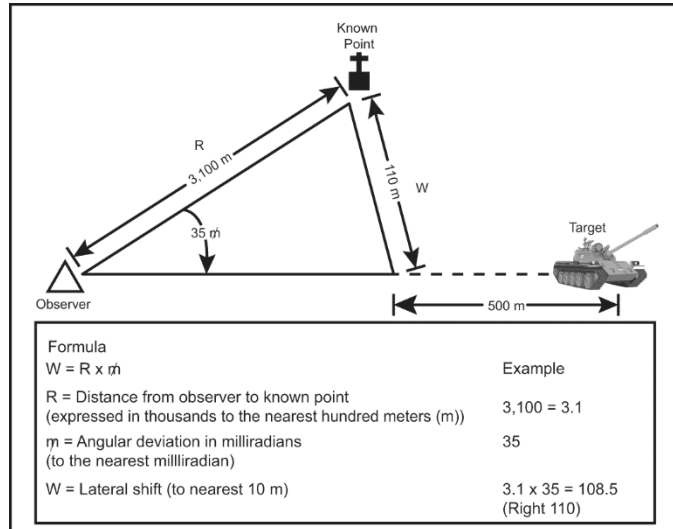


Figure 2. Mil-relation Formula in Shift From a Known Point Method

Table 10. Suppression/Immediate Smoke Mission (Grid Method)
Observer: “_____ this is _____ (fire direction center’s call sign) (observer’s call sign) suppression/immediate smoke _____, over. ” (target number or minimum 6-digit grid)
Note: The United States Marine Corps may include a “duration” call after target location.
Message to Observer
Adjustment
Mission Completion

Table 11. Marking Mission (Grid Method)
Marking missions could be used to identify targets for aircraft, to identify friendly locations, or as navigational aids. Also, they can be used to signal prearranged battlespace cues.
Observer: “ _____ , this is _____ , fire for effect, over.” (fire direction center) (observer)
“Grid _____ , over.” (6 digit minimum)
“Marking round, white phosphorous, at my command, request time of flight, over.”
Note: This is close air support (CAS) time over target for marking. White phosphorous is delivered 30 seconds and illumination on deck is delivered 45 seconds prior to CAS time over target.
Method of engagement (optional): _____
Method of fire and control (optional): _____
Message to Observer
Mission Completion

Table 12. SEAD Mission
Observer: “ _____ , this is _____ , SEAD, over.” (FDC's call sign) (observer's call sign)
“Grid to suppress _____ , grid to mark _____ , over.” (6-digit minimum) (6-digit minimum)
“ _____ , _____ , (target description) (continuous/interrupted/non-standard) _____ TOT (or TTT), over.” (timing)
Note: Continuous: TOT-60, TOT-30, TOT, TOT+30, TOT+60 (seconds). ----- ----- ----- ----- Interrupted: TOT-60, TOT-30. Non-standard: As desired by observer.
Message to Observer
Mission Completion
Legend: FDC—fire direction center TOT—time on target SEAD—suppression of enemy air defenses TTT—time to target

Table 13. Artillery or Mortar Quick Smoke Request
<p>Observer: “ _____, this is _____, adjust fire, over.” (FDC’s call sign) (observer’s call sign)</p> <p>“Grid _____, over.” (minimum 6 digits)</p> <p>“Screen _____” (target description)</p> <p>Method of engagement (optional): _____ L—length of smoke screen desired M—maneuver target line D—direction of wind: (head or tail, right or left cross) T—time or duration the smoke screen is to be effective</p> <p>“Smoke, white phosphorus, red phosphorus, in effect, over.”</p>
Adjust Fire Up/Down
<p>For ground burst: “Up 100”</p> <p>Note: To adjust high-explosive rounds onto the desired target area, the observer will request shell smoke. Once the 200 meter bracket is broken, the observer then will request “fire for effect”.</p>
<p>Legend: FDC—fire direction center</p>

Table 14. Artillery or Mortar Coordinated Illumination Request

<p style="text-align: center;">CAUTION</p> <p style="text-align: center;">Illumination can adversely impact the operations of adjacent and supporting units and requires care and adequate coordination.</p>	
Observer: “ _____ , this is _____ ”	
(fire direction center (FDC) call sign)	(observer’s call sign)
Warning Order: “ _____ , over. ”	
Target location: “ _____ , over. ”	
(grid, polar, or shift)	
Target description: “ _____ .	
(suspected, target description, size, and activity)	
Method of Engagement: “ Illumination ,	
Method of Fire and Control: _____ , over. ”	
(by shell, at my command, request ordinate information)	
<p>Note: To receive two- or four-gun illumination during an illumination mission, transmit the following under method of fire and control:</p> <p>For two-gun illumination: Two rounds burst simultaneously in the target area. The observer calls for “illumination two guns.” Use “range spread” or “lateral spread” (in relation to the observer-target line (OTL) for artillery or in relation to the gun-target line (GTL) for mortars) when greater illumination is required in depth or width within the targeted area.</p> <p>For four-gun illumination: “range and lateral spread”.</p>	
Message to Observer From FDC	
<p>“Direction (If not already given) _____ , over.”</p> <p style="text-align: center;">(the default is milliradians (specify if using degrees))</p>	
Adjustments Include:	
“ Left/right _____ ,”	
(in 200-meter increments)	
Add/drop _____ ,”	
(in 200-meter increments)	
Up/Down _____ .”	
(in 50-meter increments)	

Table 14. Artillery or Mortar Coordinated Illumination Request (Cont'd)
<p>Notes:</p> <ol style="list-style-type: none"> 1. Adjust illumination over the adjusting point or target. When desired illumination is obtained, the observer transmits: "illumination mark". 2. When the target is verified, the observer transmits "coordinated illumination" and attacks with desired munitions using the standard call-for-fire format. When adjusting the illumination round or high-explosive round, the observer must preface each correction with which munition to adjust. 3. Coordinated illumination directs the FDC to calculate and direct firing the illumination and attack munitions at a time that should result in the attack munitions impacting when the target is at maximum illumination. 4. Observers who desire to control firing the illumination and attack munitions transmit: "By shell, at my command".

3. Rockets and Missiles

- a. Guided multiple launch rocket system (GMLRS) and the Army Tactical Missile System (ATACMS) are guided munitions.
 - (1) The warning order is fire for effect.
 - (2) The method of target location should be a grid location. All methods of target location are valid for area fire missions (i.e., polar and shift from a known point). The commander may make a judgment call based on the desired effect and confidence in the target location.
 - (3) GMLRS is capable of converged (point) and circular sheafs. The launcher can calculate two types of circular sheafs: open and closed, which differ in the total radius of the geometry.
 - (4) Grid locations are transmitted in military grid reference system (MGRS) with the 100-km grid square designators and an 8- or 10 digit grid using a target mensuration system, if available. Target elevation should be in meters mean sea level (MSL) or height above ellipsoid (HAE) and the observer must specify the datum used.
 - (5) Some commands may direct that a remarks transmission will follow the standard six elements. This is the place for additional requirements by standard operating procedures or the operation order. Examples include airspace coordinating information, positive identification confirmation, target location method, and closest friendlies or collateral objects locations.
- b. The following are additional rocket and missile employment considerations.
 - (1) The vertical trajectory is most effective when paired with proximity or delay fuzes. It reduces concerns about target area masks (e.g., steep terrain or buildings) and errors in target location elevation.

(2) The nominal trajectory skews the fragmentation pattern forward along the gun-target line (GTL). It produces the maximum lethal effect when combined with the point detonating (fuze) (PD) setting.

c. Additional airspace coordination planning for GMLRS and ATACMS may be necessary due to their long ranges and high maximum ordinate. Refer to "Aircraft and Surface Fires Integration Techniques" in chapter III for more discussion.

4. Naval Surface Fire Support (NSFS)

a. Communications.

(1) Naval gunfire (NGF) ground spot net: high frequency (HF)/ultrahigh frequency (UHF) (voice).

(2) NGF air spot net: UHF/very high frequency (VHF) (voice).

(3) Shore fire control party local net: VHF (voice).

b. NSFS specific brevity words.

(1) PEPPER. Nonscheduled fire mission report. Ships make these to a supporting arms coordination center (SACC) immediately after firing.

(2) HONEY. New target report. Spotters make these to a SACC as soon as new targets are discovered or when known targets are given corrected locations.

(3) PICKLE. Unfired target report. A ship or spotter makes these to a SACC when scheduled targets cannot be fired on or when effectiveness is assessed as under 50 percent.

(4) CANDY. Ammunition remaining report. This is sent, coded, according to the operation order.

(5) GURF. The guns up ready to fire (report) (GURF) summarizes naval gunfire support (NGFS) capability when unknown to an NGFS station.

c. Mission Formats. NGFS reports are designed to minimize radio traffic and keep interested agencies informed. They are made by ships to the SACC, fire support coordination center (FSCC), or spotters using the NGFS report formats in tables 15 and 16.

d. Execution. The format shown in table 17 is used for NSFS.

e. Other Missions. Tables 18 and 19 give examples of fresh and new targets.

Note: There are NSFS reports used by North Atlantic Treaty Organization (NATO) countries that are based on Standardization Agreement (STANAG) 1034, Allied Tactical Publication 4(F), *Allied Naval Fire Support*. These reports include the Naval Gunfire Request Form and Naval Gunfire Allotment Signal and Ship Status Codes (November Codes).

Note: NSFS ships will make some of the following reports, when appropriate, during an amphibious assault.

Table 15. GURF Report	
This format is used to report naval gunfire (NGF) ship capabilities when a ship comes on station.	
Element	Information
Line A	Call sign of the ship and date-time group (DTG) of the message assigning the ship to the NGF mission.
Line B	“On station and ready” and DTG (local) end of NGF ship’s assignment.
Line C	Planned firing location (grid coordinates). If the ship will be firing from a track, enter the approximate center of the track.
Line D	Significant reduction in capability, including mount casualties and ammunition shortages.
Line E	Ammunition aboard, by type, available for NGF.
Line F	Any other information of value.
Example GURF:	
Line A	A2W, 012100Z NOV 00.
Line B	On station and ready, 022200P NOV 00.
Line C	MB 614 212.
Line D	High explosives 60, white phosphorous 15.
Line E	High explosives 140, white phosphorous 60.
Line F	Starting 021700P AUG 00, off station for 60 minutes for ammunition resupply.
Note: Use only applicable lines.	

Table 16. NGS Report Format		
(firing ship call sign)		(date-time group)
Report	Include Items	Type of Report
[] PEPPER	ALPHA, BRAVO, CHARLIE DELTA, ECHO, and FOXTROT	Nonscheduled Fire Mission
[] HONEY	ALPHA, BRAVO, CHARLIE	New Target
[] PICKLE	BRAVO, CHARLIE, and GOLF	Unfired Target
[] CANDY	HOTEL	Ammo Remaining

ALPHA	_____
	(type of mission)
BRAVO	_____
	(target number and grid coordinates)
CHARLIE	_____
	(target description)
DELTA	_____
	(agency controlling fire—voice call)
ECHO	_____
	(target assessment—destroyed/neutralized/details)
FOXTROT	_____
	(ammunition expended—code, number, type, and caliber)
GOLF	_____
	(reason target not fired on)
HOTEL	_____
	(enter, using code, amount, type, and caliber of each type of bombardment ammunition remaining)
INDIA	_____
	(action taken or under consideration)

Table 17. NSFS Call for Fire (Grid/Polar Plot/Shift from a Known Point) (Cont'd)	
Prefiring Report (Spotter Reads Back)	
Gun-target line or line of fire (if firing illumination)	
"First salvo at _____" (danger close missions only) summit _____ (MAXORD; feet for air spotter, meters for ground spotter) Changes to call for fire "Ready, time of flight _____" (time of flight in seconds)	
"Fire, over" (command from spotter after prefiring report is read back)	
Legend: ID—identification MAXORD—maximum ordinate	

Table 18. Fresh Target (Example)	
1. Spotter's identification.	(Not required, already in contact.)
2. Warning order and target number.	"Fresh target, target # UT7082."
3. Location of target.	"Left 300, drop 500, up 100."
4. Target description.	"Three T-80s stationary in tree line."
5. Method of engagement.	"High angle controlled variable timing, two guns, four salvos."
6. Method of control.	"Fire for effect."
Notes: 1. The fresh target must be within 1,000 meters from the original target. 2. A new direction may be sent after the initial salvo on the fresh target only if it has changed by more than 100 milliradians or 5 degrees.	

Table 19. New Target (Example)	
1. Spotter identification.	"(Call sign ship) this is (call sign observer)."
2. Warning order and target number.	"Fire mission target # UT7081, Over."
3. Location of target.	"Grid 123 456, altitude 50, direction 4200."
4. Target description.	"Infantry platoon dug in, no overhead protection."
5. Method of engagement.	"Variable timing in effect."
6. Method of control.	"Ship adjust, over."
7. Warning order and target number.	"NEW TARGET, target # UT7082, over."
8. Location of second target.	"Left 250, add 400, down 50."
9. Target description second target.	"Company headquarters."
10. Method of engagement.	"Variable timing in effect two salvos."
11. Method of control.	"Spotter adjust, over."
Notes: 1. The orders for the second target will be sent when the ship has sent the report: "Shot" for the first target. Once data for the new target is read back by the ship, the ship will report: "Gun-target line..., Ready..." for the new target. 2. When the ship reports: "Shot" for the second target, the correction for the first target can be sent, and so on. All corrections must have a prefix containing the last two digits of the target number to which they apply. 3. The reports "Splash" and "Out" are not sent by the ship. 4. If end of mission is given for one target, it must have a prefix containing the last two digits of the target number. If end of missions is given for both targets, each has a prefix containing the full target number. 5. Only ships with fire control systems capable of engaging two targets simultaneously can employ this procedure. 6. The number of salvos is sent when entering fire for effect (FFE) or when the spotter desires to adjust fire with multiple salvos. If the method of control is spotter adjust, the number of salvos is omitted until the spotter is ready to enter FFE. If omitted, the ship will fire one salvo.	

5. Tomahawk Land-attack Missile (TLAM) Call for Fire

- a. The TLAM is a precise, coordinate seeking weapon. A TLAM fire support request must be preceded by weapons specifically allocated to the mission. Planning and execution of TLAM fires follows two paths:
 - (1) Deliberate attack, a joint force maritime component commander (JFMCC) led planning and execution.
 - (2) Dynamic attack, a JFMCC or engagement authority led planning and execution.
- b. Key Assumptions for Employment.
 - (1) For airspace, coordinating altitudes and control measures are established in advance. Refer to the MTTP for Airspace Control for various airspace control methods that might apply.
 - (2) The salvo size default is one weapon; increased as specified.
 - (a) R/UGM-109-C ("3C") or R/UGM-109-E ("4E") missile (same WDU-36B unitary warhead).
 - (b) Only 4E has data link communication for redirection.
 - (c) The recommended target for a TLAM is a static point.
 - (3) Tables 20 and 21 contain the TLAM mission and MTO templates and a call for fire and an MTO example.

Table 20. TLAM Call for Fire
(Call for fire given in two transmissions)
First Transmission (spotter ID, warning order to include target #)
“ _____ , this is _____ , TLAM fire mission, (ship’s call sign) (observer’s call sign) target # _____ , over.” (assigned by observer)
Second Transmission (location, elevation, target description, method of engagement, method of control)
Target Location: “Location _____ , elevation _____ ; (10 digit MGRS or DD-MM-SS.ss) (feet MSL or feet HAE) Target Description: _____ . (type, size, degree of protection) Method of Engagement: _____ . (Danger close, ordnance type (3C or 4E), desired number of missiles, special instructions, desired final attack heading, or desired dive angle) Method of Control: _____ . (At my command (standard), launch time soonest, specified time on target, or no earlier/later than time) “Out.”
Example TLAM Call for Fire
First Transmission: “(ship tactical call sign) this is (observer’s call sign) TLAM fire mission Target # AA 1234, over.”
Second Transmission: “Grid 11S KS 61014 82984, elevation 12 feet HAE, one story building in the open, one block 4E, final attack heading 030, at my command, out.”
Legend: HAE—height above ellipsoid MSL—mean sea level TLAM—Tomahawk land-attack missile

Table 21. TLAM MTO			
Message to Observer (MTO)	Direct Launch	Launch to Loiter	Redirect
Firing unit(s)	X	X	X
Changes to tasking	X	X	X
Target number	X		X
Salvo size (i.e., number of rounds)	X	X	X
Time-of-launch (TOL)	Note 1	Note 1	
Time on target (TOT)	X		X
Total time of flight (TTOF) (i.e., launch to target)	X	X	X
Fire time available for redirect	Note 2	X	
Last time available to redirect	Note 2	X	
Weapons maximum ordinate (MAXORD)	Note 3	Note 3	Note 3
Run-in heading	X		X
Dive angle	X		X
Fuze setting	X	X	X
Additional remarks (e.g., time established in loiter)	Note 2	Note 2	Note 2
<p>Notes:</p> <ol style="list-style-type: none"> 1. When a Tomahawk land-attack missile (TLAM) mission is "at my command", the initial MTO will be missing certain timing information. Once "fire for effect" or a TOT is passed, the updated MTO needs only to contain updated information. 2. This information is provided as required. 3. MAXORD will be provided based on the final weapon maneuver in the target area. It will NOT be based on the weapon's preplanned flight path en route to the target area. 			
An Example of a TLAM MTO			
<p>"_____ this is _____ TLAM Target # AA 1234, (ship's call sign) (observer's call sign) one by 4E, TOT 1425, TOL: 1306, TTOF 1+19, FAH 030, (default), short, 6,500 feet mean sea level."</p> <p>Additional information required for missiles in loiter prior to redirection: Missile Communication Status: "Green missile" (good) or "Red missile" (negative) Time available first and last redirection: "Redirect 1313–1410" Time established in loiter: "Loiter 1320–1400"</p>			

6. Surface Fire Munitions

Tables 22–27 contain descriptions of surface fire munitions.

Table 22. Field Artillery Cannons and NSFS							
Weapon	Ammunition		Range (kilometers)			Rate of Fire (rounds per minute)	
	Projectile	Fuze	Max	DPICM	RAP	Sust	Max
105-mm M119	HE, WP, ILLUM, ILLUM (IR), DPICM	PD, VT MT, ET, MTSQ, Delay	11.5	14.1	19.5	3	10
155-mm M198	HE, WP, ILLUM, ILLUM (IR), DPICM, M825 Smoke, SCATMINE	PD, VT, MT, ET, MTSQ, Delay	18.3 or 22.0 w/ M795 HE, M825 Smoke	18.0 M483 or 28.2 w/ M864	30.1	2	4 for 2 minutes then 2
155-mm M109A5 ¹ A6/A7	HE, WP, ILLUM, ILLUM (IR), DPICM, M825 Smoke, SCATMINE	PD, VT, MT, ET, MTSQ, Delay, PGK	18.2 or 21.7 w/ M795 HE, M825 Smoke 24.5 w/ M982 Block 1-1a1	17.9 M483 or 28.1 w/ M864	30.0	1	4 for 2 minutes then 1
155-mm M777-series	HE, WP, ILLUM, ILLUM (IR), DPICM, M825 Smoke, SCATMINE	PD, VT, MT, ET, MTSQ, Delay, PGK	22.2 w/ M201A1 Charge 8S or 22.5 w/ M232, Zone 5; 24.5 w/ M982 Block 1-1a	17.9 or 28.1 w/ M864	30.0	2	4 for 2 minutes then 2
5 inch/54 ²	HE, ILLUM	PD, VT-RF, MT, SQ, ET, CVT, Delay, MOFN ³ , MFF ⁴	21.9 (full charge) 12.2 (reduced charge)	N/A	N/A	<10	20 for 1 minute then sustained rate of fire
5 inch/62 ²	HE, ILLUM	PD, VT-RF, MT, SQ, ET, CVT, Delay, MOFN ³ , MFF ⁴	23.8 (full charge) 12.2 (reduced charge)	N/A	N/A	<10	20 for 1 minute then sustained rate of fire

Table 22. Field Artillery Cannons and NSFS (Cont'd)

Notes:	
1. Excalibur rounds are not authorized for the M109A5.	
2. There are two NSFS-type ships: the USS Arleigh Burke-class guided-missile destroyer (DDG), a one-gun ship; and the USS Ticonderoga-class, guided-missile cruiser (CG) a two-gun ship. The primary limitation to NSFS is the hydrography, the minimum shoal water depth of an NSFS ship is 36 feet.	
3. MOFN fuzes have the following fuzing modes: PD, Delay, ET, and CVT.	
4. MFF fuzes have the following fuzing modes: PD, ET, CVT with selectable height, and VT. A negative value for height of burst may be entered for effectiveness in triple canopy tree foliage environments.	
Legend:	
CVT—controlled variable time (fuze)	MTSQ—mechanical time superquick
DPICM—dual-purpose improved conventional munitions	NSFS—Naval surface fire support
ET—electronically timed	PD—point detonating (fuze)
HE—high explosives	PGK—precision guidance kit
ILLUM—illumination	RAP—rocket-assisted projectile
IR—infrared	SCATMINE—scatterable mine
max—maximum	SQ—superquick
MFF—multifunction fuze	sust—sustained
mm—millimeter	VT—variable time (proximity fuze)
MOFN—multi-option fuze (for) Navy	VT-RF—variable time-radio frequency (proximity fuze)
MT—mechanical time (artillery fuze)	WP—white phosphorous

Table 23. Mortars					
Weapon	Ammunition		Range (m)		Rate of fire (rounds per minute)
	Model	Type	Min.	Max.	
60-mm M224/M224A1	M720A2	HE/MOF	75	3,500 ¹	30 for 4 minutes ² , then 20
	M768A1	HE/PD	75	3,500	
	M1061	HE/MOF	60	3,450	Diameter of illumination: M721–500 m M767–1,250 m
	M722A1	SMOKE (WP)	70	3,490	
	M721	ILLUM	175	3,200	
	M767	ILLUM (IR)	300	3,175	
81-mm M252/M252A1	M821A3	HE/MOF	65	5,800	30 for 2 minutes, then 15
	M889A4	HE/PD	65	5,800	
	M819	Smoke (RP)	300	4,950	Diameter of illumination: M853A1–1,500 m M816–3,750 m
	M375A2	Smoke (WP)	75	4,780	
	M853A1	ILLUM	300	5,050	
	M816	ILLUM (IR)	1,025	4,925	
120-mm M120/M120A1 (Ground Mounted) and 120-mm M121 (Carrier Mounted)	M934A1	HE/MOF	165	7,020	16 for 1 minute, then 4
	M933A1	HE/PD	165	7,020	
	M929	WP/MOF	170	7,120	Diameter of illumination: M930–1,500 m M983–3,750 m
	M930	ILLUM	375	6,675	
	M983	ILLUM (IR)	375	6,675	
120-mm RMS6L (Stryker)	M934A1	HE/MOF	150	6,630	16 for first minute, then 4 for 40 minutes. Sustained 2.
	M933A1	HE/PD	150	6,570	
	M929	WP/MOF	160	6,660	Diameter of illumination: M930–1,500 m M983–3,750 m
	M930	ILLUM	350	6,350	
	M983	ILLUM (IR)	325	6,250	
Notes:					
1. Bipod mounted, charge 4, maximum handheld range is 1,370 m.					
2. This applies to charge 2 and over. Charge 0 or 1 can sustain 30 rounds per minute.					
Legend:					
HE—high explosives			min—minimum		
ILLUM—illumination			MOF—multi-option fuze		
IR—infrared			PD—point detonating (fuze)		
m—meter			RP—red phosphorous		
max—maximum			WP—white phosphorous		

Table 24. Artillery/Mortar/Illumination Factors				
Weapon	Type	Height of Burst (meters)	Burn time (seconds)	Rate of Fall (meters/second)
60 mm	M721 ILLUM	315	40	6
	M767 ILLUM (IR)	415	40	6
81 mm	M853A1 ILLUM	600	60	6
	M816 ILLUM (IR)	600	60	6
105 mm	M314A2 ILLUM	750	60	12
	M1064 ILLUM (IR)	750	60	12
120 mm	M930 ILLUM	500	50	6
	M983 ILLUM (IR)	500	50	6
155 mm	M485A2 ILLUM	600	120	5
	M1124 ILLUM	600	120	5
155 mm	M1066 ILLUM (IR)	600	120	5
	M1123 ILLUM (IR)	600	120	5
5 inch/54	Mk-91 (ILLUM)	500	65–70	10
Legend: ILLUM—illumination IR—infrared				
mm—millimeter				

Table 25. Planning Data for Smoke					
Delivery System	Type of Round	Time to Build Effective Smoke (seconds)	Average Burning Time	Average Obscuration Length (m) per Round Wind Direction	
				Cross	Head/Tail
155 mm	WP M825	30	60–90 seconds	150	50
105 mm	WP	30	60–90 seconds	75	50
120 mm	WP M1103	30	3 minutes	600	250
	WP M929				
81 mm	WP	30	1 minute	100	40
	RP		3–10 minutes	200	50
60 mm	WP	30	1 minute	75	40
Legend: m—meter mm—millimeter					
RP—red phosphorous WP—white phosphorous					

Table 26. Artillery Precision Munitions			
Munition	Variant	Payload	Range (kilometers)
Guided 155-mm Projectile (Excalibur)	M982 Block 1A-1	59-pound warhead and fuze assembly	8.0–37.5
Target types: Precisely located targets (i.e., stationary personnel, stationary lightly armored targets) and structures where collateral damage must be restricted.			
Note: Excalibur is fired by the M777A2, M109A6, and M109A7 cannons. It has three fuze mode selections: point detonating (fuze), delay, and height of burst (HOB). The HOB proximity function provides high-order effects approximately 3.7 meters off the ground, ± 1 meter and maximum lethality.			

Table 27. Multiple Launch Rocket System (MLRS) and High Mobility Artillery Rocket System (HIMARS)					
Munition	Variant	Payload	Accuracy	Range (km)	Targets
Rockets	M26	644 M77 DPICM	Unguided: 10+ mils	10–32	Personnel, light armor, soft vehicles, area targets
	M26A2 Extended Range MLRS	518 M77 DPICM	Unguided: 10+ mils	13–45	
Guided rockets	M30	404 M77 DPICM	GPS: CEP average 5 m Inertial: 0.6 mils	15–84	Point targets
	M31	51.5 lbs of PBX 109 VT/PD/delay fuze nominal and vertical angles of fall	GPS: CEP average 5 m Inertial: 0.6 mils	15–84	
	M31A1	54 lbs of PBX 109 proximity high and low/PD/delay shallow and deep	GPS: CEP average 5 m	15–84	

Table 27. Multiple Launch Rocket System (MLRS) and High Mobility Artillery Rocket System (HIMARS) (Cont'd)				
Munition	Variant	Payload	Range (km)	Targets
ATACMS	Block 1 M39	950 M74 APAM bomblets	25–165	Personnel, light armor, soft vehicles (stationary)
	Block 1A M39A1	300 M74 APAM bomblets	70–300	
	QRU M48/M57	215 lb of Destex PD fuze vertical angle of fall (M57)	70–270	Blocks 1–1A target when duds/collateral damage are precluded. Fixed infrastructure sites (e.g., buildings)
	ATACMS Unitary	Single unitary warhead with multifunction fuze, proximity, PD, or delay	70–300	
Note: The default rates of fire are 5 seconds between rockets and 15 seconds between missiles. All munitions may be fired from the M142 HIMARS and the M270A1 MLRS.				
Legend:				
APAM—antipersonnel/antiarmor		lb—pound		
ATACMS—Army Tactical Missile System		m—meter		
CEP—circular error probable		mil—milliradian		
DPICM—dual-purpose improved conventional munitions		MLRS—multiple launch rocket system		
GMLRS—guided multiple launch rocket system		PBX—plastic-bonded explosive		
GPS—Global Positioning System		PD—point detonating (fuze)		
HIMARS—High Mobility Artillery Rocket System		QRU—quick-reaction unitary		
		VT—variable time (proximity fuze)		

7. Surface Based Fire Support Definitions

- a. *CHECK SOLUTION—An order sent by the spotter for the ship to check the fire control solution when an excessive initial or SALVO-to-SALVO error is observed.
- b. *DANGER CLOSE—This is included with the method of engagement when the predicted impact of a round or shell is within 600 meters (m) of friendly troops for mortars or artillery and 750 m for naval surface fires. The creeping method of adjustment (no adjustment greater than 100 m for mortars/artillery or 200 m for NSFS) will be used exclusively during danger close missions. Do not confuse the danger close method of engagement with risk-estimate distances (REDs) or minimum safe distances (MSDs) or the DANGER CLOSE brevity term.
- c. *DARK STAR—An illumination round that fails to deploy or properly ignite.
- d. DIRECTION—Indicates the direction from the observer to the target. Usually transmitted in mils grid; degrees may be transmitted but must be announced.
- e. FRESH TARGET—This is an order that can be sent any time during a fire mission to indicate a spotter needs to engage a higher priority target. The CFF begins with FRESH TARGET and the ship interrupts fire on the original target to engage the FRESH TARGET. The target location is sent as a correction from the last impacted SALVO of the original target (shift from a known point) and must include any elements of the CFF which differs from the original target (NSFS-only term).
- f. LASER GRID—A laser grid mission is a grid mission requiring a greater level of accuracy. Corrections are determined using a laser. In an adjust fire mission, the round impact location is transmitted as BURST GRID when the impact is measured by an observer.
- g. MAXIMUM ORDINATE (MAXORD)—In artillery and NGFS, this is the height of the highest point in the trajectory of a projectile above the horizontal plane passing through its origin. When announced, unit of measure (meters/feet) datum will be transmitted. The preference, when communicated to fixed-wing (FW) aircraft, is feet MSL and feet above ground level (AGL) for rotary-wing (RW).
- h. *NEGLECT—Used by a ship to indicate the last SALVO was fired on incorrect data (NSFS-only term).
- i. NEW TARGET—An order that can be sent any time during a fire mission to indicate the spotter requires engaging a target that is not necessarily of a higher priority than the one already being engaged. The CFF begins with NEW TARGET and the ship will continue to fire on the original target. The target location can be sent using any of the standard methods, and any elements of the NEW TARGET which differ from the original target must be sent (NSFS-only term).

- j. **OBSERVER TO TARGET FACTOR**—The distance, in meters, from the observer to the target, rounded to the nearest thousand and expressed in thousands (e.g., the observer to target factor for 6,400 meters is 6 and the observer to target factor for 2,500 meters is 3). The observer to target factor is used to compute HOB and deviation corrections.
- k. **ORDINATE (ORD)-X**—ORD-X is defined as the altitude of the artillery round at a specific distance from the target, along the GTL, back toward the firing location. For example, 2 km toward the tubes from the target would be ORD-2.
- l. ***REPEAT**—1. (During adjustment) Fire again using the same method of fire. 2. (During FFE) Fire the same number of rounds using the same method of fire.
- m. ***RIPPED CHUTE**—Sent by the spotter to indicate the illumination round parachute was ripped or separated on deployment (NSFS-only term).
- n. **ROUNDS COMPLETE**—Indicates the FFE stage is complete.
- o. **SALVO**—One shot fired at a target simultaneously by all or part of the guns in a battery (NSFS-only term).
- p. ***SHOT**—A round has, or rounds have, been fired.
- q. ***SPLASH**—Informative call to the observer or spotter 5 seconds prior to estimated time of impact.
- r. ***STRADDLE**—A spotting of STRADDLE is made for a multi-gun SALVO when some rounds fall short and some fall beyond the target. The spotter announces STRADDLE followed by a correction to place the mean point of impact on the target. The term is used during a ship adjust or a massed-fire mission (NSFS-only term).
- s. **TIME ON TARGET**—Time the observer desires a round, or rounds, to impact.

Note: The * annotates a term associated with the ATP 1-02.1, MCRP 3-30B.1, NTTP 6-02.1, AFTTP 3-2.5, *MTTP for Multi-Service Brevity Codes*.

Chapter III

AIR-TO-SURFACE FIRES

1. Joint Air-to-surface Fires

- a. Integrating air interdiction (AI) and close air support (CAS) will provide the most effective means of executing joint air-to-surface fires. Requested AI and CAS should complement the scheme of maneuver. Requirements for synchronization with the ground force should delineate the application between CAS and AI procedures. Both procedures can be employed across the area of operations (AO) and are not tied to a specific fire support coordination measure (FSCM).
- b. Refer to JP 3-09, *Joint Fire Support*, for detailed joint fire support procedures and JP 3-09.3 for detailed joint CAS procedures. Refer to JP 3-03, *Joint Interdiction*, for detailed joint AI procedures.

2. AI and Strike Coordination and Reconnaissance (SCAR)

- a. SCAR is a complementary AI operation. It provides a means of integrating and employing air and surface fires against tactical targets within the joint operation area. For a full discussion of SCAR, refer to ATP 3-60.2, MCRP 3-20D.1, NTTP 3-03.4.3, AFTTP 3-2.72, *MTTP for Strike Coordination and Reconnaissance*.
- b. Coordinating AI targeting, in the division operating area, is conducted at the division level. The interdiction coordinator does this in the joint air-ground integration center (JAGIC) or the deep battle coordinator in the tactical air operations center (USMC) (TAOC).
- c. Strikers conducting SCAR should use the format in table 28 when initiating contact with the JAGIC, TAOC, or the SCAR aircrew with on-scene command of the working area.

Table 28. SCAR Check-in Briefing Format
Aircraft: "_____, this is _____" (SCAR aircrew's call sign) (striker's call sign)
Mission number: "_____"
Note: Authentication (initiated by the net control agency) and an appropriate response are suggested here. The brief may be abbreviated for brevity/security ("as fragged" or "with exception").
Number and type of aircraft: "_____"
Position and altitude: "_____"
Ordnance: "_____" (include fuzing or laser code)
Playtime or time on station: "_____"
Capabilities: "_____" (e.g., targeting pod, laser, laser spot tracker, infrared marker, video downlink, or digital capabilities)
Abort code: "_____"
Remarks: "_____" (e.g., unmanned aircraft system lost-link routing)
Legend: SCAR—strike coordination and reconnaissance

d. The TAOC, JAGIC, or SCAR aircrew should pass the current situation update in the format shown in table 29.

Table 29. SCAR Situation Update and Battle Handover		
Situation Update Line	Situation Update	Battle Handover (In addition to situation update information passed)
Threat Activity	Threats to aviation observed: who, what, where, when.	
Enemy Situation	Give the current enemy disposition. Provide the size, activity, and location. Give specific targets and locations, if available.	Include target priorities. Include target location grids. This may require breaking up the transmission.
Friendly Situation/ Commander's Intent	SCAR, striker assets on station (time on station and ordnance). Ongoing electronic warfare/suppression of enemy air defenses/nonlethal effect activity.	
Artillery (Indirect Fire) Activity	Provide friendly indirect fire assets and considerations (e.g., azimuth of fire, maximum ordinate, priority of fire, and any active mission), if applicable.	Firing unit location, call sign, frequency, status.
Coordination	Advise all players on the net/tactical air direction. If not prebriefed or planned, determine who has engagement authority.	
Hazards	Weather, terrain, or obstructions.	
Remarks/ Restrictions	Active/updates to FSCMs and ACMs, current aircraft location (i.e., quadrant, keypad, altitude) and tasking.	Sensor management plan.
Legend: ACM—airspace coordinating measure FSCM—fire support coordination measure SCAR—strike coordination and reconnaissance		

e. Strikers can be tasked to conduct reconnaissance and strike of tactical targets in accordance with the ground force's prioritized target list. Task the strikers using *MTTP for Multi-Service Brevity Codes*, INVESTIGATE, TARGET, or SMACK.

f. When conducting AI, SCAR aircrew may task strikers to conduct attacks on validated targets using the attack briefing format shown in table 30.

Table 30. Description, Location, Elevation, Remarks, and Restrictions Attack Briefing	
Information	Description
Description	May include target type, size, disposition, and other amplifying data.
Location	Format must be compatible with the receiving asset's system. Options include global area reference system, latitude and longitude coordinates, talk-ons, and BULLSEYE.
Elevation	Given in feet mean sea level.
Remarks/Restrictions	Include deconfliction measures, ordnance, final attack heading, and time on target windows, as required. List restrictions.

g. Assets conducting SCAR should have the ability to integrate with air and surface fires to mass integrated firepower on targets. Coordination will be completed by the SCAR aircrew, the JAGIC, or the TAOC, coordinated with lower-echelon forces.

3. CAS

a. CAS Execution Considerations.

(1) Table 31 depicts a CAS execution template.

Table 31. CAS Execution Template	
1	Routing and safety of flight
2	CAS aircraft check in
3	Situation update
4	Gameplan
5	CAS brief
6	Remarks and restrictions
7	Readbacks
8	Correlation
9	Attack
10	Assess effects
11	Battle damage assessment
12	Routing and safety of flight

(2) Figure 3 provides an example of a CAS execution flow.

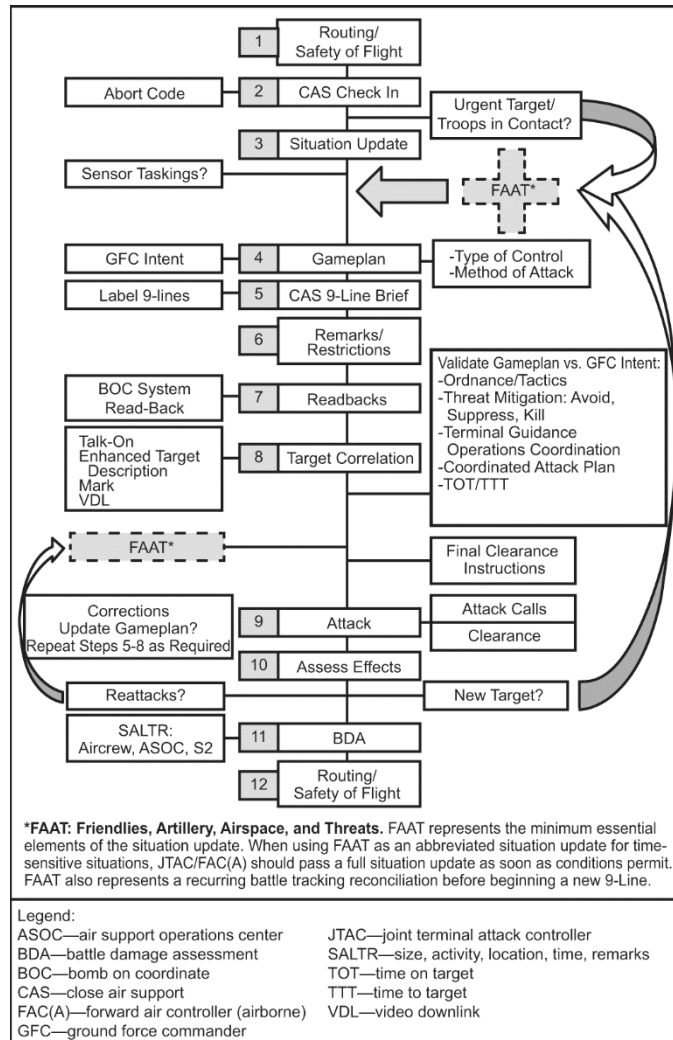


Figure 3. CAS Execution Template

b. Terminal Attack Control Responsibilities. Brief, stack, mark, and control are primary terminal attack control responsibilities. When multiple joint terminal attack controllers (JTACs) or FAC(A)s share the area of operations, the brief, stack, mark, and control responsibilities must be clearly assigned. (See table 32).

Table 32. Terminal Attack Control Roles and Responsibilities	
Role	Responsibilities
Brief	<ul style="list-style-type: none"> • Is the primary area of operations (AO) battle tracking agent. • Builds and manages the situation update. • Performs the tactical risk assessment with the ground commander. • Builds the gameplan and close air support (CAS) briefs, remarks, and restrictions. • Collects readbacks and verifies target correlation. • Tracks the battle damage assessment.
Stack	<ul style="list-style-type: none"> • Owns aircraft routing and safety of flight. • Deconflicts aircraft from other air assets and surface fires. • Collects CAS aircraft check ins. • May relay the situation update, if tasked by brief owner. • Provides primary AO threat mitigation. • Tracks airspace coordinating measures (ACMs) and fire support coordination measures (FSCMs).
Mark	<ul style="list-style-type: none"> • Accomplishes target correlation. • Provides and coordinates target talk-ons and target marks. • Coordinates approval and restrictions for electronic or visual marks.
Control	<ul style="list-style-type: none"> • Provides terminal attack control for CAS attacks. • Obtains fires approval authority from the ground commander. • Monitors attacking aircraft to ensure compliance with restrictions.

c. Routing and Safety of Flight. CAS aircraft will remain at the contact point and altitude as directed by command and control (C2) until approved into the AO by the stack owner. See table 33 for routing and safety of flight considerations.

Table 33. Routing and Safety of Flight Considerations
<ul style="list-style-type: none"> • Three-dimensional directions from the current aircraft position to the intended holding point or area. • Holding point and altitude, once established, and which agency to contact. • Other aircraft on station. • Surface-to-air threats that may immediately affect close air support aircraft. • Any other safety of flight issues.

d. Initial Point (IP) Selection.

(1) Preplanned, geographic IPs are useful for multitarget environments.

(2) The keyhole template (figure 4) is an efficient method for establishing an IP/holding area (HA) in the absence of control points or when the control point location does not sufficiently support target engagement. When using the keyhole template with FW assets, distance represents nautical miles from the echo point and closest allowable hold range to the echo point. The target location may be used as the echo point. When using the keyhole template with RW assets, distance represents km to the center of the battle position (BP), with the standard BP being 2 km x 2 km. Stack owners may direct CAS aircraft to loiter around the echo point, outside a specified distance, using the term "maintain Echo (distance)" (e.g., "maintain Echo 5").

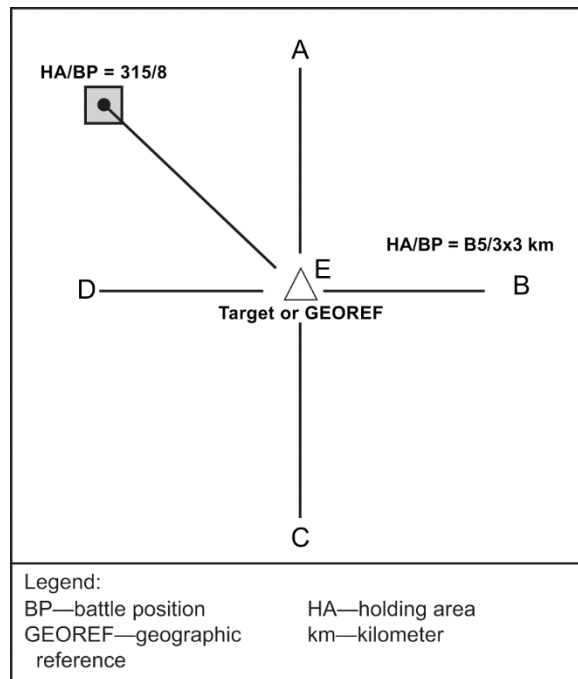


Figure 4. Keyhole Template

e. CAS Aircraft Check In. The CAS aircrew will provide the standard CAS check-in brief (table 34) upon request from the JTAC or FAC(A).

Table 34. CAS Check-in Briefing	
Aircrew: “ _____, this is _____”	.”
Mission number: “ _____”	.”
Number and type of aircraft: “ _____”	.”
Position and altitude: “ _____”	.”
Ordnance: “ _____”	.”
Playtime or time on station: “ _____”	.”
Capabilities: “ _____”	.”
(FAC(A), type of sensors, Link 16, VDL code, SITREPs on board, map version or GRGs, UAS lost link procedures/route).	
Abort code: “ _____”	.”
Legend:	
FAC(A)—forward air controller (airborne)	SITREP—situation report
GRG—gridded reference graphic	UAS—unmanned aircraft system
	VDL—video downlink

f. Situation Update.

- (1) JTACs or FAC(A)s will provide the situation update to arriving aircraft, when able.
- (2) Arriving aircraft should provide the JTAC with factor threat information, if known.
- (3) Tables 35 and 36 contain examples of information to include in a situation update. Table 35 is in the threat, enemy situation, friendly update, artillery, clearance authority, hazards, and remarks/restrictions (TEFACHR) format. Table 36 is in the targets, threats, friendlies, artillery, clearance, ordnance, and restrictions (TTFACOR) format.

Table 35. CAS Situation Update TEFACHR Format		
Line	Situation Update	Battle Handover (BHO)
Threat	<ul style="list-style-type: none"> • General locations of surface-to-air threats not already covered. • Time of last observed surface-to-air fires. 	
Enemy Situation	<ul style="list-style-type: none"> • General enemy disposition. • Avoid listing grids. Target grids will be addressed in CAS briefs. 	<ul style="list-style-type: none"> • General enemy disposition. • Ground commander's targeting priority list. • Target location grids (may require breaking up transmission). • Ground commander's attack guidance matrix.
Friendly Forces	<ul style="list-style-type: none"> • General friendly situation and scheme of maneuver. • Use geographic references, phase lines, checkpoints, etc. The technique is to use general terms: "all friendlies are east of the 94 easting". • Avoid passing friendly grids. If needed, use no more than 6 digits. • All factor friendly forces during TOS, not just the JTAC. • All CAS assets, ordnance, and TOS remaining for the BHO. 	
Artillery	<ul style="list-style-type: none"> • List factor indirect fire assets. This may include general direction of fire. 	<ul style="list-style-type: none"> • Determine the firing unit's location, call sign, frequency, and status.
Clearance Authority	<ul style="list-style-type: none"> • Omit this if the speaker has control. • Clarify roles if there are multiple voices on tactical air direction. For example, "Broadsword 11 has control and is located in the combat operations center. My JFO call sign, Mustang, is located with Charlie Company and is up this net." • Define who has authority for brief, stack, mark, and control. • Pass a plan for approving fires for BHO. 	
Hazards	<ul style="list-style-type: none"> • Towers, minimum safe altitude, weather (including surface winds). 	
Remarks and Restrictions	<p>Remarks and restrictions may include the following:</p> <ul style="list-style-type: none"> • Ordnance restrictions. • JTAC capabilities (e.g., laser, infrared, video downlink). • Factor ACM/FSCM. • Radio calls required by controller. • Intent for aircraft (e.g., CAS, multisensory imagery reconnaissance). • Updates to preplanned ACM/FSCM/MCM. • Provide a positive passing of the appropriate elements of brief, stack, mark, and control during BHO. • Other remarks. 	

Table 35. CAS Situation Update TEFACHR Format (Cont'd)													
An Example of a Situation Update													
<p>JTAC or FAC(A): "The current surface-to-air threat is an unlocated ZSU 23-4, last seen west of MSR 5. The enemy situation is a light armored company attempting to flank us to the north and two companies dug in three clicks to our west, break".</p> <p>"Friendlies are two companies in the vicinity of OP 2, one on the high ground and the other in a blocking position to the east. I am with the company on the high ground. There is also a team at the northwest tip of Blue Mountain; 81-mm mortars are firecapped south of OP 2, firing generally northwest. Break. Winds on the deck are 15–20 knots out of the northwest, I have a videoscout, but no laser. Request 'IN' with heading for all type 2 controls. I plan on using you to disrupt the light armor. Advise when ready for gameplan."</p>													
<p>Legend:</p> <table> <tr> <td>ACM—airspace coordinating measure</td><td>JTAC—joint terminal attack controller</td></tr> <tr> <td>FAC(A)—forward air controller (airborne)</td><td>MCM—maneuver control measure</td></tr> <tr> <td>FSCM—fire support coordination measure</td><td>mm—millimeters</td></tr> <tr> <td>JFO—joint fires observer</td><td>MSR—main supply route</td></tr> <tr> <td></td><td>OP—observation post</td></tr> <tr> <td></td><td>TOS—time on station</td></tr> </table>		ACM—airspace coordinating measure	JTAC—joint terminal attack controller	FAC(A)—forward air controller (airborne)	MCM—maneuver control measure	FSCM—fire support coordination measure	mm—millimeters	JFO—joint fires observer	MSR—main supply route		OP—observation post		TOS—time on station
ACM—airspace coordinating measure	JTAC—joint terminal attack controller												
FAC(A)—forward air controller (airborne)	MCM—maneuver control measure												
FSCM—fire support coordination measure	mm—millimeters												
JFO—joint fires observer	MSR—main supply route												
	OP—observation post												
	TOS—time on station												

Table 36. CAS Situation Update TTFACOR Format		
Line	CAS Situation Update	Battle Handover (BHO)
Threat	<ul style="list-style-type: none">• General locations of surface-to-air threats not already covered.• Time of last observed surface-to-air fires.	
Targets	<ul style="list-style-type: none">• General enemy disposition.• Avoid listing grids. Target grids will be addressed in CAS briefs.	<ul style="list-style-type: none">• General enemy disposition.• Ground commander's targeting priority list.• Target location grids (may require breaking up transmission).• Ground commander's attack guidance matrix.
Friendly Forces	<ul style="list-style-type: none">• General friendly situation and scheme of maneuver.• Use geographic references, phase lines, checkpoints, etc. The technique is to use general terms: "all friendlies are east of the 94 easting".• Avoid passing friendly grids. If needed, use no more than 6 digits.• All factor friendly forces during TOS, not just the JTAC.• All CAS assets, ordnance, and TOS remaining for the BHO.	
Artillery	<ul style="list-style-type: none">• List factor indirect fire assets. This may include general direction of fire.	<ul style="list-style-type: none">• Determine the firing unit's location, call sign, frequency, and status.
Clearance Authority	<ul style="list-style-type: none">• Omit this if the speaker has control.• Clarify roles if there are multiple voices on tactical air direction. For example, "Broadsword 11 has control and is located in the combat operations center. My JFO call sign, Mustang, is located with Charlie Company and is up this net."• Define who has authority for brief, stack, mark, and control.• Pass a plan for approving fires for BHO.	
Ordnance	<ul style="list-style-type: none">• Determine the expected ordnance required to generate the ground commander's desired objective.• Provide any restrictions to ordnance, such as no cluster bomb units or low collateral damage bombs only.	
Remarks and Restrictions	Remarks and restrictions may include the following:	
	<ul style="list-style-type: none">• Hazards (weather) or other remarks.• JTAC capabilities (e.g., laser, infrared, video downlink).• Factor ACM/FSCM.• Intent for aircraft (e.g., CAS, multisensory imagery reconnaissance).	<ul style="list-style-type: none">• Updates to preplanned ACM/FSCM/MCM.• Radio calls required by controller.• Provide a positive passing of the appropriate elements of brief, stack, mark, and control during BHO.

Table 36. CAS Situation Update TTFACOR Format (Cont'd)															
An Example of a Situation Update															
<p>JTAC or FAC(A): "The current surface-to-air threat is an SA-6 at KJ 123 456, just west of MSR Tampa. The target is a light armored company attempting to flank us to the north and two companies dug in 3 kilometers to our west, break."</p> <p>"Friendlies are two companies in the vicinity of OP 2, one on the high ground and the other in a blocking position to the east. I am with the company on the mountain, artillery is located at Firebase 5E, firing generally west, break."</p> <p>"Savage 13 has control. Plan on using your GP bombs to disrupt the light armor. Winds on the deck are 10 knots out of the west. Savage is laser and IR capable. Advise when ready for gameplan."</p>															
<p>Legend:</p> <table> <tr> <td>ACM—airspace coordinating measure</td><td>IR—infrared</td></tr> <tr> <td>FAC(A)—forward air controller (airborne)</td><td>JFO—joint fires observer</td></tr> <tr> <td>FSCM—fire support coordination measure</td><td>JTAC—joint terminal attack controller</td></tr> <tr> <td>GP—general purpose</td><td>MCM—maneuver control measure</td></tr> <tr> <td></td><td>MSR—main supply route</td></tr> <tr> <td></td><td>OP—observation post</td></tr> <tr> <td></td><td>TOS—time on station</td></tr> </table>		ACM—airspace coordinating measure	IR—infrared	FAC(A)—forward air controller (airborne)	JFO—joint fires observer	FSCM—fire support coordination measure	JTAC—joint terminal attack controller	GP—general purpose	MCM—maneuver control measure		MSR—main supply route		OP—observation post		TOS—time on station
ACM—airspace coordinating measure	IR—infrared														
FAC(A)—forward air controller (airborne)	JFO—joint fires observer														
FSCM—fire support coordination measure	JTAC—joint terminal attack controller														
GP—general purpose	MCM—maneuver control measure														
	MSR—main supply route														
	OP—observation post														
	TOS—time on station														

g. Additional Battle Handover Considerations. Prior to the change in the terminal attack controller (JTAC or FAC(A)), a handover brief shall be conducted with the oncoming controller.

h. Night Considerations.

(1) Marking Devices. Refer to appendix A for compatibility of infrared marking devices and various CAS platform sensors.

(2) Air-delivered Illumination. Aerially delivered illumination (i.e., via LUU-2/19 or Mk-257/278) can be useful to friendly ground units and aircrew to aid in locating targets and identifying surrounding terrain and obstacles.

i. Reconnaissance Considerations and Sensor Taskings. Reconnaissance taskings, including sensor postures, can be passed in the remarks of the situation update or as required during the mission. Refer to appendix B for specific terminology.

j. CAS Gameplan and 9-line CAS Briefing.

(1) The gameplan must include type of control and method of attack. Additional elements are per JTAC or FAC(A) discretion. The 9-line is the standard CAS brief for all aircraft (see table 37).

Table 37. Gameplan and 9-line CAS Brief

Do not transmit the numbers. Units of measure are standard unless briefed. Lines 4, 6, and any restrictions are mandatory readbacks. The joint terminal attack controller (JTAC) may request an additional readback.

JTAC: “_____, advise when ready for gameplan.”

(call sign)

JTAC: "Type (1, 2, 3) control (method of attack, effects desired or ordnance, interval). Advise when ready for 9-line."

1. IP/BP: “_____.”

2. Heading: “_____.”

(degrees magnetic, initial point or battle position-to-target)

Offset: “_____.”

(left or right, when requested)

3. Distance: “_____.”

(initial point-to-target in nautical miles, battle position-to-target in meters)

4. Target elevation: “_____.”

(in feet, mean sea level)

5. Target description: “_____.”

6. Target location: “_____.”

(latitude and longitude or grid coordinates, or offsets or visual)

7. Type mark/terminal guidance : “_____.”

(description of the mark, if laser handoff, call sign of lasing platform and code)

8. Location of friendlies: “_____”

(from target, cardinal direction and distance in meters)

Position marked by: “_____.”

9. "Egress _____."

Remarks and Restrictions (*items are restrictions):

- *Final attack headings or attack direction.
- Laser-to-target line/pointer target line.
- Surface-to-air threat, location, and type of air defense suppression.
- *Airspace coordination areas.
- *Danger close and initials.
- *Post launch abort restrictions.
- Additional remarks (e.g., gun-to-target line, weather, hazards).
- Desired type and number of ordnance or weapons effects.
- *Time on target/time to target.
- Additional calls requested.
- *Approval out of battle position for rotary-wing aircraft.

Legend:

BP—battle position

IP—initial point

Note: For off-axis weapons, the weapons final attack heading may differ from the aircraft heading at the time of release. The aircrew should inform JTAC when this occurs and ensure weapon final attack headings comply with given restrictions. See JP 3-09.3 for more final attack heading considerations.

- (2) As a technique to pass remarks and restrictions, the phrase "Restrictions" may be used to key aircrew in on mandatory readback items.

k. Battle Damage Assessment (BDA).

- (1) An accurate BDA is critical to confirm CAS attacks met the ground force commander's intent.
- (2) Depending on target type, sensor capabilities, and threat level, the aircrew may be able to provide a BDA. However, other CAS team members (such as the JTAC or FAC(A), joint fires observers (JFOs), or other observers) may be able to provide a more accurate BDA.
- (3) The BDA report should include: size, activity, location, time, remarks (SALTR). An example of a BDA report format is shown in table 38.
- (4) If conditions preclude briefing BDA, at a minimum pass successful, unsuccessful, or unknown.

Table 38. BDA Report	
Size: "	"
(number and type of equipment/personnel observed)	
Activity: "	"
(movement direction, stationary, dug-in)	
Location: "	"
Time: "	"
Remarks: "	"
(munitions expended, observed damage, mission number, and mission accomplished)	

l. FAC(A) Integration.

- (1) FAC(A)s must be integrated into the ground scheme of maneuver to assume the increased responsibilities of brief, stack, mark, and control.
- (2) FAC(A) capabilities include the following.
 - (a) Terminal Attack Control.
 - Provides final attack clearance in accordance with type 1, 2, and 3 control.
 - Provides a final quality control check to prevent friendly fire.

- (b) Radio Relay.
 - Provides a communication link for the JTAC and the supported unit; between the support unit and aviation C2 system; and between the JTAC and other CAS assets.
 - Performs on-scene commander (OSC) duties in the event of combat search and rescue.
 - (c) Reconnaissance.
 - Performs and delegates sensor taskings.
 - Provides target analysis and weaponeering recommendations.
 - Provides a perspective from the air.
 - (d) Coordinating Indirect Fires. Performs as an indirect fire observer and performs calls for fire.
 - (e) Coordinating and Deconflicting Assets.
 - Deconflicts aircraft and surface fires.
 - Passes situation updates.
 - Compiles targeting information into a CAS brief.
 - Passes targeting information (i.e., CAS briefs, calls for fire, etc.).
 - (f) BDA. Develops and passes BDA.
 - (g) Target Marking, Designation, and Coordinate Generation.
 - Provides target talk-ons and marks.
 - Provides terminal guidance for laser guided weapons.
 - Generates target coordinates for weapons employment.
 - (h) Coordinates SEAD.
- m. JFO Integration.
- (1) JTACs and FAC(A)s can use JFOs to develop and correlate targeting data, mark targets, and support terminal guidance operations (see table 39).

Table 39. An Example of JTAC to JFO Coordination
<p>The joint terminal attack controller (JTAC) provides information to the joint fires observer (JFO):</p> <p>Target refinement.</p> <p>Ordnance or effects requested.</p> <p>Direction of attack.</p> <p>Abort code.</p> <p>Time on target.</p> <p>Mark information and JFO marking responsibilities (if required):</p> <ul style="list-style-type: none"> • Mark the target. • Provide corrections from the mark. • Set PRF code to _____. <p>Note: With this information, the JFO confirms the ability to provide any required marks, terminal guidance operations, or talk-ons, and briefs the close air support mission plan to the ground commander.</p>

(2) JFOs shall pass the observer lineup (table 40), the CAS situation update, and observer target brief (lines 4 through 8 of the CAS 9-line shown in table 41) directly to the JTAC or may require the CAS aircraft to relay the situation update to the JTAC.

Table 40. Observer Lineup
<p>“_____ this is _____ with observer lineup, over.” (JTAC call sign) (JFO call sign)</p> <p>“My position is _____.” (i.e., grid and reference point)</p> <p>“I am in _____,” (overwatch, convoy, defensive, etc.)</p> <p>located _____ from target area, (direction and distance m/km)</p> <p>marked by _____. I have _____ targets for CAS. (friendly mark type) (number)</p> <p>My specialized equipment is _____, over.” (PSS-SOF, LTD with JFO PRF code, LRF, GPS, IR pointer, etc.)</p>

Table 40. Observer Lineup (Cont'd)	
Notes: 1. JFOs should only pass their position directly to the JTAC. 2. The JFO should be prepared to describe how the target coordinates were derived for each CAS 9-line. 2. Friendly grid coordinates should not be passed on an unsecure net. 3. The number of targets refers to the number of CAS 9-lines, not the total number of desired points of impact.	
Legend: CAS—close air support GPS—Global Positioning System IR—infrared JFO—joint fires observer JTAC—joint terminal attack controller LRF—laser range finder LTD—laser target designator PRF—pulse repetition frequency PSS-SOF—Precision Strike Suite Special Operations Forces	

Table 41. JFO Target Brief
4. Target elevation: "Line 4, _____." (in feet mean sea level)
5. Target description: " _____."
6. Target location: " _____." (latitude and longitude or grid coordinates or offsets or visual)
7. Type mark/terminal guidance : " _____." (description of the matrix, if laser handoff, call sign of lasing platform and laser code)
8. Location of friendlies: " _____." (from target, cardinal direction and distance in meters)
Position marked by: " _____."
"Advise ready for remarks."
Remarks:
Laser-to-target line or pointer target line: " _____."
Threat: " _____." (direction and distance)
Suppression of enemy air defenses: " _____." (interrupted, continuous, or non-standard)
Gun-target line or line of fire: " _____." (maximum ordinate)
Restrictions (require readback):
Final attack heading: " _____."
Airspace coordination area: " _____."
DANGER CLOSE: " _____."
Time on target: " _____."

n. RW CAS Employment Considerations.

(1) Once approved for a CAS attack, clearance to use off-axis weapons (e.g., crew served weapons) upon ingress to and egress from the target area is implied. Fires from off-axis weapons are subject to the restrictions outlined in the CAS attack brief.

(2) The primary attack brief for RW CAS is the 9-line. In certain situations, RW aircraft, including Army RW aircraft conducting attacks using CAS tactics, techniques, and procedures (TTP) may have very high situational awareness due to a low operating altitude. In these instances, the RW CAS 5-line brief (table 42) can expedite fires.

(3) The RW CAS 5-line brief is an observer-centric CAS brief. These TTP are used for bomb-on-target attacks.

Table 42. RW CAS 5-line Brief	
1. Observer/Warning Order/Gameplan	“ _____ , 5-line, (aircraft call sign) (JTAC/FAC(A) call sign) Type (1, 2, or 3) control, MOA (BOC or BOT), (ordnance requested). ”
2. Friendly location/mark	“ My position _____ , marked by _____ ” (target reference point, grid, etc.) (beacon, IR strobe, etc.)
3. Target location	“ Target location, _____ ” (magnetic bearing and range in meters, target reference point, grid, etc.)
4. Target description/mark	“ _____ , marked by _____ .” (target description) (IR, tracer, etc.)
5. Remarks and Restrictions (* items are restrictions):	<ul style="list-style-type: none"> • Laser-to-target line or pointer target line. • Desired type and number of ordnance or weapons effects (if not previously coordinated). • Surface-to-air threat, location, and type of SEAD. • Additional calls requested. • Additional remarks (gun-target line, weather, hazards). • *Final attack headings. • *Airspace coordination areas. • *Danger close and initials. • *Time on target/time to target. • *Post launch abort coordination and considerations.
Note: The rotary wing CAS 5-line should be passed as one transmission. If the restrictions portion is lengthy, it may be a separate transmission.	
Legend: BOC—bomb on coordinate BOT—bomb on target FAC(A)—forward air controller (airborne) IR—infrared JTAC—joint terminal attack controller MOA—method of attack SEAD—suppression of enemy air defenses	

O. Army Attack Aviation Procedures.

(1) Army aviation units are organic, assigned, or attached to corps, divisions, and brigades and perform air-ground operations as part of a combined arms team. Army aviation assets receive mission-type orders and execute them as an integral unit or maneuver element. Special

situations may arise where attack aviation assets are employed in smaller units. The Army does not consider its attack aircraft CAS systems, although they can conduct attacks employing CAS TTP when operating in support of other forces.

(2) Army aviation conducts attacks across the width and breadth of the supported ground commander's AO. When operating in proximity to friendly forces, aircrews receive a situation update from the ground commander or observer and develop a plan to engage the enemy, while maintaining freedom to maneuver. Army attack aviation conducts attacks using the Army attack aviation call for fire TTP and does not require terminal attack control to employ ordnance.

(3) Army attack teams will brief the information in table 43 at check in.

Table 43. Army Aviation Air-to-ground Check-in Brief	
Aircraft: " _____ , this is _____ ."	(ground unit) (aircraft call sign)
Aircraft team: " _____ ."	(composition and location)
Munitions available: " _____ ."	(rockets/guns/missiles)
Night vision (if applicable): " _____ ."	(capability and type)
Station time: " _____ ."	(minutes)

(4) The Army attack aviation CFF can be used for all threat conditions. It does not affect the aircrew's tactics in executing attacks.

(5) When operating in proximity to friendly forces, the air mission commander or flight lead must have direct communication with the ground commander or observer on the scene to provide direct fire support. After receiving the Army attack aviation CFF from the ground forces, the aircrews must positively identify the location of the friendly element and the target prior to conducting any engagement. Methods for marking the location of friendlies and the enemy include: laser hand off, tracer fire, marking rounds (flares or mortars), smoke grenades, signal mirrors, VS-17 panels, infrared strobe lights, laser target marker, or chemical sticks.

p. Army aviation attack request and special operations forces (SOF) gunship CFF is shown in table 44.

Table 44. Army Aviation Attack Request and SOF Gunship CFF Format

1. Observer and Warning Order.
" _____, **this is** _____, **fire mission, over.**"
(aircraft call sign) (observer call sign)
2. Friendly Location and Mark.
"**My position** _____, **marked by** _____."
(e.g., grid) (strobe, beacon, etc.)
3. Target Location.
"**Target Location** _____."
(bearing (magnetic) and range (meters), grid, etc.)
4. Target Description and Mark.
" _____, **marked by** _____."
(target description) (infrared pointer, tracer, etc.)
5. Remarks: " _____, **over.**"
(clearance, danger close, at my command, threats, restrictions, etc.)

Notes:

1. Clearance. If airspace has been cleared between the employing aircraft and the target, transmission of this brief is clearance to fire unless "danger close", "at my command", or an additional method of control is stated.
2. Danger Close. The observer or commander must accept responsibility for increased risk. State "cleared danger close" in line 5 and pass the initials of the on-scene ground commander. This clearance may be preplanned.
3. At My Command. For positive control of the aircraft, state "at my command" on line 5. The aircraft will call "ready to fire", when ready. To command aircraft attack, the observer will say "(aircraft call sign), fire."
4. For synchronization of fires, methods of fire and control may be included in line 5. Refer to Table 3, "Methods of Fire and Control", for additional measures.

q. SOF Gunship Fires.

- (1) Due to unique systems and capabilities, AC-130s do not require terminal attack control from ground controllers for all weapons profiles.
- (2) The AC-130 can accept a 5-line (table 42) or a 9-line brief (table 36).
 - (a) AC-130 crews prefer a 5-line for gun engagements and a 9-line for precision-guided munitions.
 - (b) When using gun and precision-guided munitions during a simultaneous attack, use a 9-line with gun reattack in the remarks.
- (3) See table 45 for AC-130 adjust fire procedures.

Table 45. Adjusting AC-130 Gunship Fire
<ol style="list-style-type: none"> 1. Adjust the round impact by giving cardinal/subcardinal direction and range (meters) from impact to the desired target. For example, "adjust fire northeast 200, over". 2. Mark or confirm targets using covert illumination with the infrared marker (SPARKLE) or laser. 3. To move SPARKLE, say "move SPARKLE (distance and direction)" (e.g., 100 meters east). 4. Once SPARKLE is over the target, say "freeze SPARKLE." (If you say "CEASE SPARKLE", the gunship will turn off the infrared marker.)
<p>Notes:</p> <ol style="list-style-type: none"> 1. Do not refer to clock positions. 2. Do not pass run-in headings for gun engagements. 3. Do not correct left/right or short/long. 4. If applicable, pass multiple target locations in precedence, as soon as possible, to allow the AC-130 rapid engagement to preclude an enemy scatter effect.

- (4) FW Integration with an AC-130.
 - (a) TTP in table 46 allow continuous support to ground forces while integrating the firepower of the AC-130 and various CAS aircraft. Figures 5–7 depict the FW integration tactics.
 - (b) Firepower should be amassed and constant. Limit any breaks in weapons deliveries to flight path conflicts.
 - (c) The AC-130 flies a continuous (approximately 3 minute) orbit around the target, or approximately 40–45 seconds per sector.

Table 46. AC-130 Integration Attributes			
Tactic	Deconfliction	Advantages	Disadvantages
Wheel	Visual	Less airspace required.	Close air support (CAS) aircraft must remain visual.
Initial Point (IP) Target Run-in	Procedural	Familiarity with standard IP-to-target attack.	<ul style="list-style-type: none"> • High workload. • Communications intensive. • Infrequent attacks.
Opposite Sector	Procedural	<ul style="list-style-type: none"> • Allows constant fires from CAS aircraft and the AC-130. • Can incorporate more than one set of CAS aircraft. 	Requires gunship position updates.

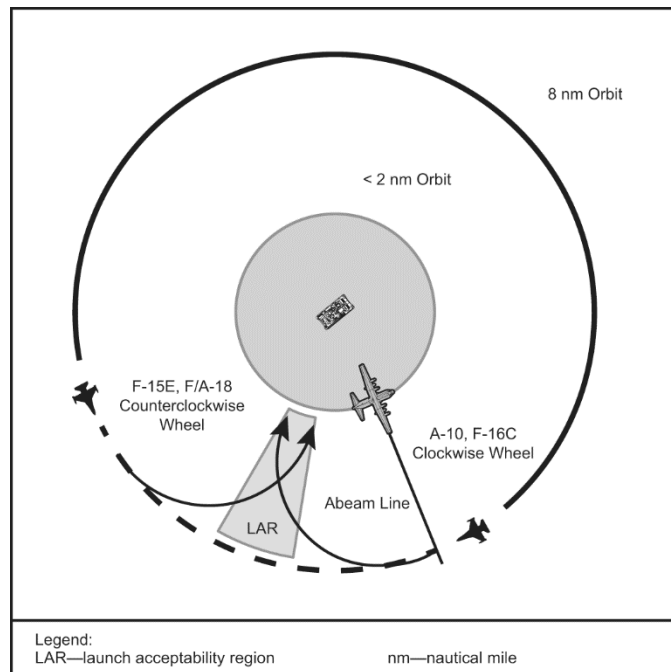


Figure 5. An AC-130 Wheel Example

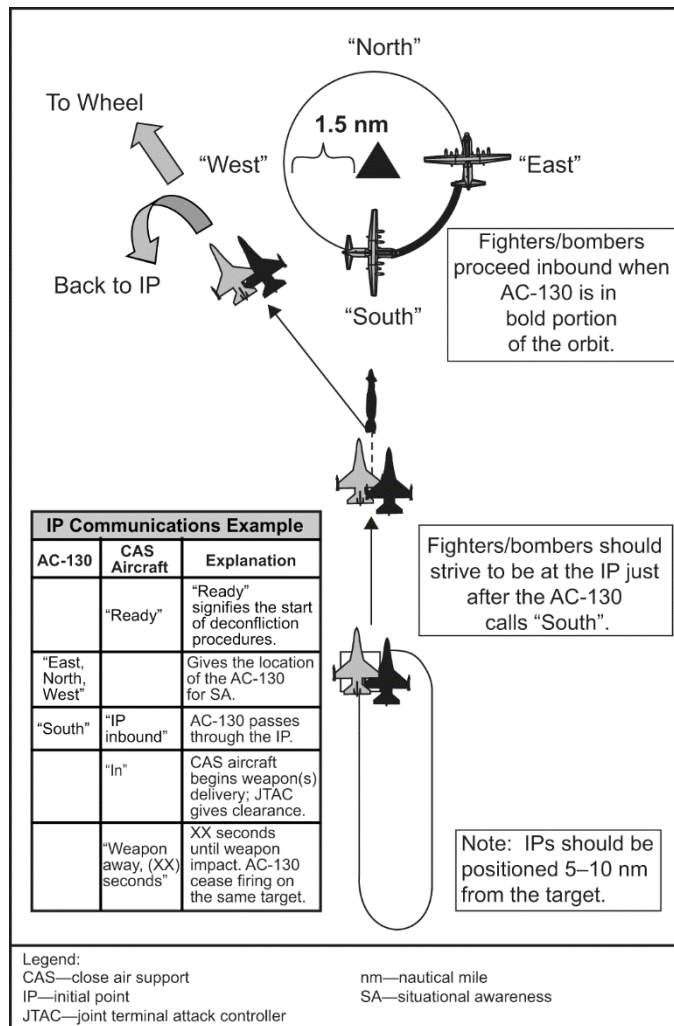


Figure 6. An AC-130 IP-to-target Run-in Example

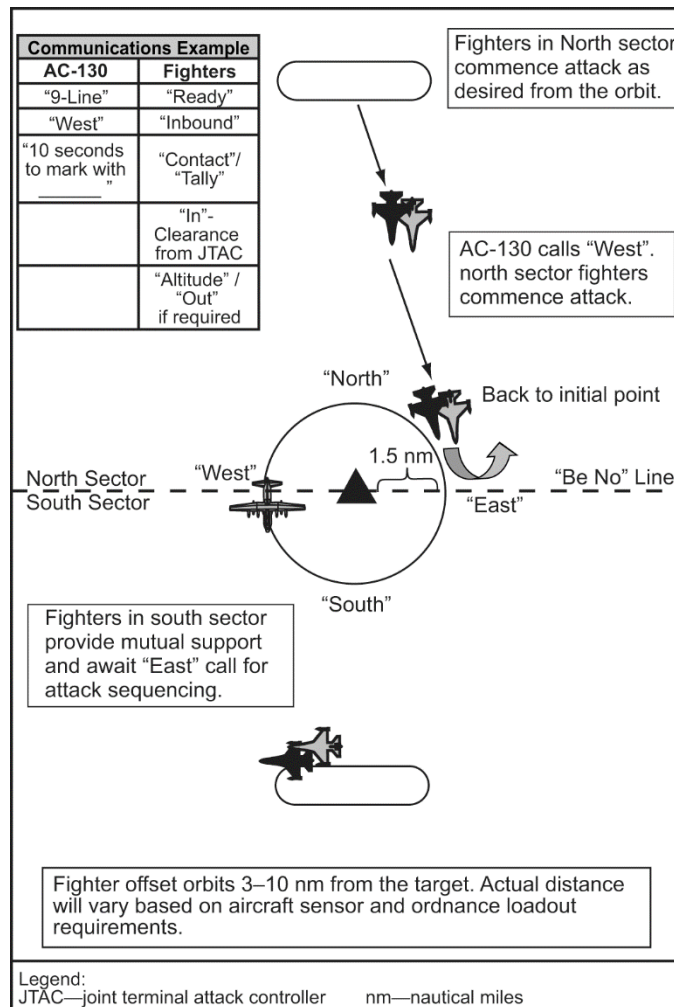


Figure 7. An AC-130 Opposite Sector Attack Example

(5) RW integration with AC-130. Continuous integrated AC-130 and RW fire and sensor support to ground forces is possible using the TTP described in table 47 in conjunction with the deconfliction plan in figure 8.

NOTE

This procedure should not be used for AC-130 impact angles less than 45°. If using 25 mm, no-fire headings may be required due to ricochet fan.

Table 47. Integrated RW and AC-130 Communication Example

AC-130	RW Aircraft	Explanation
"Sparkle on."	"Contact/Tally."	Both aircraft confirm target for deconfliction.
	"Established 1,000 meters east of target, 200 feet AGL."	RW confirms position is outside engagement zone and AGL to establish distance (refer to figure 8).
"Rounds away."		
"Cold."	"Cease fire."	If RW needs to move inside the engagement distance (refer to figure 8), call "cease fire" for AC-130 to go cold.
Note: The RW must call "abort" if it's unable to maintain the safety distance or loses situational awareness on the target being engaged.		
Legend: AGL—above ground level RW—rotary-wing		

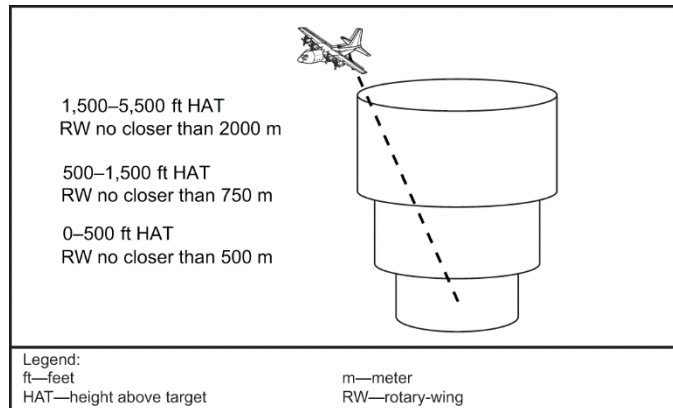


Figure 8. RW Deconfliction from AC-130 Attacks

r. Bomber CAS Employment Considerations

- (1) Bombers are best suited to engaging large target areas with multiple desired points of impact (DPIs). They loiter and engage from medium to high altitudes with an extensive variety of payload capabilities and in-flight adjustable weapon settings. They may provide 4 or more hours of uninterrupted time on station.
- (2) Bombers have multiple crewmembers and radios enabling them to coordinate with multiple agencies simultaneously.
- (3) In multiple target strikes, expect the aircrew to read back lines 4, 6, and 8 from the 9-line CAS brief, and provide a separate system read back for each bomb on a coordinate target. JTACs should provide additional target information using only lines 4, 6, and 8 prior to remarks, in accordance with JP 3-09.3. Additional DPIs may increase the required time from 9-line to engagement due to system entry.
- (4) Bombers prefer a minimum of 15 nautical miles of airspace due to turning radii and run-in distances. JTAC's must discuss required airspace with the bomber crew on check in.
- (5) Extended run-in profiles may result in loss of target identification and create communication problems between the bomber and JTAC.
- (6) Reattack times will be longer for bombers than for fighter aircraft.
- (7) Bombers may be capable of creating refined target coordinates without use of a targeting pod.

s. CAS Execution with Non-JTAC Personnel.

(1) In certain circumstances, the ground commander might require air support when a JTAC or FAC(A) is not available, but detailed integration with friendly forces fire and movement is still required.

(2) The commander must consider the increased risk of fratricide when using personnel who are not JTAC or FAC(A) qualified. If the maneuver commander accepts the risk, the request is forwarded to the CAS controlling agency (i.e., air support operations center, direct air support center, or joint air operations center) who will alert the aircrew who will be working with non-JTAC personnel.

(3) The aircrew executing CAS, under these circumstances, bear the responsibility for the detailed integration required to minimize fratricide (normally done by a JTAC or FAC(A)). Therefore, ground commanders and CAS aircrew members should use caution when conducting CAS with non-JTAC personnel.

(4) Table 48 illustrates a checklist for the aircrew and non-JTAC qualified personnel to conduct CAS in the absence of a capable, informed JTAC or FAC(A).

Table 48. Checklist for CAS with Non-JTAC Qualified Personnel		
Steps	Aircrew	Non-JTAC Qualified Personnel
1. Establish two-way communication.	Contact the JFO or OSC.	Advise the aircrew, "I am not a JTAC" or "I am a JFO".
2. Attempt to incorporate a capable JTAC or FAC(A).	Query an ASOC or DASC for assistance from a qualified JTAC.	Contact a higher command echelon and request assistance from an assigned JTAC.
<div style="border: 3px double black; padding: 10px; text-align: center;"> CAUTION Proceed with caution if a JTAC or FAC(A) is not available. </div>		
3. Inventory marking devices.	Query JFO/OSC for friendly and target marking capabilities.	Prepare to mark friendly positions and the target location.
4. Build 9-line information and determine logical restrictions.	Gather target and friendly data from JFO/OSC. Be prepared to accept the target location as an offset and distance from the friendly position.	Provide factor-friendly positions to the aircrew. Provide target location, description, and elevation. If unable, expect to pass the target location as an offset and distance from the friendly position.
5. Perform a visual reconnaissance pass.	Attempt to correlate target and friendly data passed in step 4. Integrate marks, if able.	Be prepared to provide an enhanced target area description, and mark target and friendly locations to assist the correlation.
6. Develop a progressive fire support plan.	Integrate capabilities to achieve the OSC's intent while mitigating risk to friendly forces.	Establish contracts to abort attacking aircraft and provide corrections to weapons effects.
7. Take cover.	Instruct friendlies to take cover. Provide the vector to cover, if needed.	Find cover to shield against weapons effects.
8. Mark the target.	Confirm the target location by marking it with a nonlethal weapon, WP rocket, laser, or IR pointer, if able.	Mark the target using any available means (e.g., tracer fire, mortars, smoke, crew served weapons, etc.)
9. Engage the target.	Use the lowest collateral damage weapon available to satisfy the OSC's intent.	Provide corrections as a cardinal direction and distance from the last impacts. Continue until the GFC's intent is achieved.
Legend: ASOC—air support operations center JFO—joint fires observer DASC—direct air support center JTAC—joint terminal attack controller FAC(A)—forward air controller (airborne) OSC—on-scene commander GFC—ground force commander WP—white phosphorous IR—infrared		

4. Threat Mitigation Plan (Avoid-Suppress-Kill).

- a. Factor threats will affect the attacking aircraft's ingress or egress geometry or weapons delivery. JTACs, FAC(A)s, or the SCAR aircrew should coordinate to identify all factor threats prior to the attack.
- b. The aircraft will avoid factor threats using standoff weapons, or avoid the threat envelope using modified flight profiles, such as masked ingress and egress profiles.
- c. If aircraft cannot avoid the threat, JTACs, FAC(A)s, and the SCAR aircrew should develop a suppression plan.
- d. JTACs, FAC(A)s, and the SCAR aircrew may elect to kill (neutralize or destroy) the threat to allow follow-on attacks on the primary target. Figure 9 displays an avoid-suppress-kill threat mitigation methodology.

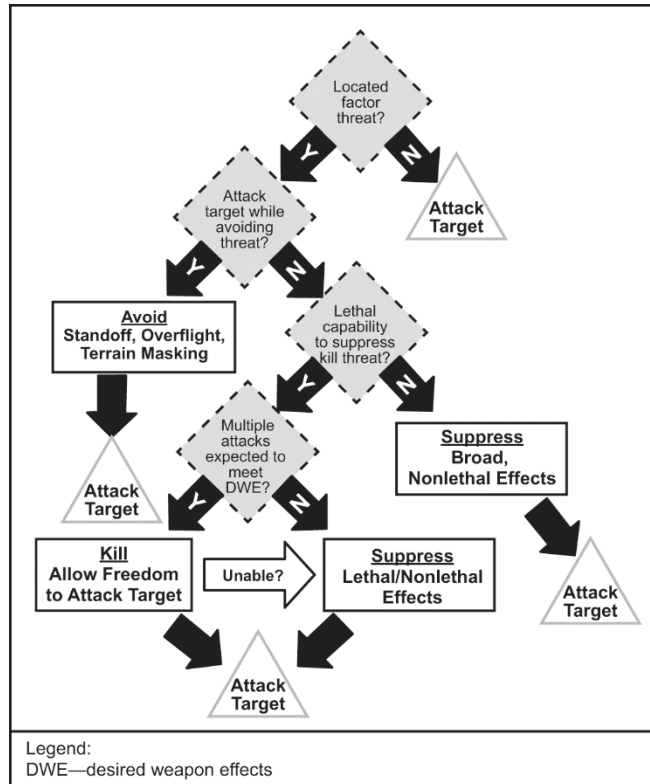


Figure 9. Avoid-Suppress-Kill Threat Mitigation Methodology

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5. Aircraft and Surface Fires Integration Techniques.

a. Aircraft and surface fires can be integrated and deconflicted through lateral separation, altitude, time, or a combination of these.

(1) Lateral separation (see figure 10) works best when aircraft and surface fires engage separate target arrays.

(2) Timing is useful when multiple assets engage the same target array. Depending on weapons delivery parameters (see figure 11).

(3) Altitude deconfliction may be useful in either situation.

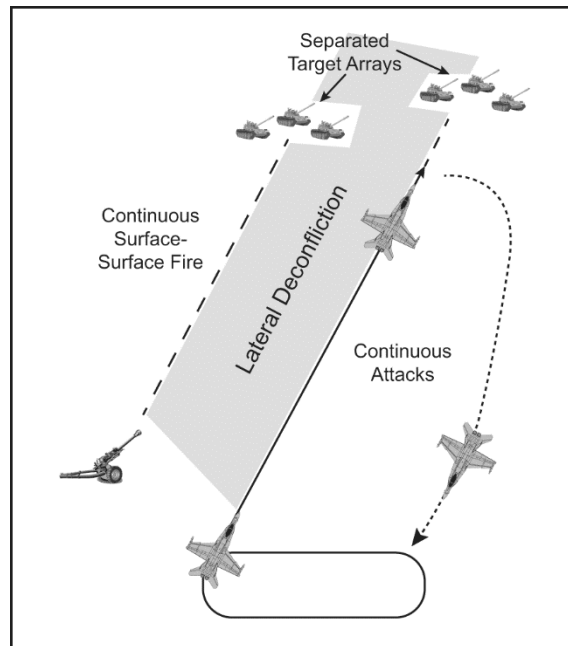


Figure 10. Lateral Fires Deconfliction

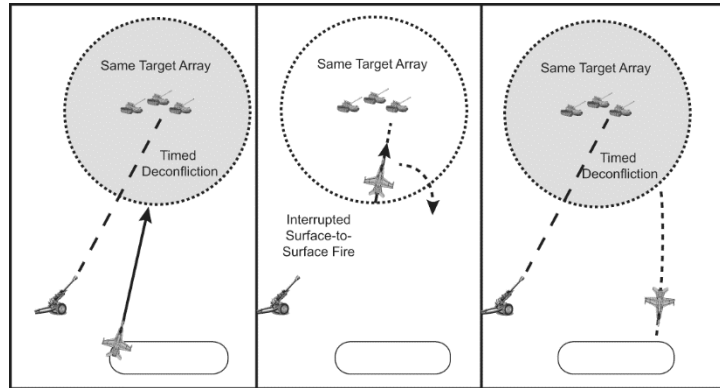


Figure 11. Timed Fires Deconfliction

- b. Effective integration uses complementary capabilities of air and surface fires to achieve the commander's intent without imposing unnecessary restrictions.
- c. Aircraft can work near active GTLs with positive coordination.
- d. The responsible airspace control agencies must deconflict ATACMS and GMLRS immediately due to their long flight profiles. Refer to figure 12 for airspace coordinating requirements.

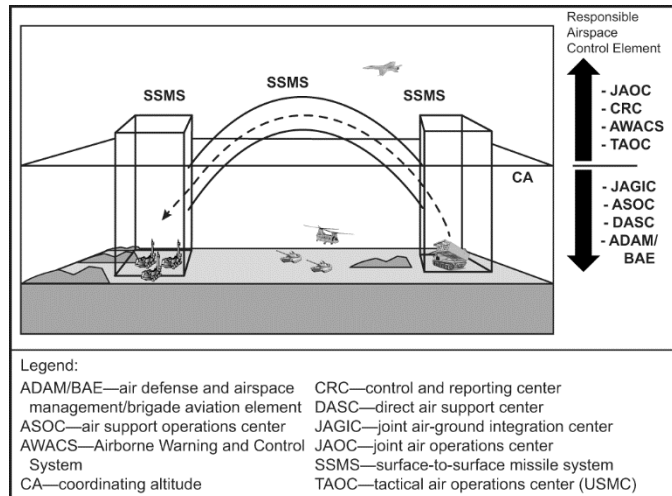


Figure 12. Clearance of Fires Above the Coordinating Altitude

e. Surface fires can require significant coordination time. When using surface fires for SEAD, build and coordinate fire missions early to reduce time required and enhance combined effects during attacks.

6. Coordinated Attacks.

a. The aircrew with the highest situational awareness may be delegated tactical lead for coordinated attacks. The tactical lead authority can only be delegated by the JTAC, FAC(A), or SCAR aircrew. An aircraft given the tactical lead does not have terminal attack control responsibilities, rather the tactical lead should ensure deconfliction between aircraft is maintained and recommend attack geometry and timing between flights/sections.

b. The type, ingress, egress, sort (TIES) method is a useful way to brief a coordinated attack. TIES refers to the:

- (1) Type of coordinated attack.
- (2) Ingress direction for each attacking flight.
- (3) Egress direction for each attacking flight.
- (4) Sort the targets to be attacked.

c. Table 49 describes the types of coordinated attacks.

(1) The type of attack is based on the avenue of approach to the target and timing.

(a) Example 1: A “combined, simultaneous, visual” attack means shared airspace approach to the target with simultaneous attacks, using visual cues.

(b) Example 2: A “sectored, sequential, 1 minute” means attackers approach from sectored airspace with sequential time spacing of 1 minute.

(2) It should be specified whether the timing is time on target (TOT) or time to target (TTT).

Table 49. Coordinated Attacks			
Avenue of Approach to Target	Simultaneous Attack	Sequential Attack	Random Attack
Combined airspace.	Visual or timing.	Visual spacing or time separation.	Not normally used.
Sectored airspace.	Visual or timing.	Visual spacing or time separation.	Free flow.*
*Ensure strafe fan or bomb and missile fragment deconfliction.			

Chapter IV ELECTRONIC ATTACK (EA)

1. EA Operations

- a. EA is considered a form of fires and involves the use of electromagnetic energy, directed energy, or antiradiation weapons to prevent or reduce an enemy's effective use of the electromagnetic spectrum (EMS).
- b. Primary EA activities include counter-communications, counter-radar, navigation warfare (NAVWAR), and counter radio-controlled improvised explosive device (RCIED).
 - (1) Counter-communications EA targets enemy wireless communication systems while allowing friendly use of the EMS. Target examples include:
 - (a) Tactical frequency modulation (FM)/VHF push-to-talk (PTT) radios.
 - (b) Commercial PTT radios.
 - (c) Data links.
 - (d) Radio relays and repeaters.
 - (e) Cellular and satellite phones.
 - (f) Wireless internet access points.
 - (2) Counter-radar EA targets enemy land-, sea-, or air-based radars while allowing friendly use of radar systems. Techniques include noise and deception (i.e., false targets) jamming. Target examples include:
 - (a) Early warning and air surveillance radars.
 - (b) Ground-controlled intercept and air traffic control radars.
 - (c) Surface-to-air missile target acquisition and target tracking radars.
 - (d) Counter-artillery battery radars.
 - (e) Air and naval navigation radars.
 - (3) NAVWAR, or counter-navigation EA, targets the enemy's use of positioning, navigation, and timing capabilities while preserving its use for friendly forces. Target examples include:
 - (a) Satellite-based global navigation systems.
 - (b) Ground-based radio-frequency navigation systems.
 - (4) Counter RCIED EA uses the EMS to preempt and disrupt RCIED threats.

2. Planning Considerations

a. Desired effects drive requests for electronic fires and may include actions to deny, degrade, or disrupt the enemy's use of the EMS, and to deceive the enemy via the EMS. Examples of desired effects include:

- (1) Denying early warning communications and radar.
- (2) Denying or deceiving the enemy radar presentation.
- (3) Isolating a target from visual observer networks.
- (4) Denying C2 or targeting information to a firing unit.
- (5) Screening friendly force movements.
- (6) Severing targeting communications.
- (7) Facilitating exploitation of enemy communications.
- (8) Suppressing RCIEDs.

b. Integrating EA and electronic warfare support (ES) capabilities is essential to effective EA fires support. Examples of EA and ES capabilities that can be integrated are:

- (1) Selective. Jamming to deny the enemy use of specific, predetermined frequencies while funneling the enemy to use other frequencies not being jammed. This allows for collecting enemy communications and presenting the enemy with operational obstacles.
- (2) Spectral. Denying use of whole portions of the EMS while allowing total use of other portions of the spectrum.
- (3) Structural. Denying use of multiple portions of the EMS spectrum to induce communication over a selected venue for optimized exploitation.
- (4) Geographic. Denying communications in a specific region while allowing uninhibited communications in other regions (also a form of deception jamming).
- (5) Target Cueing and Refinement. EA assets may be unable to exploit while jamming. ES target cueing enables rapid target identification and assignment of adversary chattermarks. ES assets also may provide feedback to EA assets' jamming assignment effectiveness.

c. Deconfliction and synchronization are essential to effective EA fires support and to prevent EMS fratricide. Deconfliction is employing EA in a manner that minimizes impact on friendly use of the EMS. The primary method of EMS deconfliction is the joint restricted frequency list (JRFL).

- (1) The JRFL is built by the J-2, J-3, J-5, J-6 and the joint frequency management office or joint spectrum management element. The JRFL contains three types of frequencies (i.e., guarded, protected and taboo). See JP 3-13.1, *Electronic Warfare*, for more information on the JRFL.

(a) Guarded frequencies are adversaries' frequencies currently being exploited for combat information and intelligence.

(b) Protected frequencies are friendly frequencies used for a particular operation, identified and protected to prevent them from being inadvertently jammed by friendly forces while active electronic warfare (EW) operations are directed against hostile forces.

(c) Taboo frequencies are friendly frequencies of such importance that they must never be deliberately jammed or interfered with by friendly forces.

(2) Tactical units should ensure all planned friendly frequencies and exploited adversary frequencies are on the JRFL prior to commencing operations.

(3) EA fires should be synchronized and deconflicted between airborne and ground-based systems in planning and during execution. For example, airborne systems are able to generate effects against rear-echelon forces due to increased line of sight. Ground-based systems may generate effects closer to friendly forces, allowing airborne assets to engage other priority targets.

(4) EA assets should be deconflicted by time, geography, or target in cases where integration is not possible to prevent friendly EMS fratricide.

(5) In the event of EMS fratricide, tactical units should attempt to resolve the issue in real time through the jam control authority or directly with the EA asset. Post mission, requestors should use the joint spectrum interference resolution process found in CJCSI 3320.02F, *Joint Spectrum Interference Resolution*.

3. Tasking and Execution

a. EA requests fall within three operational categories: preplanned, preplanned on-call, and immediate. Table 50 is the electronic attack request form (EARF) format.

(1) Requesting preplanned EA support is similar to requesting CAS. Request EA effects using a DD Form 1972 with specific EA effects requests attached in an EARF.

(2) For on-call or immediate EA, use the EA briefing in table 51.

Table 50. EARF	
Requesting Major Supported Command:	
Requesting Unit:	
Contact Information: This is for the person who will be responsible to verify the EARF has been approved before the mission starts and to relay the information to the executing unit.	
Joint Tactical Air Strike Request (JTAR) Number: Enter the JTAR number that will be submitted with this EARF.	
Concept of Operations (CONOPS): Describe the CONOPS. This will include the objective, forces used, timeline of the mission, and coordination efforts required for mission success. Relate the impact of mission success to specific objectives for the integrated tasking order.	
Electronic Attack (EA) CONOPS: Define the desired effect(s) and timeline.	
Other Required Capabilities: Specify any capabilities required to execute the CONOPS, such as direction finding or exploitation.	
Jam Control Authority: Jam Initiate Authority: CEASE BUZZER (Communications) Procedures: CEASE MUSIC (Radar) Procedures: This will be in accordance with theater special instructions. Provide a communication plan between the jamming control authority and EA asset. Very high/ultrahigh frequency is the primary means to talk to a supporting aircraft. If unable to establish communications, consider using another asset to relay information. Some aircraft may be internet relay chat or satellite communications capable.	
Friendly Frequency Use for Operation:	
Target System(s) to be Jammed/Denied:	Target requested (list the type and frequency, if known). Intelligence assessment (this is required for each request). Do not copy and paste frequencies from one day to the next without intelligence validation and assessment.
Target Location: Point, linear, or rectangular target grids.	
Jamming date-time groups: From and To, in Zulu Time (preferred).	
Type of EA Requested: Preplanned and scheduled on-call.	

Table 51. Electronic Attack Brief	
Do not transmit line numbers. Units of measure are standard unless briefed. Lines 1 and 2 are mandatory readback lines. The JTAC may request additional readback.	
JTAC: " _____ , this is _____ ;" (aircraft call sign) (JTAC's call sign)	
1.	Target or Effect Description: " _____ ;" a. Rapper or Target Name (if applicable) b. Frequency (if known) c. Modulation (if known)
2.	Target Location: " _____ ;" (latitude and longitude or MGRS)
3.	Remarks: " _____ ."
Legend: JTAC—joint terminal attack controller MGRS—military grid reference system	

b. EA execution requires specific rules of engagement and authorities. At a minimum the theater special instructions and EARF should define authorities and criteria for:

- (1) Jamming Control Authority (JCA). This is the approval and execution authority for any CEASE BUZZER/MUSIC requests and can order target jamming by EA assets, as necessary, within their area of operations. JCA, or portions thereof, may be delegated.
- (2) Jam Initiate Authority. This provides authority to initiate jamming against specific targets in accordance with EA requests, without requesting authority from the JCA.
- (3) Kill-chain Communications. These are enemy communications which, if left unjammed, will pose an *immediate threat* to friendly forces. Examples include enemy calls for reinforcement and calls for fire. Denying kill-chain communications does not require JCA approval.

c. After completing operations where EA was requested and executed, the requestor should provide feedback to debrief whether the desired effect was produced.

4. EA Capabilities Reference

a. Aircraft Endurance. The following aircraft maximum unrefueled flight times include transit and on-station times.

- (1) EA-18G maximum unrefueled flight time: 2 hours.
- (2) EC-130H maximum unrefueled flight time: 7 hours.
- (3) F/A-18 (A-F) maximum unrefueled flight time: 2 hours.
- (4) F-16 (Block 50/52) maximum unrefueled flight time: 1.5 hours.

b. Air, ground, and maritime forces have assets capable of performing EA. Table 52 lists them.

Table 52. Joint Electronic Attack Capabilities							
Platform	Capability				Targets		
	Locate	Exploit	Jam	ARM	Comm	EW/TA radar	SAM TA/TT
Airborne Electronic Attack							
EA-18G	X		X	X	X ¹	X	X
EC-130H	X	X	X		X	X	X ¹
F/A-18 (A-F)				X		X ^{1, 2}	X ²
F-16 (Block 50/52)				X		X ^{1, 2}	X ²
Ground Electronic Attack							
Prophet	X	X	X		X		
MEWSS	X	X	X		X		
CESAS	X	X	X		X		
CREW			X		X		
CCS ³			X		X		
Naval (Surface) Electronic Attack							
SSEE	X	X	X		X		
Notes:							
1. Limited effects.							
2. No offensive jamming; ARM only.							
3. Ground-to-space electronic attack.							
Legend:							
ARM—antiradiation missile				EW—early warning			
CCS—Counter-Communications System				MEWSS—mobile electronic warfare support system			
CESAS—Communications Emitter Sensing and Attack System				SSEE—ship's signal exploitation equipment			
CREW—counter radio-controlled improvised explosive device electronic warfare				SAM—surface-to-air missile			
				TA—target acquisition			
				TT—target tracking			

Chapter V

CYBERSPACE EFFECTS

1. Cyberspace Operations

- a. Cyberspace operations use computer networks to deny, degrade, disrupt, destroy, or manipulate information resident in, or in transit between, computers and computer networks.
- b. Cyberspace operators are not located in the joint operations area. Their ability to create desired effects are not limited by physical separation. Physical separation may add complexity to synchronizing cyberspace effects and conventional forces.

2. Planning Considerations

- a. Approval and execution of cyberspace operations take time to coordinate and plan. When requesting cyberspace effects, planners should focus on the effect and not the means to produce it. Effects should be characterized using the deny, degrade, disrupt, destroy, or manipulate criteria as seen in JP 3-12, *Cyberspace Operations*.
- b. Most cyberspace operations units employ top secret/sensitive compartmented information communications for tactical C2.
 - (1) It is critical to establish the communications paths when planning to synchronize cyberspace effects with other operations.
 - (2) These communications paths should include a relay from radio to an operator with access to SECRET Internet Protocol Router Network (SIPRNET) or Joint Worldwide Intelligence Communications System (JWICS) Microsoft Internet relay chat (mIRC). If the relay is only to SIPRNET mIRC, a secondary relay from SIPRNET to JWICS is required.
- c. The joint tactical cyberspace request form is the primary method for tactical-level units to request cyberspace effects (see table 53). It can be found on the to United States Cyber Command (USCYBERCOM) request for support (RFS) portal.
 - (1) The joint tactical cyberspace request serves as a formal request to plan, schedule, execute, deconflict and assess cyberspace operations.
 - (2) Tactical units complete sections 1–3 and submit the request form 72 hours prior to execution via fire support channels.
 - (3) The request is routed to the joint task force (JTF). The JTF will either submit the RFS to USCYBERCOM (if delegated authority) or forward the RFS to the combatant command. RFS requests last for less than 90 days.
 - (4) USCYBERCOM reviews the RFS form and assigns it to the appropriate cyberspace component for strike package development, capabilities analysis, and force assignment.

Table 53. Joint Tactical Cyberspace Request	
1. Mission Request	Description of Request (Required)
Priority	[High] [Medium] [Low]
Cyberspace Operation Type	[OCO] [DCO] [DODIN] [cyberspace ISR/OPE]
Operation Information Security Officer	
Related Cyberspace Effects Request Format	
Requesting Organization	
2. Timing and Tempo	Description of Request (Required)
Planning	[Preplanned] [Immediate]
Schedule Type	[Scheduled] [Immediate]
Start By	mm/dd/yyyy hh:mm Z
Finish By	mm/dd/yyyy hh:mm Z
3. Effects Requested	Description of Request (Required)
Requested Effect	
Target/Threat Location	
Desired Effects	
Termination Criteria	
4. Cyberspace ISR/OPE Mission	Description of Request (Only required for cyberspace ISR and OPE missions)
Area of Operations	
ISR Reference Points	
Amplifying Information	
5. DCO Mission	Description of Request (Only required for DCO missions)
Threat	
Assessment Type	
Assessment Location	
Amplifying Information	
6. OCO Mission	Description of Request (Only required for OCO missions)
Intel Trigger (optional)	
IO Product (optional)	
Valid Targets	
Amplifying Information	
7. DODIN Mission	Description of Request (Only required for DODIN period of non-disruption missions)
Justification	
Locations Affected	
Amplifying Information	Provide a list of services and circuits
Legend: DCO—defensive cyberspace operations OCO—offensive cyberspace operations DODIN—Department of Defense information network OPE—operational preparation of the environment IO—information operations ISR—intelligence, surveillance, and reconnaissance	

d. Table 54 provides examples of targets that may be vulnerable to cyberspace effects.

Table 54. Systems, Components, and Elements Vulnerable to Cyberspace Effects			
Target System	Target Component	Target Element	Desired Effect
Integrated air defense forces	Early warning radar	Network	Manipulate, degrade, disrupt
	Support Facilities	Public-switched telephone network	Deny, disrupt
Electric power	Command and control	Supervisory control and data acquisition	Degrade, disrupt, destroy
	Distribution	Power substation	Deny, disrupt
Intelligence	Product dissemination	Phones	Deceive, degrade, disrupt
	Finance	Fund transfers	Deny, disrupt
Communications	Media tools	Web based	Deny, disrupt, manipulate

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Appendix A
CAPABILITIES AND COMMUNICATION EQUIPMENT

1. Capabilities and Communications Equipment

Tables 55–57 contain information regarding the relevant capabilities of listed aircraft.

Table 55. Fixed-wing Capabilities and Communications Equipment					
Aircraft	Ordnance	Sensor, Marking Capabilities	Data	Voice	Video Downlink⁶
AV-8B ¹	AGM-65, 2.75 inch rockets, 5 inch Zuni, 25 mm	LITENING ² , LUU-2/19, M257/278	VMF	2 VHF/UHF	Transmit C
A-10C ¹	AGM-65, 2.75 inch rockets, 30 mm	LITENING ² or SNIPER ² , LUU-2/19, M257/278, quickdraw	SADL, VMF, SA MODE	1 VHF/UHF/SATCOM, 1 UHF, 1 VHF	Transmit C
AC-130U	105 mm, 40 mm, 25 mm	MX-15, MTV, SAR, projectile impact predictions	Link 16, HPW, SA MODE, SADL	2 UHF, 3 VHF, 2 HF, 2 SATCOM	Transmit C Digital, Receive C
AC-130W	AGM-176, 30 mm, 105 mm, SDB I, Laser SDB	2 MX-20	SADL, HPW, ANW2, Gateway, SA MODE, Link 16	6 UHF/VHF, 4 SATCOM	UHF, L, S, C, Ku
AC-130J	AGM-176, 30 mm, 105 mm, SDB I, laser SDB, Hellfire	2 MX-20	SADL, Link 16 (J-voice), HPW, ANW2, KuKa, HARRIS SA, Vortex	2 UHF, 2 VHF, 5 multi-band (3 SATCOM)	UHF, L, S, C, Ku
B-1B ¹	JASSM, SDB	SNIPER ²	Link 16, JREAP-A	1 UHF/VHF/SATCOM, 1 UHF/SATCOM, 1 HF	Transmit C
B-2 ³	JDAM, GP, JASSM, EGBU, GBU-57	SAR, radar	Link 16, HPW	2 UHF/VHF/SATCOM, 1 HF	
B-52 ¹	CALCM, JASSM, MALD	SNIPER ² or LITENING ²	JREAP-A, VMF	4 UHF/VHF, 1 SATCOM HF	Transmit C
F-15E	Note 1, EGBU, JSOW, 20 mm	SNIPER ² or LITENING ² , SAR	Link 16	1 UHF/VHF, 1 SATCOM HF	Transmit C

Table 55. Fixed-Wing Capabilities and Communications Equipment (Cont'd)					
Aircraft	Ordnance	Sensor, Marking Capabilities	Data	Voice	Video Downlink ⁶
F-16 ¹	AGM-65, HARM, SDB, JASSM, 2.75 inch rockets, 20 mm	SNIPER ² or LITENING ² , HTS ⁴	Link 16 or SADL, IDM/IDT, SA MODE (Block 30), VMF (ANG only)	1 UHF/VHF/SATCOM, 1 UHF	Transmit C
F/A-18 ¹	AGM-65, AGM-84H/K, HARM, JASSM, 2.75 inch rockets, 5 inch Zuni, 20 mm	ATFLIR ² , LITENING ² , NIGHTHAWK (CF-18), LUU-2/19	Link 16, VMF	2 UHF/VHF	Transmit ATFLIR C ⁷ , LITENING C
F-22 ³	GBU-32, SDB	Radar	Link 16	1 UHF, 1 UHF/VHF	
F-35 ^{3,5}	LGB, JDAM, SDB, GBU-49, JSOW, 25 mm	DAS, SAR, GMTI	Link 16, VMF	1 UHF/VHF	
KC-130J Harvest Hawk	Hellfire, Griffin	TSS, LUU-2/19, PSS-SOF		2 UHF, 2 VHF, 2 HF	Transmit Ku; Receive L, S, C, Ku
MC-12		MX-15DiD (high drag)	Link 16, SADL, HPW, SA MODE	2 VHF only, 4 UHF/VHF/FM, 1 HF, 1 SATCOM	S, C, Ku
P-3 ³	AGM-65P, AGM-84H/K, CBU, GP	ASX-4, ASX-6, Star SAFIRE (high drag), SAR	Link 11	3 UHF, 1 VHF, 2 HF, 1 SATCOM	Transmit common data link, C, or Ku
P-8 ³	AGM-65P, AGM-84H/K, Mk-54, CBU, GP	APY-10, ALQ-218, AAS, MTI, SAR, ISAR	Link 16	2 UHF, 2 VHF, 1 HF, 1 SATCOM	Transmit C, Ku
U-28		MX-15, MTS-A	Link 16, SADL, HPW, ANW2, Gateway	6 UHF/VHF/SATCOM	UHF, L, S, C, Ku
GR-4 (UK) ³	LGB, GP, DMS Brimstone, 27 mm	LITENING ²	Link 16, VMF	1 UHF, 1 VHF-AM/FM	Transmit C
Typhoon (UK) ³	EGBU, GP Bombs, 27 mm	LITENING ²	Link 16	1 UHF, 1 VHF (AM only), 1 Tactical VHF	Transmit C
Sentinel (UK) ⁵		Wide area GMTI/SAR	Link 16	1 UHF/VHF, 1 SATCOM	Transmit C, Ku
Notes: 1. These aircraft can carry CBU, GP bombs, JDAM, LGB, laser JDAM. See individual aircraft manuals for specific information. 2. Not all aircraft with these pods have downlink capability. 3. These aircraft may not be SINGARS capable. 4. Block 40, 42, 50, or 52. 5. Listed ordnance is a postulated basic weapons capability. 6. Video downlinks are transmit and receive capable unless specified. 7. Analog only. 8. All aircraft listed in this table are HAVE QUICK II capable.					

Table 55. Fixed-Wing Capabilities and Communications Equipment (Cont'd)

Legend	
AAS—advanced aerial sensor	JASSM—joint air-to-surface standoff missile
AM—amplitude modulation	JDAM—Joint Direct Attack Munition
ANG—Air National Guard	JREAP—Joint Range Extension Applications Protocol
ANW2—Adaptive Networking Wideband Waveform	JSOW—joint standoff weapon
ATFLIR—advanced targeting forward-looking infrared	LGB—laser-guided bomb
CALCM—conventional air-launched cruise missile	MALD—miniature air-launched decoy
CBU—cluster bomb unit	mm—millimeter
DAS—distributed aperture system	MTI—moving target indicator
DMS—dual-mode seeker	MTV—mobile tactical video
EGBU—enhanced guided bomb unit	PSS-SOF—Precision Strike Suite-Special Operations Forces
FM—frequency modulation	SA—situational awareness
GMTI—ground moving target indicator	SADL—situation awareness data link
GP—general purpose	SAR—synthetic aperture radar
HARM—high-speed antiradiation missile	SATCOM—satellite communications
HF—high frequency	SDB—small diameter bomb
HPW—high-performance waveform (satellite communications)	SINCGARS—single-channel ground and airborne radio system
HTS—high-speed antiradiation missile targeting system	TSS—target sight system
IDM—improved data modem	UHF—ultrahigh frequency
IDT—interflight data transfer	UK—United Kingdom
ISAR—inverse synthetic aperture radar	VHF—very high frequency
	VMF—variable message format

Table 56. Rotary-wing Capabilities and Communications Equipment						
Aircraft	Ordnance		Sensor Marking Capabilities	Data	Voice ¹	Video Downlink ²
	Forward	Off-axis				
AH-1	Hellfire, APKWS, 2.75 inch, 5 inch rockets	20 mm	AH-1W: NTSU AH-1Z: TSS		2 VHF/UHF	Transmit L, S ³ ; Receive L/S/C ³
AH-6	Hellfire, 50 caliber, 7.62 mm, 2.75 inch rockets		AESOP FLIR		1 VHF-FM, 1 VHF-AM, 1 UHF/Sat-AM	
AH-64D AH-64E	Hellfire, APKWS, 2.75 inch rockets	30 mm	MTADS, MMW Radar	BFT, VMF Link 16 (AH-64E only)	2 VHF-FM, 1 VHF-AM, 1 UHF/SATCOM	Ku-TCDL; Receive: UHF, L, S, C, Ku
HH-60G		50 caliber, 7.62 mm	FLIR, LWIR, IZLID, DALS/quickdraw	SADL	2 VHF, 1 UHF/Sat-AM	
HH-60H	Hellfire	50 caliber, 7.62 mm	FLIR, IZLID	BFT	3 VHF/UHF/SATCOM	
MH-60L	Hellfire, 30 mm, 2.75 inch rockets	7.62 mm	AESOP FLIR		VHF-FM/AM UHF/Sat-AM	
MH-60R	Hellfire, APKWS	50 caliber, 7.62 mm	MTS, IZLID	Hawk-link, Link 16	2 VHF/UHF/SATCOM	Transmit Ku
MH-60S	Hellfire, APKWS, 20 mm, 2.75 inch rockets	50 caliber, 7.62 mm	MTS, IZLID, DALS/quickdraw	Link 16	2 VHF/UHF/SATCOM	Transmit S, C ³
SH-60B	Hellfire	50 caliber, 7.62 mm	FLIR	Hawk-link	2 VHF/UHF/SATCOM	
Tiger (EU, AUS)	Hellfire, APKWS, 2.75 inch rockets	30 mm	Roof-mounted sight (FLIR, DTV, LTD, LST), IZLID	Euro-grid	3 VHF/UHF/SATCOM 1 HF/Data	
UH-1Y	APKWS, 2.75 inch rockets	50 caliber, 7.62 mm	BRITE Star II		3 VHF/UHF/SATCOM ⁴	
Notes: 1. All aircraft in this table are HAVE QUICK II and SINGARS capable. 2. Video downlinks are transmit and receive capable unless specified. 3. Analog only. 4. SATCOM is demand assigned multiple access only.						
Legend: AESOP—Afloat Electromagnetic Spectrum Operations Program AM—amplitude modulation APKWS—Advanced Precision Kill Weapon System AUS—Australia BFT—blue force tracker DALS—downed aviator locator system DTV—day television EU—European Union FLIR—forward-looking infrared FM—frequency modulation HF—high frequency IZLID—infrared zoom laser illuminator designator LST—laser spot tracker LTD—laser target designator LWIR—long-wave infrared mm—millimeter MMW—millimeter wave MTADS—modernized target acquisition and designation sight MTS—multispectral target system NTSU—night targeting system upgrade SADL—situation awareness data link sat—satellite SATCOM—satellite communications SINGARS—single-channel ground and airborne radio system TCDL—tactical common data link TSS—target sight system UHF—ultrahigh frequency VHF—very high frequency VMF—variable message format						

Table 57. Unmanned Aircraft System Capabilities and Communication						
Aircraft ¹	Ordnance	Sensor Marking Capabilities	Data	Voice	Video Downlink ²	Altitude (feet)/ Endurance
MQ-1C ^{3,4}	Hellfire	EO, LLLTV, MWIR, LTD, LRF, SAR, GMTI, IR pointer	TCDL	VHF, UHF, SATCOM, HQ II, SINGGARS	C, Ku	2 k AGL–25 k MSL/ 25–40 hours
MQ-4C		EO, IR, MFAS, AIS	TCDL	VHF, UHF, SATCOM, CT		50–60 k MSL/ 31 hours
MQ-5B	GBU-44	EO, MWIR, LTD, LRF, IR pointer	TCDL	VHF, UHF, SATCOM, HQ II	C Digital	2 k AGL–18 k MSL/20 hours
MQ-8B		BRITE Star II, Vortex	TCDL	VHF, UHF, SATCOM	C Digital, Ku, CDL	2 k AGL–10 k MSL/4.5 hours
MQ-9 ³	Hellfire, GBU-12/49, GBU-38	MTS-B, SAR, GMTI	Link 16	VHF, UHF, SATCOM, HQ II, SINGGARS	C, Ku	2 k AGL–30 k MSL/ 14–17 hours
MQ-27A/B		EO, MWIR, IR Pointer			C	2 k AGL–19.5 k MSL/24+ hours
RQ-4		EO, IR, SAR, GMTI	TCDL	VHF, UHF, SATCOM, CT	C	50–58 k MSL/ 28 hours
RQ-7B v1/v2		POP-300D (EO, MWIR, LTD, LRF, IR pointer)	TCDL	VHF FM Relay, UHF ^{4,5} , Sat ^{4,5} , HQ II, SINGGARS	C	2 k AGL–16 k MSL/9 hours
RQ-11B ⁶		EO, MWIR		VHF, UHF ⁵ , SINGGARS	C	100–300 AGL/ 1.5 hours
RQ-12A ⁶		EO, MWIR		VHF, UHF ⁵ , SINGGARS	C	500 AGL/ 50 minutes
RQ-20B ⁶		EO, MWIR		VHF, UHF ⁵ , SINGGARS	C	500 AGL/ 2 hours
RQ-21A		EO, MWIR, LRF, IR pointer, AIS		UHF Relay, VHF ⁵ , UHF ⁵ , SATCOM ⁶ , SINGGARS	C Digital	2 k AGL–20 k MSL/16 hours
Notes: 1. All listed UAS are Rover 6 Capable. 2. Video downlinks are all transmit and receive capable. 3. The MQ-1/9 and Gray Eagle employ the K, M, N, P, P+, and R Hellfire variants. 4. The RQ-7B air vehicle has only VHF-FM capabilities. 5. The ground control station has these communication abilities. 6. Not Rover 4 or 5 capable.						
Legend: AGL—above ground level AIS—automated information system CDL—common data link CT—cipher text EO—electro-optical FM—frequency modulation GMTI—ground moving target indicator HQ—HAVE QUICK IR—infrared k—thousand LLLTV—low-light level television LRF—laser range finder LTD—laser target designator MFAS—multifunction active sensor MSL—mean sea level MTS—multispectral target system MWIR—mid-wavelength infrared SAR—synthetic aperture radar SATCOM—satellite communications SINGGARS—single-channel ground and airborne radio system TCDL—tactical common data link UAS—unmanned aircraft system UHF—ultrahigh frequency VHF—very high frequency						

2. Aircraft Sensor Capabilities

Table 58 contains aircraft sensor capabilities.

Table 58. Aircraft Sensor Capabilities					
Sensor	Spectrum	Platforms	Laser Target Designator	Laser Spot Tracker	IR Pointer
AN/AAS-44(V)	IR	MH-60R/S	Yes	No	No
AN/AAS-44C(V)2	IR, EO, LLLTV	SH-60B, HH-60H	Yes	No	Yes
AN/SZQ-2	IR, LLLTV, SWIR	MH-47G, MH-60M	Yes	Yes	Yes
AN/SZQ-3 (V)2	IR, LLLTV	A/H-6M	Yes	Yes ¹	Yes
ATFLIR	IR, CCD	F/A-18 ²	Yes	Yes	Yes
BRITE Star II	IR, CCD	UH-1Y	Yes	No	Yes
LITENING	IR, CCD	AV-8B, A-10C, B-52/H, F-16, F/A-18 (USMC)	Yes	Yes	Yes
MTADS	IR, DTV	AH-64D/E	Yes	Yes	Yes
MTS-A/B	IR, EO, LLLTV, SWIR	MQ-1C, MQ-9	Yes	No	Yes
MX-15Di	IR, CCD, SWIR	H-6, P-3, AC-130U, King Air variants, Lynx, Wildcat	Yes	Yes	Yes
MX-20	IR, CCD, SWIR	P-8A, P-3, AC-130W/J ³	Yes	No	Yes
NTS/NTSU	IR, DVO, CCD	AH-1W	Yes	No	No ⁴
SNIPER	IR, CCD	A-10C, B-1B, F-15E	Yes	Yes	Yes
TSS	IR, CCD	AH-1Z, KC-130J	Yes	No	Yes
TFLIR AN/AAQ-40	IR	F-35A/B/C	Yes	Yes	No
Notes: 1. The AN/SZQ-3 fielded on some A/H-6Ms has only an LTD and IR pointer. 2. USN and CVN based USMC F/A-18s only. 3. AC-130W and AC-130J have two MX-20 EO and IR sensors and do not have LST. 4. The IR pointer is not boresighted to laser, EO, or IR for AH-1W helicopters.					
Legend: ATFLIR—advanced targeting forward-looking infrared CCD—charge-coupled device CVN—aircraft carrier, nuclear DTV—day television DVO—direct-view optics EO—electro-optical IR—infrared LLLTV—low-light level television LST—laser spot tracker LTD—laser target designator					
MTADS—modernized target acquisition and designation sight MTS—multispectral target system NTS—night targeting system NTSU—night targeting system upgrade SWIR—short-wave infrared TFLIR—targeting forward-looking infrared TSS—target sight system USMC—United States Marine Corps USN—United States Navy					

3. Spectrum Usage for Sensors, Weapons, and Marking Devices

Figure 13 depicts spectrum usage by sensors, weapons, and marking devices.

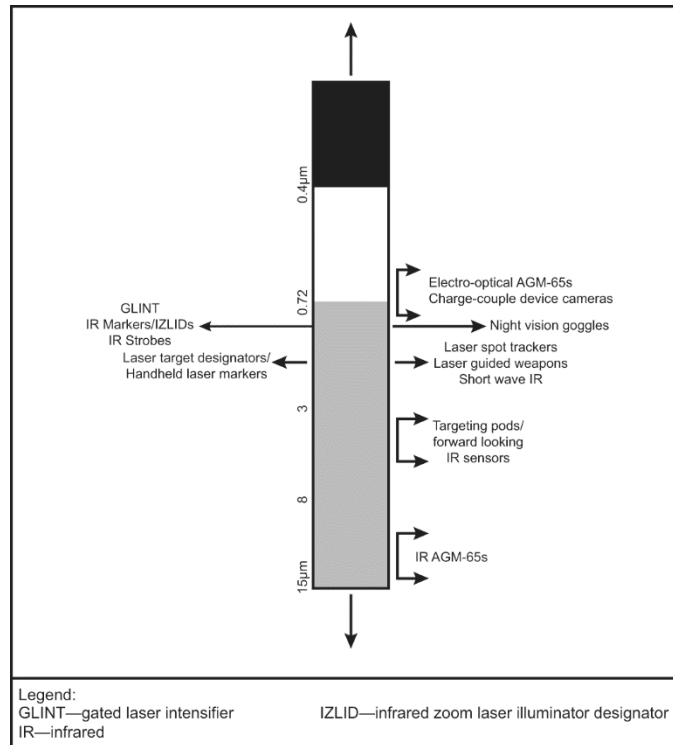


Figure 13. Spectrum Usage for Sensors, Weapons, and Marking Devices

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Appendix B BREVITY

Brevity terms ease coordination and improve understanding during multi-Service operations. A brevity code provides no security but which has as its sole purpose the shortening of messages rather than the concealment of their content. Tables 59–67 contain brevity terms grouped by tactics and are relevant to the fire support mission. For the complete listing of all multi-Service brevity terms refer to Army Techniques Publication (ATP) 1-02.1, Marine Corps Reference Publication (MCRP) 3-30B.1, Navy Tactics, Techniques, and Procedures (NTTP) 6-02.1, Air Force Tactics, Techniques, and Procedures (AFTTP) 3-2.5, *Multi-Service Tactics, Techniques, and Procedures for multi-Service Brevity Codes*.

Table 59. Key to Appendix B	
*	Meaning may differ from North Atlantic Treaty Organization (NATO) brevity word.
**	Not a NATO brevity word.
[NATO]	Brevity words not used by United States forces but may be encountered in combined operations (Allied Procedural Publication (APP)-7[E]) or communications.
[A/A]	Brevity code meaning applies to air-to-air (A/A) operations or communications.
[A/S]	Brevity code meaning applies to air-to-surface (A/S) operations or communications.
[S/A]	Brevity code meaning applies to surface-to-air (S/A) operations or communications.
[S/S]	Brevity code meaning applies to surface-to-surface (S/S) operations or communications.
[EW]	Brevity code meaning applies to electronic warfare (EW) operations or communications.
[AIR-MAR]	Brevity code meaning applies to maritime air (AIR-MAR) operations or communications.

Table 60. General Brevity Terms	
Term	Definition
ANCHOR [location]	1. Orbit about a specific point. 2. Refueling track flown by tanker.
ANGELS	Height of FRIENDLY aircraft in thousands of feet from mean sea level (MSL).
AS FRAGGED	*Unit or element will perform exactly as briefed.
AUTHENTICATE	Coded challenge/response to coded challenge.
[number, weapon type] AWAY	[A/S] [S/A] Release or launch of specified weapon at designated target (e.g., 1 AWAY, 2 PIGS AWAY, BIRDS AWAY, etc.). At minimum number or weapon type required. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">NOTE</p> <p>Include the launch location in BULLSEYE format and weapons track direction when appropriate.</p> </div>
BASE [+/- number]	Reference number used to indicate such information as headings, altitude, fuels, etc.
BRACKET [direction]	[A/A] [A/S] Maneuver to a position on opposite sides, either laterally or vertically from the target.
BULLDOG	*[S/S] FRIENDLY surface or submarine launched antiship missile.
CEASE [activity]	**Discontinue stated activity; e.g., CEASE BUZZER, CEASE LASER, CEASE SPARKLE.
CHATTERMARK [communication type]	Begin using briefed communication procedures to counter communications jamming. If no modifier is specified, "radio" is understood.
CHERRY	*[A/S] [S/A] [A/A] Informative call from ISR or close air support platform to the inbound aircraft that the LZ/DZ has enemy activity above the prebriefed risk tolerance of the ground force commander. Opposite of, and cancels, ICE.
CHERUBS	Height of a FRIENDLY aircraft in hundreds of feet above surface.
CLEARED HOT	1. [A/S] Type 1 and 2 close air support terminal attack control clearance to release ordnance on this pass. 2. [A/S] Training range operations: the range control officer or range safety officer authorizes ordnance release.

Table 60. General Brevity Terms (Cont'd)	
Term	Definition
CLEARED TO ENGAGE	<p>1. **[A/S] Type 3 close air support, terminal attack control clearance. Attack aircraft or flight may initiate attacks within the parameters imposed by the joint terminal attack controller.</p> <p>2. **[A/A] [A/S] Clearance to fire on designated GROUP or target.</p>
CONTINUE	Continue present maneuver. This does not imply a change in clearance to engage or expend ordnance.
CONTINUE DRY	<p>[A/S] Continue present maneuver, ordnance release not authorized. Used to provide approval to aircraft to continue the pass without expending ordnance during type 1, 2, or 3 control. (The joint terminal attack controller must use "Type 3, CONTINUE DRY" for dry type 3 control.)</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">NOTE</p> <p>Simulated weapons deliveries may be performed.</p> </div>
DANGER CLOSE	<p>**[A/S] [S/S] FRIENDLY troops are within 0.1% probability of incapacitation from the target (determined by the weapon or munition that is delivered or fired).</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">NOTE</p> <p>Specific DANGER CLOSE distances, assumptions, and procedures are contained in appendix H.</p> </div>
ENGAGEMENT COMPLETE	[A/S] Mandatory call from the attack aircraft to the joint terminal attack controller or forward air controller, during type 3 close air support terminal control, indicating completion of ordnance release. See also CLEARED TO ENGAGE.

Table 60. General Brevity Terms (Cont'd)	
Term	Definition
FARM	**[A/S] Helicopter status of fuel (expressed in PLAYTIME), ammunition, rocket, and missile (e.g., "Taz 31, FARM 2+00, 300, 14, 4"). See WHAT STATE.
GREEN	<p>1. [A/A] [A/S] [AIR-MAR] Direction of no known enemy threats requires [direction] modifier.</p> <p>2. [A/A] [A/S] [AIR-MAR] Aircraft is at a weapon or fuel state that allows continued execution of the mission.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;">NOTE</p> <p>A specific loadout or fuel state should be determined during mission planning.</p> </div>
ICE	*[A/S] [S/A] [A/A] Informative call from an ISR or close air support platform to the inbound aircraft that the LZ/DZ has enemy activity above the prebriefed risk tolerance of the ground force commander. Opposite of, and cancels, CHERRY.
IN [direction]	<p>1. [A/A] Turning toward a known threat. Opposite of OUT.</p> <p>2. [A/S] Entering terminal phase of an air-to-ground attack. Opposite of OFF.</p>
[status] LIGHT	<p>**[S/A] Mission status.</p> <p>**(RED): Prebriefed threats have not been mitigated for further mission execution. Aircraft should evaluate their position relative to the threat and take appropriate actions.</p> <p>**(YELLOW): Designated assets can continue to operate relative to the prebriefed threat while other assets should continue to hold.</p> <p>**(GREEN): All aircraft are cleared to execute prebriefed missions.</p>
LOWDOWN	**A request for the tactical ground picture in an area of interest.
MINIMIZE	The radio frequency is becoming saturated, degraded, or jammed and briefer transmissions must follow.
OFF [direction]	[A/A] [A/S] Attack is terminated, and aircraft maneuvering to the indicated direction.

Table 60. General Brevity Terms (Cont'd)	
Term	Definition
OFFSET [direction]	Maneuver in a specified direction with reference to the target.
PIG(S)	[A/S] FRIENDLY glide weapon(s) (e.g., joint standoff weapon (JSOW)). See [number, weapon type] AWAY.
PLAYTIME	Amount of time aircraft can remain on station, given in hours plus minutes (e.g., ONE PLUS THIRTY equals 1 hour and 30 minutes).
[frequency] POGO [frequency]	Switch to communication channel number preceding POGO. If unable to establish communications, switch to channel number following POGO. If no channel number follows POGO, return to this channel.
RED	<p>*[A/A] [A/S] [AIR-MAR] Aircraft is at a weapon or fuel state that is insufficient to continue execution of the mission.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">NOTE</p> <p>A specific loadout or fuel state should be determined during mission planning.</p> </div>
REDWOOD	<p>**[S/A] An informative or directive call to initiate (HOT) or cease (COLD) the integration of FRIENDLY S/A fires into a fighter or joint engagement zone without further coordination. Must include modifier HOT or COLD.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p style="text-align: center;">NOTE</p> <p>Friendly aircraft are expected to maintain an appropriate stand off following a REDWOOD HOT call, unless the acceptable level of risk permits otherwise.</p> </div>
REMINGTON	**[A/A] [A/S] No ordnance remaining except gun or self-protect ammunition.
RENEGADE	A civil platform that is assessed as operating in such a manner as to raise suspicion that it might be used as a weapon.

Table 60. General Brevity Terms (Cont'd)	
Term	Definition
RESET	[A/A] [S/A] Proceed to a prebriefed position or area of operations.
RETROGRADE (ING)	*Withdraw(ing) while executing defensive procedures in response to a threat.
RIFLE [number, time]	*[A/S] [AIR-MAR] FRIENDLY A/S missile launch. Option to add follow-on modifiers for the number of munitions or time of flight. <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p style="text-align: center;">NOTE</p> <p>Include launch location in the BULLSEYE format and weapons track direction, when appropriate.</p> </div>
RIPPLE	[A/S] [S/A] [AIR-MAR] Two or more munitions will be released or fired in close succession. Associated with number and type of weapon with release interval. (Normally discussed during the prestrike gameplan between aircraft or between aircraft and ground tactical controller.)
SAM [direction]	Visual acquisition of an S/A missile in flight or a S/A missile launch; should include position.
SHOPPING	[A/S] An aircraft request to the forward air controller or joint terminal attack controller or command and control platform for a target or task.
SHOT	**[S/S] Round(s) has(ve) been fired.
SHREW	**Persistent interference from an undetermined source that is degrading situational awareness on the current radio channel.
SKUNK	*[A/S] [AIR-MAR] A maritime or ground CONTACT that has not been identified.
SLAPSHOT [type, bearing]	[A/S] [EW] Immediately employ a best available antiradiation missile against a specified threat at the specified bearing.
SNIPER [type, location (range, bearing)]	[A/S] [EW] Aircraft to employ a range-known antiradiation missile against a specified threat at the specified location.

Table 60. General Brevity Terms (Cont'd)	
Term	Definition
SORT	1. [A/A] Assignment of responsibility within a GROUP; criteria can be met visually, electronically (i.e., radar), or both. 2. **[A/S] Assignment of specific targeting responsibilities.
SORTED	[A/A] [A/S] [AIR-MAR] Sort responsibility within a GROUP has been met.
SPLASH(ED)	1. *[A/A] [S/A] Target destroyed. 2. [A/S] Weapons impact. 3. *[S/S] [S/A] Informative call to observer or spotter 5 seconds prior to estimated time of impact.
SUNSHINE	[A/S] Illuminating a target with artificial illumination.
WAGON [left/right]	**[A/S] Rotary wing directive call to orbit around the target (e.g., "Taz 31, WAGON left").
WEAPONS [status]	**Weapons control status. Fire only: 1. ** (FREE): at targets not identified as FRIENDLY in accordance with current ROE. 2. ** (TIGHT): at targets positively identified as HOSTILE in accordance with current ROE. 3. ** (HOLD/SAFE): in self-defense or in response to a formal order.
WINCHESTER	No ordnance remaining.
YELLOW	**[A/A] [A/S] [AIR-MAR] Aircraft is at a weapon or fuel status that is approaching a level insufficient to continue executing the mission. <div style="border: 1px solid black; padding: 10px; margin-top: 10px;"> <p style="text-align: center;">NOTE</p> <p>A specific loadout or fuel state should be determined during mission planning.</p> </div>
Legend: DZ—drop zone EW—electronic warfare ISR—intelligence, surveillance, and reconnaissance LZ—landing zone ROE—rules of engagement	

Table 61. Marking Brevity Terms	
Term	Definition
BLIND	No visual contact with FRIENDLY aircraft, ship or ground position. Opposite of VISUAL.
CONTACT	1. Sensor information at the stated position. 2. [A/S] Acknowledges sighting of a specified reference point (either visually or via sensor). 3. [A/A] Individual radar return within a GROUP or ARM.
LOOKING	[A/S] [AIR-MAR] Aircrew does not have the ground or surface object, reference point, or target in sight (opposite of CONTACT).
MARK	1. Record the location of a point or object of interest. 2. **[A/S] [S/S] Spotting round, white phosphorus or illumination on the deck to indicate targets to aircraft, ground troops, or fire support. 3. **[A/A] Challenge and response term for requested aircraft to report contrails.
NO JOY	*[A/A] [A/S] [S/A] Aircrew does not have visual contact with the TARGET or BANDIT. Opposite of TALLY.
OCCUPIED	[A/S] Ground equipment present at tasked target location. Opposite of VACANT.
PADLOCKED	Aircrew cannot take eyes off an aircraft, ground target, or surface position without risk of losing TALLY or VISUAL.
SMOKE	[A/S] Smoke marker used to mark a position.
TALLY	Sighting a target, nonfriendly aircraft, or enemy position. Opposite of NO JOY.
VACANT	[A/S] Ground equipment not present at a specific or tasked target location. Opposite of OCCUPIED.
VISUAL	Sighting of a FRIENDLY aircraft or ground position or ship. Opposite of BLIND.

Table 62. Laser Brevity Terms	
Term	Definition
BUDDY [LASE or GUIDE]	*[A/S] Request or informative communications to have guidance of a weapon from a source other than the delivering aircraft.
DEADEYE	The laser designator system is inoperative.
LASER ON	[A/S] [S/S] Directive call to start lasing.
LASING	[A/S] [S/S] The speaker is firing the laser in response to LASER ON.
NEGATIVE LASER	[A/S] Laser energy has not been acquired.
SHIFT [direction, track number]	<p>*[A/S] [AIR-MAR] Shift laser, infrared, radar, device, energy, or aimpoint.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">NOTE</p> <p>This can be used to shift from the offset position onto the target. Also, it is used during multi-aircraft attack to shift laser energy or target assignments.</p> </div>
SPOT	<ol style="list-style-type: none"> 1. [A/S] Acquisition of laser designation. 2. Platform is laser spot tracker capable.
STARE [laser code, reference point]	**Cue the laser spot search or tracker function on the specified laser code in relation to the specified reference point. The reference point may include the following: steerpoint, geographic reference, bearing and range, or data link point.
TEN SECONDS	[A/S] Standby for LASER ON call in approximately 10 seconds.

Table 63. Infrared Brevity Terms	
Term	Definition
MATCH [type]	*[A/S] [AIR-MAR] [S/S] Overlay requested target designator type (e.g., MATCH SPARKLE, MATCH LASER).
PULSE	*Illuminate(ing) a position with flashing infrared energy.
ROPE	[S/A] Circling an infrared pointer around an aircraft to help the aircraft identify the FRIENDLY ground position. <div style="border: 2px solid black; padding: 10px; text-align: center;">WARNING This technique may damage night vision devices.</div>
SNAKE	*[A/S] Oscillate an infrared pointer in a figure eight about a target.
SPARKLE	1. [A/S] [S/S] Mark or marking target by infrared pointer. 2. Platform is infrared pointer capable.
STEADY	[A/S] Stop oscillation of infrared pointer.
Note: The brevity terms listed in this table amplify the infrared communications in Army techniques publication (ATP) 1-02.1, Marine Corps reference publication (MCRP) 3-30B.1, Navy tactics, techniques and procedures (NTTP) 6-02.1, Air Force tactics, techniques, and procedures (AFTTP) 3-2.5, <i>MTTP for Multi-Service Brevity Codes</i> .	

Table 64. Video Downlink and Remote Video Terminal Brevity Terms	
Term	Definition
CHECK CAPTURE	Target appears to be no longer tracked by sensor.
CHECK FOCUS	Sensor image appears to be out of focus.
DECLUTTER	[A/S] Authoritative request for the pilot or operator to remove targeting symbology to allow the user to see a better picture of the target area.
HANDSHAKE	1. Link 16 Air Control network participation group (NPG) initiation between the air control unit and controlled aircraft. 2. [A/S] Video data link established.
HOLLOW	1. Any data link message not received. 2. *[A/S] Lost video data link.
RESTAKE	[A/S] Drive a new STAKE at the target centroid reported with direction of travel and elevation. Initiated by the aircrew.
ROVER	Platform is ROVER video downlink capable.

Table 64. Video Downlink and Remote Video Terminal Brevity Terms (Cont'd)	
Term	Definition
SET	<ol style="list-style-type: none"> 1. Set (or have set) a particular speed. May be indicated in knots or mach. 2. No longer slewing sensor and awaiting further updates. 3. **Overwatch aircraft is in position.
SHADOW	Follow indicated TARGET.
SLEW	**Move the sensor in the direction indicated (accompanied with a unit of measure). For example, "SLEW left one half screen."
STAKE	<ol style="list-style-type: none"> 1. *[A/S] Reference point for A/S targeting operations. 2. *A full-motion video system mark has been set and is used as a frame of reference.
SWITCH [item]	<ol style="list-style-type: none"> 1. **Switch the setting on the referenced item. 2. **(CAMERA) Switch full-motion video to electro-optical or infrared. 3. (POLARITY) Switch infrared polarity to black hot or white hot.
ZOOM (in/out)	<p>*[EW] Increase or decrease the sensor's focal length.</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <p style="text-align: center;">NOTE</p> <p>"ZOOM in/out" is followed by "ONE, TWO, THREE, or FOUR" to indicate the number of fields of view to change.</p> </div>

Table 65. Sensor Tasking Brevity Terms	
Term	Definition
[target or object] CAPTURED	*[A/S] Specified surface target or object has been acquired and is being tracked with an onboard sensor.
DROP(PING)	<ol style="list-style-type: none"> 1. [A/A] [A/S] Stop or stopping monitoring of specified emitter or target or GROUP and resume(ing) search responsibilities. 2. (TRACK number) Remove the emitter or target from the tactical picture or track stores. 3. [EW] Remove a specific system or electronic order of battle category from search responsibilities.

Table 65. Sensor Tasking Brevity Terms (Cont'd)	
Term	Definition
MELD	<ol style="list-style-type: none"> 1. *[A/A] Bias radar coverage in accordance with briefed parameters. 2. *[A/A] Shift radar responsibilities from sanitizing to gaining situational awareness on the assigned GROUP. 3. [A/S] [AIR-MAR] Directive call to another aircraft to match the sensor location.
MONITOR (ING) [GROUP or object]	<ol style="list-style-type: none"> 1. *[A/A] [A/S] Maintain(ing) sensor awareness on specified GROUP or object. Implies tactically significant changes will be communicated. 2. *[AIR-MAR] Maintain contact or targeting information on a maritime surface contact.
MOVER(S)	Unidentified surface vehicle(s) in motion.
POPEYE	<ol style="list-style-type: none"> 1. Flying in clouds or an area of reduced visibility. 2. Reduced electro-optical or infrared visibility due to atmospheric.
[type] POSTURE	**[A/S] Communicates sensor posture type (offensive, defensive, or neutral) by the joint terminal attack controller to assets. Does not imply the FRIENDLY ground forces' tactical situation.
SCAN	*[A/S] Search sector indicated and report any CONTACTS.
SLANT	**Refers to the number of people or objects noted at a specified location (men/women/children). For example, in response to a request for SLANT on a target building: "SLANT 4/6/4."
SQUIRTER	**[A/S] [S/S] A ground-borne object of interest departing the objective area.
STATUS [phase]	<ol style="list-style-type: none"> 1. [A/A] Request for an individual's tactical situation. 2. **[A/A] [A/S] Directive call requesting amplifying information on current task or aircraft state. For example, respond with WORKING, JONESING, VOID, CONTACT, CAPTURE, TARGETED, LOCKED, CLEAN, ENGAGED, FUEL (RED/YELLOW/GREEN), WEAPON (RED/YELLOW/GREEN) ready or plain English.

Table 65. Sensor Tasking Brevity Terms (Cont'd)	
Term	Definition
TRACK [direction]	<ol style="list-style-type: none"> 1. **[A/A] GROUP's or CONTACT's direction of flight or movement. 2. **[A/S] [S/S] Directive call assigning responsibility, to maintain sensors or visual on a defined object or area, to an asset. 3. **[A/S] Rotary-wing directive call to establish race track (e.g., "Taz 31, TRACK left"). 4. **[A/S] [AIR-MAR] Information call stating direction of vehicle or CONTACT in motion (e.g. TALLY TECHNICAL TRACK Northwest).
TRACKING	**[EW] [S/A] infrared lock-on.

Table 66. Digitally Aided Close Air Support Brevity Terms	
Term	Definition
AUTOCAT	Any communications relay using automatic retransmissions.
CANTCO	Aircrew selected digital reply to a received digital tasking advising UNABLE.
CHECK DATA [source]	Specify a medium for message traffic (e.g., J28.2).
CHECK TIDS	** Directive or descriptive call to reference a data link display and may be followed by amplifying information.
DATA [object, position]	Data link message concerning an object at stated location.
DONORIZE(D)	** Aircraft data has been input into the host aircraft as a flight, team, or donor to enable target or data sharing among tactical data link participants.
FOREST	** Variable message format network.
INDEX	** Unique number assigned to a tactical data link J12.6 message to differentiate between more than one POINT or MARKPOINT (e.g., "SCREWTOP 23, POINT INDEX 2 is disabled vehicle").
JACKAL	Surveillance network participation group of Link 16 tactical digital information link-J.
KICK [appropriate frequency]	*Change radio or data link to a specified net or frequency, used for an unplanned change in frequency (e.g. CHATTERMARK). Also see PUSH.

Table 66. Digitally Aided Close Air Support Brevity Terms (Cont'd)	
Term	Definition
MARKPOINT	Data link nondesignated geographic point of interest (J12.6 subsystem identification number (SID) 9 message).
[type] POINT	Data link sensor point or track of interest, such as the J12.6 SID 10 data link message. **CONTACT POINT: Indicates the aircraft has acquired the track of interest TRACK NUMBER on their data link. **DROP POINT: Data link target sorting message is no longer needed or desired. **HOLD POINT: Maintain weapons quality track data. **SHOOT POINT: Directive call to shoot datalink targeting message does not imply targeting responsibility. **TARGET POINT: Target the referred data link target sorting message (e.g., "Iron 4, TARGET Iron 1's POINT").
SKIP IT	Directive call for a specific platform not to engage the indicated track, followed with further directions.
SOUR	(Opposite of SWEET). 1. (Mode/type) [A/A] [S/A] Invalid or no response to an administrative identification, friend or foe, or selective identification feature check. 2. (Link name) (e.g., "TIMBER SOUR") Potential problems with net entry; initiates premission link troubleshooting.
SWEET	(Opposite of SOUR; cancels SICK, BENT). 1. (Mode, type) [A/A] [S/A] Valid response to an administrative identification, friend or foe or selective identification feature check request. 2. (Link name) (e.g., TIMBER SWEET) Confirms receipt of data link information. 3. Indicated equipment is operating efficiently.
TIMBER	[E/W] Link 16 Network.
TIMBER CHANNEL	Stacked net within a Link 16 Network.
TRACK NUMBER [number]	Data link information file.
ZAP	Request for data link information.

Table 67. Electronic Warfare Brevity Terms	
Term	Definition
BAY	*[EW] Carry out the indicated deception plan or in accordance with previous orders.
BUZZER	<p>**[EW] Electronic communications jamming.</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p style="text-align: center;">NOTE</p> <p style="text-align: center;">Same as NATO term, CHATTER.</p> </div>
CANYON	[EW] Use electronic jamming on the indicated radar frequency or in accordance with previous orders or make an informative call for executing the electronic attack (EA) list or EA against the designated group.
CLAM	<p>1. *[EW] Cease emissions on specified equipment.</p> <p>2. [EW] Directive or informative call that jamming has stopped on the current assignment. Assumed when COLD.</p>
JAM	[EW] Directive call to initiate jamming.
MUSIC	*[A/A] Radar electronic deceptive jamming.
POND	*[EW] Carry out the jamming plan indicated or in accordance with previous orders.
SEAD	[A/S] Directive call to execute prebriefed suppression of enemy air defense contracts.

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Appendix C LASER OPERATIONS

1. Laser Designation Zones

Figure 14 depicts the optimal laser designation attack zones and safety zone.

2. Rotary-wing Hellfire Designator Safety Zone

- a. See figures 15 and 16 for rotary-wing Hellfire designation depictions.
- b. Within 30 degrees of the shooter aircraft's line of fire (in the Hellfire designator safety zone), the missile may track and impact an obstruction (e.g., trees, grass, hills) near the designator operator if it is accidentally illuminated by the laser beam.
- c. The designator shall have a clear, unobstructed line of sight to the target. Take care to ensure the designator line of sight is unobstructed across the entire path of a moving target during the time of missile flight to impact.
- d. Airborne designators must ensure they are outside the Hellfire designator safety zone, per figure 16.

WARNING

Infrared (IR) pointers or laser sources should not be used as the sole source for target marking or verification. Attack aircraft may confuse an IR pointer or laser energy source with the intended target. When using IR pointers or lasers to mark a target, include "IR POINTER" or "LASER" in the marks portion (line 7) of the close air support briefing. Joint terminal attack controllers (JTACs) also should provide the pointer-target-line or laser-target-line in degrees magnetic from the energy source to the target. JTACs should use a discrete target mark whenever possible.

CAUTION

To minimize the possibility of laser guided weapons tracking to the laser source, laser target designator lenses should be clean and as free from obscuration as practical.

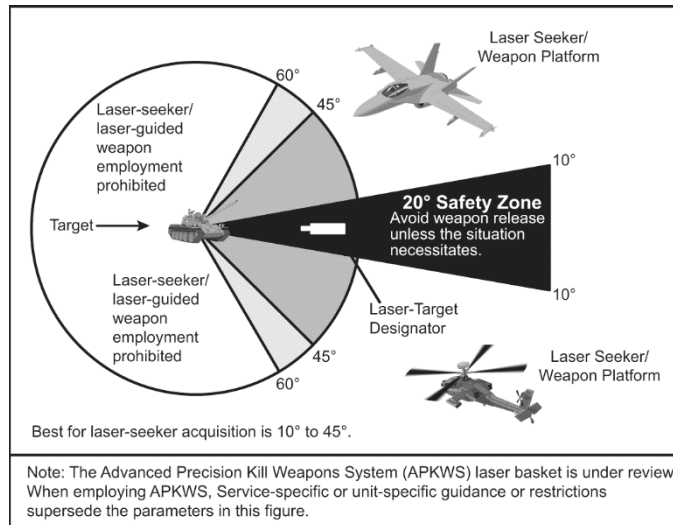


Figure 14. Laser Designation and Optimal Attack Zones

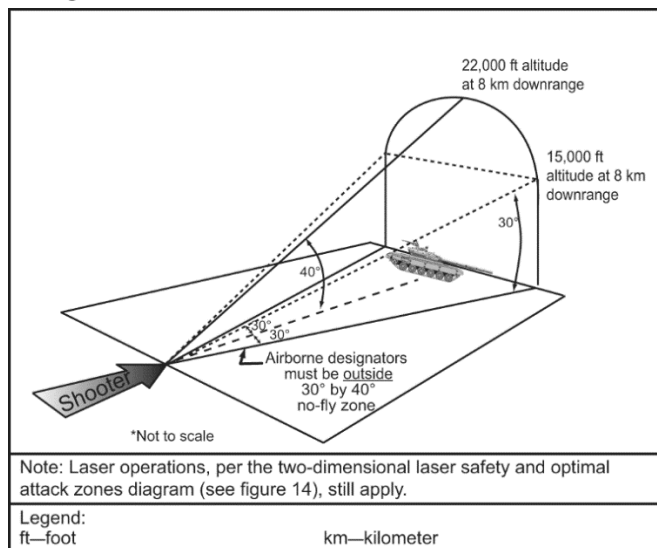


Figure 15. Rotary-wing Hellfire Designator Three-dimensional View

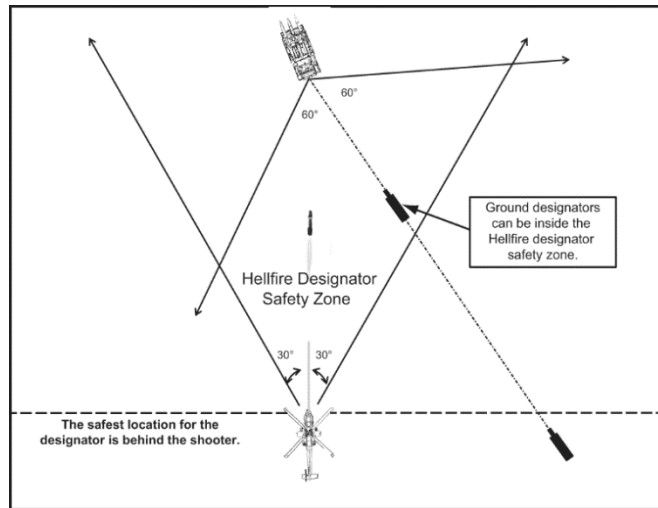


Figure 16. Hellfire Designation Two-dimensional View

3. Laser Communications Examples

The following paragraphs provide examples for their recommended brevity terms used during laser operations. The brevity code clarification is found in Appendix B, Brevity.

a. Example 1. Ground or airborne based delay lase for a fixed-wing (FW) delivered laser-guided bomb (LGB).

(1) Assumption 1: The attacking aircraft is delivering the LGB BOC, target location and laser coordination conducted as part of the attack brief, and the laser designator is guiding the LGB with a delay lase.

(2) Assumption 2: The attacking aircraft's call sign is Viper 11 and the laser designator's call sign is Lightning 33. The weapon time of flight (TOF) is 30 seconds and the laser code is 1688.

(a) Laser designator: "Lightning 33, CAPTURED, 1688 SET".

(b) Attacking aircraft: "Viper 11, 1 AWAY, 30 seconds".

(c) Attacking aircraft: "Viper 11, 10 seconds".

(d) Attacking aircraft: "Lightning 33, LASER ON".

(e) Laser designator: "Lightning 33, LASING 1688".

(f) When weapon impact is observed, laser designator: "SPLASH".

b. Example 2. Ground or airborne based, continuous lase for a FW delivered LGB.

(1) Assumption 1: The attacking aircraft is delivering the LGB bomb on coordinate (BOC). The target location and laser code coordination were conducted as part of the attack brief and the laser designator is guiding the LGB with a continuous lase.

(2) Assumption 2. The attacking aircraft's call sign is Viper 11 and the laser designator's call sign is Broadsword 22. The weapon TOF is 30 seconds and the laser code is 1688.

- (a) Laser designator: "Broadsword 22, CAPTURED, 1688 SET".
- (b) Laser designator: "Viper 11, proceed inbound heading 300-330, laser-to-target line (LTL) 340, call for LASER".
- (c) Attacking aircraft: "Viper 11, 10 seconds".
- (d) Attacking aircraft: "Viper 11, 1 AWAY, 30 seconds, Broadsword 22 LASER ON".
- (e) Laser designator: "Broadsword 22, LASING 1688".
- (f) When weapon impact is observed, laser designator: "SPLASH".
- (g)

c. Example 3. Laser handoff.

(1) Assumption 1: The target location has been coordinated.

(2) Assumption 2: The laser designator's call sign is Broadsword 22 and Viper 11 is the aircraft receiving the laser handoff. The laser code is 1688.

- (a) Laser designator: "Viper 11, proceed inbound heading 300-330, LTL 340, call for LASER".
- (b) Aircraft receiving laser handoff: "Viper 11, 10 seconds".
- (c) Aircraft receiving laser handoff: "Broadsword 22, LASER ON".
- (d) Laser designator: "Broadsword 22, LASING 1688".
- (e) Aircraft receiving laser handoff: "Viper 11, SPOT" (add "CEASE LASER" if designation is complete).
- (f) Aircraft receiving laser handoff: "Viper 11, CEASE LASER" when designation is complete (if not completed with the "SPOT" call).
- (g) Aircraft receiving laser handoff: "Broadsword 22, CEASE LASER".

Appendix D
AIRCRAFT-DELIVERED MUNITIONS DESCRIPTIONS

1. Unguided Bombs

- a. Mk-82/BLU-111: 500-pound (lb) general purpose (GP) bomb. BLU-111 uses a thermally protected body. Effects: blast, fragmentation, and limited cratering.
- b. BLU-126: 500 lb, thermally protected, low collateral damage bomb (LCDB) (6% explosive fill of BLU-111). Effects: Limited blast and fragmentation.
- c. BLU-129: 500 lb, very low collateral damage, precision lethality bomb. Carbon-fiber composite for low fragmentation with a multiphase blast explosive for high lethality. It is the explosive equivalent of a Mk-82.
- d. Mk-83/BLU-110: 1,000 lb GP bomb. BLU-110 uses a thermally protected body. Effects: blast, fragmentation, and cratering.
- e. BLU-109: 2,000 lb, penetrator, protected, GP bomb. Effects: cratering and hard-target penetration.
- f. Mk-84/BLU-117: 2,000 lb GP bomb. BLU-117 uses a thermally protected body. Effects: blast, fragmentation, and cratering.

2. Guided Bombs

- a. Inertially Aided Munitions (IAMs). These are precision, all weather, inertial navigation system (INS)/Global Positioning System (GPS)-guided bombs that use an onboard INS. GPS inputs to the INS reduce the munition's INS drift during time of flight to reduce the miss distance.

Note: In a contested, degraded, and operationally limited environment, GPS signals may be degraded or denied. In these circumstances, GPS-aided INS munitions are capable of using only their INS (no GPS inputs) which may reduce accuracy. The magnitude of accuracy degradation depends on munition type and weapon time of flight.

- b. Weapons Used Against Stationary Targets. Depending on the attacking platform, multiple IAMs may be dropped on the same or different targets in a single pass.
 - (1) GBU-31 (v)1 Joint Direct Attack Munition (JDAM) with a Mk-84 bomb body.
 - (2) GBU-31 (v)2: JDAM is identical to the (v)1 with a BLU-117 bomb body.
 - (3) GBU-31 (v)3: JDAM with a BLU-109 bomb body.
 - (4) GBU-31 (v)4: JDAM is identical to the (v)3 for use by the United States Navy (USN) and United States Marine Corps (USMC).
 - (5) GBU-32 (v)1: JDAM with a Mk-83 bomb body.
 - (6) GBU-32 (v)2: JDAM is identical to the (v)1 with a BLU-110 bomb body.
 - (7) GBU-38 (v)1: JDAM with a Mk-82 bomb body.

- (8) GBU-38 (v)2 and (v)3: JDAM is identical to the (v)1 with a BLU-111 bomb body and minor differences in guidance sets.
 - (9) GBU-38 (v)4: JDAM with a BLU-126 LCDB body.
 - (10) GBU-38 (v)5: JDAM with a BLU-129 carbon-fiber bomb body.
 - (11) GBU-39/B small diameter bomb (SDB): This is a 250 lb class weapon effective against fixed or stationary targets with some penetration capability. As a standoff weapon, the SDB may climb in altitude after release to assume its glide profile. The weapon's flight path may present deconfliction problems depending on the airspace coordinating areas in place.
 - (12) GBU-39A/B focused-lethality munition (FLM): A multiphase blast version for decreased collateral damage. It replaces the steel warhead with a composite case to minimize fragments.
 - (13) GBU-39B/B laser-guided SDB: Replaces the nose cone with a laser seeker to provide a moving target capability and may be employed in legacy mode as a GPS-aided, INS munition without laser updates.
 - (14) GBU-69/B: A small, glide munition; a 60-lb GPS-aided INS munition with semi-active laser terminal guidance and a blast-fragmentation warhead. It is effective against stationary and moving personnel and soft-skinned vehicles with point detonate, height-of-burst, and delay options.
- c. Paveway II Series.
- (1) GBU-10: Laser-guided, free-fall weapon with a 2,000 lb Mk-84 or BLU-117 bomb body. Laser codes are only preflight selectable (code 1511-1788).
 - (2) GBU-12: Laser-guided, free-fall weapon with a 500 lb Mk-82, BLU-111, or BLU-129 bomb body. Laser codes are only preflight selectable.
 - (3) GBU-16: Laser-guided, free-fall weapon with a 1,000 lb Mk-83 or BLU-109 bomb body. Laser codes are only preflight selectable.
 - (4) GBU-48 Enhanced Paveway II: Dual-mode laser/GPS-aided INS free-fall weapon using the 1,000 lb Mk-83 bomb body.
 - (5) GBU-49 Enhanced Paveway II: Dual-mode laser/GPS-aided INS free-fall weapon using the 500 lb BLU-133 bomb body (similar to the Mk-82).
 - (6) GBU-50 Enhanced Paveway II: Dual-mode laser/GPS-aided INS free-fall weapon using the 2,000 lb Mk-84 or BLU-109 bomb body.
 - (7) GBU-51: Laser-guided, free-fall GBU-12 kit with a BLU-126 LCDB body.
 - (8) GBU-58: Laser-guided, free-fall weapon with a 250 lb Mk-81 bomb body. Laser codes are only preflight selectable.
- d. Paveway III Series.
- (1) GBU-24: A 2,000 lb class weapon with a BLU-109, Mk-84, or BLU-116 advanced unitary penetrator (munition) (AUP) bomb body. Laser codes are

only preflight selectable. The AUP is a 2,000 lb class bomb with twice the penetration capability of the BLU-109. The BLU-116 is used by the USN.

(2) GBU-27: A GBU-24 modified to fit into internal aircraft bays.

(3) GBU-28: A 5,000 lb penetrating weapon used with a BLU-113 or BLU-122 bomb body. The GBU-28A/B includes laser-only guidance while later variants include dual-mode laser/GPS-aided INS guidance.

e. Paveway IV. This is a dual mode, 500 lb weapon using INS/GPS-aided INS guidance with terminal laser guidance. It is fully programmable in-flight for impact angle, azimuth, and fuze settings. The weapon uses a modified Mk-82 bomb body enhanced for greater penetration effects over a baseline Mk-82.

f. Laser-guided joint direct attack munition (LJDAM). This is a multimode weapon (including guidance via GPS) that uses GPS-aided INS guidance along with coordinate refinement through laser updates. It may be used as a legacy JDAM GPS-aided INS, only, without laser updates. LJDAM can hit high speed, moving targets.

(1) GBU-54 (v)1 and (v)2: Mk-82/BLU-111 bomb body.

(2) GBU-54 (v)3 and (v)4: BLU-126 LCDB body.

(3) GBU-54 (v)5: BLU-129 carbon fiber bomb body.

3. Guided Missiles

a. AGM-65 (Maverick). Designed for striking armor and a variety of tactical targets, including moving vehicles. Maverick provides standoff ranges of up to 10 nautical miles (nm).

(1) Guidance:

(a) Television (A, B, H, K); infrared (IR) (D, F, G); Maverick seeker locks onto the target prior to release and guides autonomously.

(b) Laser (E, E2, L).

(2) Warhead: A 125 lb shaped charge jet and blast (A, B, D, H) or a 300 lb penetrator/blast-fragmentation (E, F, G, K, L).

b. AGM-84 Standoff Land-attack Missile.

(1) AGM-84E: Designed to provide day, night, and adverse weather precision strike capability against land targets and ships in port. GPS-aided INS, IR terminal guidance coupled with automated target recognition, and man-in-the-loop control.

(2) AGM-84H/K: Standoff land-attack missile-expanded response (SLAM-ER). An intermediate range of over 150 nm.

c. AGM-88 Antiradiation Missile.

(1) AGM-88B/C: High-speed antiradiation missile (HARM). A supersonic missile designed to seek and destroy radar-equipped air defense systems (range over 40 nm).

- (2) AGM-88E: An advanced antiradiation guided missile. Updated guidance and control using millimeter-wave seeker and GPS-aided INS.
- (3) AGM-88F: High-speed antiradiation missile control section modification. Updated GPS-aided INS navigation, improved target hit probability, and flight controls.
- d. AGM-114 (Hellfire). Laser or radar-guided air-to-ground missile.
 - (1) AGM-114A/B/C/F/K: Shaped charge warheads designed for use against armored vehicles.
 - (2) AGM-114F/A, AGM-114K-2A: Shaped charge warhead with a fragmentation sleeve.
 - (3) AGM-114L: Millimeter-wave radar guided, shaped-charge warhead compatible with the AH-64D/E Apache. All-weather capable.
 - (4) AGM-114M: Blast-fragmentation warhead with delay fuze only.
 - (5) AGM-114N/N-6: A thermobaric blast-fragmentation warhead with a metal augmented charge. It is designed to kill by overpressure and overtemperature in confined spaces. Delay fuze only.
 - (6) AGM-114P/P-2A: Similar to K/K-2A except with updated guidance for employment from remotely-piloted aircraft (RPA).
 - (7) AGM-114P+: Two variants currently employed. Capable of RPA off-axis employment. They are designed for structures, armor, light vehicles, and personnel and incorporate R-model guidance with other warheads.
 - (a) P-4A: Shaped-charge warhead with a fragmentation sleeve.
 - (b) N-4: Blast-fragmentation warhead with metal augmented charge.
 - (8) AGM-114R: A multi-purpose, programmable fuze, integrated blast, fragmentation-sleeve warhead. Updated guidance over AGM-114P with capability for RPA high off-axis attacks. Designed for structures, armor, vehicles, and personnel.
 - (a) R-2: R-model guidance with an updated warhead adding a height-of-burst sensor and user-programmable variable delays.
 - (b) R-9E: Identical to the R-2 except the precursor warhead is replaced with a height-of-burst assembly. The weapon contains a fragmenting steel case with an internal, tungsten sleeve.
 - (c) R-9H: The same as the R-9E except it incorporates a reduced amount of explosives in the warhead.
- e. AGM-154 Joint Standoff Weapon (JSOW). Low observable, all weather 1,000 lb class of air-to-ground glide weapons. It has a modular payload assembly designed to attack armored vehicle columns, surface-to-air weapon emplacements, and personnel.
 - (1) Guidance.
 - (a) AGM-154A and B: GPS-aided INS.

- (b) AGM-154C (USN only): INS/GPS-aided INS with IR seeker and precision-automated target acquisition.
- (2) Warheads.
 - (a) AGM-154A: 145 BLU-97 bomblets.
 - (b) AGM-154B: 6 BLU-108s (24 skeets).
 - (c) AGM-154C: BLU-111 or Broach.
- f. AGM-158 Joint Air-to-surface Standoff Missile (JASSM). A precision cruise missile designed for launch from outside area defenses to kill hardened, soft, and area targets. AGM-158A offers ranges greater than 200 miles. Guidance includes imaging, IR, and radar. AGM-158B, JASSM-extended range (ER), offers ranges greater than 500 miles.
- g. AGM-176 (Griffin). Subsonic, air-ground missile with GPS-aided INS, or semi-active laser terminal homing and includes a blast-fragmentation warhead. It is designed for personnel and soft skinned targets.
- h. AGM-179A Joint Air-to-ground Missile (JAGM). The JAGM is the joint force replacement for the air-launched Hellfire and Maverick families of missiles. JAGM uses a multimode seeker to provide precision point, active fire-and-forget, and passive fire-and-forget targeting. It is designed for armored vehicles, thin-skinned vehicles, maritime patrol craft, structures, field fortifications, and personnel.
- i. Brimstone. A low-collateral, dual-mode missile based on a Hellfire body and uses laser or millimeter-wave radar for terminal guidance. It is optimized for moving targets and small groups of personnel.

4. Guns

- a. 7.62-millimeter (mm) Mini-Gun (GAU-17). Target practice (TP), armor-piercing (AP), tracer.
- b. .50 caliber (GAU-21). TP, AP, armor-piercing incendiary (API), and tracer.
- c. 20 mm (M197). AP, high explosives (HE), and incendiary.
- d. 20-mm Gatling. TP, high explosives incendiary (HEI), API, target practice-tracer (TP-T), high explosive incendiary-tracer (HEI-T), penetrator with enhanced lateral efficiency.
- e. 25-mm Gatling (GAU-12/22). TP, HEI, API, TP-T, or HEI-T.
- f. 30 mm (M230 Cannon AH-64). TP, semi armor piercing high explosive incendiary (SAPHEI), shaped charge, and fragmentation.
- g. 30-mm Gatling (GAU-8 on A-10C). 1.5 lb projectile TP, HEI, API, or combat mix (combined HEI-API).
- h. 30 mm (M44 on AC-130W/J). TP, PGU-13D/B HEI and PGU-46/B HEI.
- i. 40 mm (AC-130U). HEI, API, HEI-plugged.
- j. 105 mm (AC-130U/J). TP, HE and HE high fragmentation with variable fuzing.

5. Rockets

- a. AGR-19/AGR-20 Guided Rocket. Advanced Precision Kill Weapons System (APKWS) adds a laser guidance kit to the 2.75 inch, wrap-around, folding fin aircraft rocket. This weapon can be employed from rotary-wing and fixed-wing aircraft and is capable of striking stationary and moving targets.
- b. Unguided rockets (2.75 inch rocket warheads).
 - (1) High Explosives.
 - (a) M-151: 10 lb HE; fuzes: point detonating (fuze) (PD) and time delay (TD).
 - (b) M-146/229: 17 lb HE; fuzes: PD, TD.
 - (c) M-261: Multipurpose submunition (MPSM); fuze: airburst; nine shape charge/fragmentation submunitions.
 - (d) M-282: Multipurpose penetrator used for military operations for urbanized terrain applications or on hardened structures; equivalent to M-229 with TD fuzing and a hardened penetrator nose cone.
 - (2) Illumination.
 - (a) M-257: Overt illumination, 1 million candlepower; average a 120-second (sec) burn.
 - (b) M-278: Covert (near IR) illumination (.7–1.1 microns) 1,000 candlepower, average 180-second burn.
 - (3) Flechettes (all are airburst).
 - (a) M-255A1: 1,179, 60-grain flechettes (United States Army).
 - (b) WDU-4A/A: 2,200, 20-grain flechettes (USMC and United States Air Force).
 - (c) M-149: 1,179 60-grain flechettes (USMC).
 - (4) Phosphorus.
 - (a) Mk-67 mod 1: Smoke, red phosphorous (RP).
 - (b) Mk-67 mod 0: Smoke, white phosphorus (WP).
 - (c) M-156: WP (used for target marking).
 - (d) M-264: RP (smoke screening), airburst.
 - (5) Training.
 - (a) M-274: TP (a practice M-151).
 - (b) M-267: TP (a practice M-261/MPSM warhead).
 - (6) 5.00-inch Rocket Warheads.
 - (a) High Explosives.
 - Mk-24 GP fuzes: PD, point, TD; fragmentation, AP, antimaterial, and light armor.

- Mk-32 antitank/AP fuzes: PD, point, and TD; for use against personnel.
- Mk-63 mod 0 fuzes: PD, point, TD; HE-fragmentation; AP, and antimaterial.
- (b) Illumination. Mk-33 mod 1.
- (c) Phosphorus.
 - Mk-34 mod 0/1: WP; fuzes: PD, point, TD; smoke.
 - Mk-34 mod 2: RP; fuzes: PD, point, TD; smoke.
- (d) Radar Countermeasures. Mk-84.
- (e) Practice. Mk-6/24/32 and WTU-11/B inert practice rounds.

6. Cluster Munitions

Note: Cluster bomb unit (CBU) bomblet density and dispersion will vary based on weapon release parameters, submunition spin rate, and weapon dispersal parameters. See individual munition technical manuals for specific information.

- a. Mk-20 and CBU-99/100 (USN). Effective against armor, personnel, artillery, and other material targets. It dispenses 247 Mk-118 mod 0/1 bomblets in an oval pattern.
- b. CBU-78 Gator (USN). A Rockeye dispenser loaded with 60 submunition mines. There are 45 BLU-91/B antitank and 15 BLU-92/B antipersonnel mines in each weapon. Submunitions must be set to one of three self-destruct times: T1 (3.2–4.0 hours), T2 (38.2–48.0 hours), and T3 (288–360 hours).
- c. CBU-87/B Combined Effects Munitions. Dispenses 202 BLU-97 bomblets (same as the JSOW) with a shaped charge for armor, steel-scored liner for fragmentation, and incendiary ring.
- d. CBU-89/B Gator. This is a stores release and SUU-64 tactical munitions dispenser loaded with a mixture of 72 BLU-91/B antiarmor and 22 BLU-92/B antipersonnel mines with preset self-destruct times.
- e. CBU-97/B Sensor-fuzed Weapon. A SUU-64 with an airbag dispensing system and 10 BLU-108/B submunitions. This cluster weapon is dropped over an area with vehicles. The fuze sensors detect heat and fires at the engine of the vehicles.
- f. Wind-corrected Munitions Dispenser (WCMD). A modified tail kit that allows cluster munitions to be dropped as inertially-aided munitions for improved accuracy.
 - (1) CBU-103: Consists of a CBU-87 with a WCMD.
 - (2) CBU-104: Consists of a CBU-89 with a WCMD.
 - (3) CBU-105: Consists of a CBU-97 with a WCMD.
 - (4) CBU-107 passive-attack weapon: This is a mixture of inert kinetic energy penetrators (i.e., 364 large, 1,004 medium, and 2,406 small rods).

7. Illumination Flares

- a. LUU-2 Flare. Parachute flare with a 4 minute burn time at an average of 1.6 million candle power.
- b. LUU-19 Covert Flare. Parachute flare with a burn time of approximately 7 minutes in the IR spectrum.

8. Weapon Pairings

Table 68 provides recommended target-to-weapon pairings.

Table 68. Recommended Target-Weapon Pairings		
Targets	Recommended Ordnance Options ¹	
Radars	SDB JDAM AGM-88 Hellfire (Blast/Frag)	Brimstone Maverick APKWS JASSM/JSOW
Soft targets, static vehicles, aircraft in the open	Hellfire (all variants) Maverick Brimstone Griffin LJDAM ²	LGB ² JDAM ² Guns: SAPHEI APKWS
Moving vehicles	Hellfire (all variants) Maverick Brimstone Griffin	LGB ² Guns: SAPHEI APKWS LJDAM ²
Armored vehicles: tanks, APCs	Hellfire (shaped charges) Maverick Brimstone	CBU-87/97/103/105 Guns: 30 mm API LJDAM ²
Personnel: Individuals/small groups	LJDAM ² LGB ² SDB Brimstone	Griffin APKWS Hellfire (Blast/Frag) Guns: HEI
Personnel: Large group	LJDAM ² LGB ²	CBU GP ² JDAM ²
Buildings ³	JDAM ² LJDAM ²	LGB ² SDB GP ²
Artillery/fixed AAA in the open	LJDAM ² LGB ² JDAM ² Hellfire (all variants)	Brimstone Maverick GP Guns: SAPHEI

Table 68. Recommended Target-Weapon Pairings (Cont'd)		
Targets	Recommended Ordnance Options ¹	
Hardened position targets in revetments	JDAM ² LJDAM ² Maverick	Hellfire (Blast/Frag) Hellfire (shaped charges) Brimstone Guns: SAPHEI
Self-propelled SAM and AAA	LJDAM ² LGB ² Brimstone	JDAM ² Maverick Hellfire (all variants) SDB
Notes: 1. Consider the type of aircraft, aiming system, delivery mode, threat, and required time to employ to select the appropriate weapon for the tactical situation. 2. Assume all LGBs, LJDAMs, JDAMs, and GPs (except SDB) use 500-pound class, or higher, bomb bodies. 3. Building construction types can vary greatly among structures. Material composition and construction techniques will directly impact weapon effectiveness.		
Legend: AAA—antiaircraft artillery APC—armored personnel carrier API—armor-piercing incendiary APKWS—Advanced Precision Kill Weapon System CBU—cluster bomb unit frag—fragmentation GP—general purpose HEI—high explosives incendiary JASSM—joint air-to-surface standoff missile JDAM—joint direct attack munition JSOW—joint standoff weapons LGB—laser-guided bomb LJDAM—laser-guided joint direct attack munition SAM—surface-to-air missile SAPHEI—semi armor piercing high explosive incendiary SDB—small diameter bomb		

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Appendix E DIGITALLY AIDED CLOSE AIR SUPPORT OPERATIONS

This appendix contains digitally aided close air support (DACAS) tables to be used by personnel when conducting DACAS operations.

1. Planning Considerations

- a. Link 16. Table 69 shows a list of items required for successful DACAS system communication and data exchange when using Link 16.

Table 69. Link 16 Requirements	
1. Call sign	6. Joint voice channel
2. Joint Tactical Information Distribution System unit (JU)	7. Network timing reference (NTR) or external timing reference (ETR)
3. Track block	8. Timing parameters
4. Fighter channel	9. Network design load (NDL)/initialization data load (IDL)/joint network load
5. Control channel	10. Correct crypto

- b. Situation awareness data link (SADL). SADL-required settings for successful DACAS system communication and data exchange are listed in table 70.

Table 70. SADL Requirements	
1. Call sign	6. Guard channel
2. Joint Tactical Information Distribution System unit (JU)	7. Network shape
3. Track block	8. Flight positions
4. Air key	9. Correct crypto
5. Gateway key	10. Gateway or air-to-air mode

- c. Variable Message Format (VMF). Table 71 shows a list of items required for successful DACAS system communication and data exchange when using VMF over combat net radio (CNR).

Table 71. Variable Message Format (VMF) Requirements	
1. Call sign	5. Unit reference number (URN)
2. Subnet mask	6. Timing parameters
3. Internet protocol address	7. Correct crypto
4. Link address	

- d. If no initialization data load (IDL) timing parameters are assigned in the operations task link CNR segment, use the default "hybrid" IDL timing parameters in table 72 when conducting VMF over CNR. Both columns in this

table are the same and reflect parameters for cipher text and plain text operations.

Table 72. Default IDL Timing Parameters. Mission Profile= “Hybrid”	
188-220 Parameters	Cipher and Plain
NAD scheme	R-NAD
Digital port data rate	16000
Transport/network layer protocol	IPv4
Forward error correction	Enabled
Time dispersion coding	Enabled
Data link layer scrambling	Enabled
Physical layer scrambling	Disabled
Equipment preamble time (msec)	650
Phasing transmission time (msec)	150
Net busy detect time without squelch detect (msec)	1763
Net busy detect time with squelch detect (msec)	1763
DTE turnaround time (msec)	50
DTE processing time (msec)	1021
DTE acknowledge prep time (msec)	1021
Turnaround time (msec)	2600
Tolerance time (msec)	127
Equipment lag time (msec)	563
Number of stations	6
Legend: DTE—data terminal equipment NAD—network access delay IDL—initialization data load R-NAD—random-network access msec—milliseconds delay	

e. Table 73 depicts standard data link series messages.

Table 73. Standard Joint Series Data Messages			
J-Series Messages		K-Series Messages	
J2.0	Indirect interface unit PPLI	K01.1	Free text
J2.2	Air PPLI	K02.27	CAS request
J2.5	Land point PPLI	K02.28	CAS BDA report
J2.6	Land track PPLI	K02.31	Mission request rejection
J3.5	Land or point track	K02.32	CAS request acceptance
J12.0	Mission assignment	K02.33	CAS aircrew briefing
J12.6	Target sorting	K02.34	AOS/OSR
J13.2	Air platform and system status	K02.35	Aircraft departing initial point
J28.2	Text message	K02.57	Aircraft attack position and target designation
		K02.58	CAS aircraft final attack control
		K02.59	Request for aircraft attack position and target designation
		K04.1	Observation report
		K04.17	Image transfer
		K05.1	Position report
Legend: AOS—aircraft on station OSR—on-station report BDA—battle damage assessment PPLI—precise participant location CAS—close air support and identification			

2. Execution

- a. Tables 74–76 depict DACAS mission flow cadences between the joint terminal attack controllers (JTACs), aircrew, and joint fires observers (JFOs).
- b. Assumption. Aircrew and JTACs will be prepared to revert to voice for terminal attack control if DACAS techniques become less efficient, degraded, or inoperative.

Table 74. DACAS: VMF over CNR Format			
Phase	Who	Tx	Action
1. Routing and safety of flight	Aircrew	V	<ul style="list-style-type: none"> Establish initial voice contact. Advise, "FOREST SWEET".
	JTAC	V	<ul style="list-style-type: none"> Transmit routing and safety of flight. Request aircrew send OSR/AOS.
2. CAS aircraft check in ¹	Aircrew	D	<ul style="list-style-type: none"> Send OSR/AOS (K02.34) and FTM (K01.1), if needed.
	JTAC	V	<ul style="list-style-type: none"> Transmit, "OSR/AOS received, standby situation update".
3. Situation update	JTAC	D	<ul style="list-style-type: none"> Send FTM (K01.1), (K05.1), and (K04.1).
	Aircrew	V	<ul style="list-style-type: none"> Transmit, "Situation update received, ready for gameplan".
4-6. Gameplan, CAS brief, remarks, and restrictions	JTAC	V	<ul style="list-style-type: none"> Transmit gameplan. Transmit, "Standby for CAS brief".
	JTAC	D	<ul style="list-style-type: none"> Send (K02.33) and (K05.1).
	Aircrew	D	<ul style="list-style-type: none"> Send WILCO or CANTCO.
7. Readbacks ²	Aircrew	D	<ul style="list-style-type: none"> Designate target coordinates. Send K02.57.
	JTAC	V	<ul style="list-style-type: none"> Transmit, "Good K02.57, readback restrictions".
	Aircrew	V	<ul style="list-style-type: none"> Read back restrictions.
	JTAC	V	<ul style="list-style-type: none"> Transmit, "Good readback".
8. Correlation ³	JTAC	D	<ul style="list-style-type: none"> BOT: Refer to K02.57 to correlate. BOC: K02.57 satisfies system readback.
9. Attack	Aircrew	D/V	<ul style="list-style-type: none"> Send DPIP (K02.35). Or transmit, "IP inbound".
	JTAC	D	<ul style="list-style-type: none"> Send single K02.59 request to view aircraft attack position and direction.
	Aircrew	V	<ul style="list-style-type: none"> Transmits "IN" call.
	JTAC	V	<ul style="list-style-type: none"> Transmit clearance or abort.⁴
10. Assess	JTAC	V	<ul style="list-style-type: none"> Assess weapon effects. Transmit, "Standby BDA".
11. BDA ⁵	JTAC	D/V	<ul style="list-style-type: none"> Send CAS BDA report (K02.28). Send FTM (K01.1) if final mission report. Or, transmit BDA.
	Aircrew	V	<ul style="list-style-type: none"> Confirm receipt of BDA.
12. Routing and safety of flight	JTAC	V	<ul style="list-style-type: none"> Transmit routing and safety of flight.

Table 74. DACAS: VMF over CNR Format (Cont'd)

Notes:

1. Upon receipt of aircraft check in (K02.34) the JTAC's ground kit auto-learns CAS aircraft's VMF addressing information. If the K02.34 is not received, the JTAC should send a single K02.59 request; broadcast an FTM (K01.1); or verbally request, "send check in".
2. The K02.57 is the most accurate representation of elevation and target location and satisfies a digital readback of lines 4 and 6 for BOT and BOC.

NOTE

When MGRS is selected for display in aircraft systems or ground kits, translation may cause small rounding errors in the 5th or 10th digit. The user can choose to reference lat/long to confirm accuracy.

3. The JTAC can track multiple aircraft with a broadcast or multicast K02.59 but should coordinate with aircrew over voice. If this technique is used, the JTAC should send a cancel K02.59 prior to ingress and terminal phases. Continuous data bursts on the TAD net from continuous K02.59s can disrupt voice and data communications and should not be used during ingress and terminal phases.
4. An additional digital clearance may be sent using a CAS air final attack message (K02.58). Refrain from sending this if attack will be disrupted.
5. Some aircraft require BDA (K02.28) to close a mission assignment. JTAC ensures K02.59 is terminated to stop tracking the aircraft.

Legend:

AOS—aircraft on station	JTAC—joint terminal attack controller
BDA—battle damage assessment	lat/long—latitude and longitude
BOC—bomb on coordinate	MGRS—military grid reference system
BOT—bomb on target	OSR—on-station report
CAS—close air support	TAD—tactical air direction
CNR—combat net radio	Tx—transmission
D—digital	V—voice
DPIP—departing initial point	VMF—variable message format
FTM—free text message	
IP—initial point	

Table 75. DACAS: SADL or Link 16 Format			
Phase	Who	Tx	Action
1. Routing and safety of flight ^{1,2}	JTAC	V	•Transmit routing and safety of flight.
	Aircrew	V	•Confirm routing and safety of flight.
	JTAC	D	•Send [type] point for threats via target sorting message (J12.6).
2. CAS aircraft check in ³	JTAC	D	•Confirm aircraft system status: ordnance and fuel (J13.2).
		V	•Transmit, "I have your PPLI, go with remainder of check in".
	Aircrew	V	•Transmit remainder of check in (i.e., laser, VDL, abort).
	JTAC	V	•Confirm receipt of check in.
3. Situation update ⁴	JTAC	D	•Send situation update via FTM (J28.2).
	Aircrew	V	•Transmit, "Situation update received".
	JTAC	D	•Send [type] point, target sorting message (J12.6).
	Aircrew	D	•Hook and save target sorting message (J12.6).
		V	•Transmit, "Ready for gameplan".
4–6. Gameplan, CAS brief, remarks, restrictions ⁵	JTAC	V	•Transmit gameplan, 9 line, remarks, and restrictions.
		D	•Send MA (J12.0), if able.
7. Readbacks ⁶	Aircrew	D	•Match [type] point. •Send the target sorting message (J12.6) to the target.
		V	•Read back restrictions.
	JTAC	V	•Transmit, "Good point and readback".
8. Correlation ⁷	JTAC	D	•BOT: Correlate matched point or sensor point.
	Aircrew	V	•BOC: Transmit system readback.
9. Attack	Aircrew	V	•Aircrew voice transmits "IP inbound", if requested. •Aircrew voice transmits, "IN" call.
	JTAC	V	•Transmit clearance or abort.
10. Assess	JTAC	V	•Assess weapons effects. •Transmit, "Standby BDA".
11. BDA ⁸	JTAC	V	•Transmit BDA.
12. Routing and safety of flight	JTAC	V	•Transmit routing and safety of flight.

Table 75. DACAS: SADL or Link 16 Format (Cont'd)

Notes:

1. Aircrew should donorize JTAC's JU number. If donorized, the aircraft can receive the JTAC's targets or digital reference points. The JTAC publishes PPLI (J2.X) and transmits the routing and safety of flight.

NOTE

Aircrew should ensure JMPS load enables J2.6 land track PPLI selection. If unable, the JTAC ground system must be configured to publish friendly location as an air PPLI (J2.2), in order to be donorized.

2. The points (J12.6) should be submitted to C2 for land point/track (J3.5) conversion to enhance the situational awareness for all participants.
3. By selecting the desired aircraft in the ground system, the JTAC can view the aircraft's PPLI containing ordnance, fuel in pounds, and system status with an air platform and system status (J13.2) message.
4. JTAC may choose to send a preplanned situation update code with a FTM (J28.2) prior to aircraft check in. The aircrew will advise receipt of the situation update code. The JTAC may publish multiple digital reference points. Aircrew may hook each [type] point and target sorting message (12.6), confirm points via voice, and transmit each [type] point and index number back to the JTAC.

WARNING

The target sorting message (J12.6) should only be used to designate targets and NOT for friendly positions. Not all aircraft can differentiate digital reference points.

5. For systems that use the FTM (J28.2) 9-line, JTACs may omit the voice 9-line. SADL-capable JTACs may send digital 9-lines if the aircraft can receive an untruncated MA (J12.0). Control message exchanges may be required. Link 16 capable JTACs should refer to target point, index number, and target description as lines 4–6 during the voice 9-line. If using a digital reference point derived from a third party contributor, index number and call sign may be used as a mark in line 7.
6. For BOT only, the matched point satisfies digital readback of lines 4 and 6. The matched point is the most accurate representation of elevation and target location. The JTAC retains the right to request verbal readbacks of lines 4 and 6 derived from [type] point/index number. Aircrew shall readback the coordinate using either the lat/long or MGRS format. Read back of the index number by itself does not satisfy this requirement.

Table 75. DACAS: SADL or Link 16 Format (Cont'd)

NOTE

When MGRS is selected for display in aircraft systems or ground kits, translation may cause small rounding errors in the 5th or 10th digit. The user can choose to reference lat/long to confirm accuracy.

7. A target sorting message (J12.6) matching or confirming the aircraft's sensor point satisfies correlation. The JTAC refers to the [type] point and index number. For example, "Storm 41, match target point, index 6".

8. Aircrew will close out or update the target status if using MA (J12.0). After attacking a target, JTACs will unpublish [type] points/index numbers. Index numbers will be repeated if cancelled or deleted from the kit.

Legend:

BDA—battle damage assessment	JU—Joint Tactical Information
BOC—bomb on coordinate	Distribution Sytem unit
BOT—bomb on target	MA—mission assignment.
C2—command and control	MGRS—military grid reference
CAS—close air support	system.
D—digital	PPLI—precise participant location
FTM—free text message	and identification.
IP—initial point	SADL—Situation Awareness
JMPS—Joint Mission Planning	Data Link
System	Tx—transmission
JTAC—joint terminal attack	V—voice
controller	VDL—video downlink

Table 76. DACAS: JFO Integration using Line of Sight Communication ¹			
Phase	Who	Tx	Action
JFO and JTAC coordination ²	JFO	V	•Contact the JTAC on a precoordinated network.
		D	•Send own location with position report (K05.1), observer lineup, and a situation update FTM (K01.1).
		D	•Send the target location using a CAS brief (K02.33) or observation report (K04.1).
		D/V	•Send or voice transmit lines 7, 8, remarks, and restrictions via FTM (K01.1).
	JTAC	V	•Confirm target information for CAS briefs.
CAS briefing and correlation ^{3, 4}	Aircrew	D	•Send K02.57.
		V	•Read back restrictions.
	JFO	D	•BOT: Reference K02.57 to correlate targets.
		D/V	•BOC: System readback satisfied by K02.57 or by voice.
Clearance ^{5, 6}	Aircrew	V	•Transmit, "IP inbound", if requested.
	JTAC	D	•Send a single K02.59 request to view aircraft attack position and direction.
	Aircrew	V	•Transmit "IN" call.
	JTAC	V	•Transmit clearance or abort.
Weapons effects, assessment, and BDA	JFO	V	•Assess weapons effects. •Transmit "Standby BDA", once attack is complete.
		D	•Send CAS BDA via K02.28 (multicast to JTAC and aircrew).
	Aircrew	V	•Confirm receipt of BDA.
Routing and safety of flight	JTAC	V	•Transmit routing and safety of flight.

Table 76. DACAS: JFO Integration using Line of Sight Communication (Cont'd)	
Notes:	
<p>1. The message traffic configuration for the JFO and engagement authority should be unicast to the JTAC. JTAC should multicast to all CAS participants (JFO, engagement authority, and aircrew) and the aircrew should broadcast to all CAS participants. JFO continues to monitor the assigned networks and the ground kit as the JTAC coordinates with CAS aircraft.</p> <p>2. Some systems allow the JTAC to modify a K02.33 or K04.1 to generate their own digital 9-line. The JFO should label each target brief (i.e., target brief A, B, etc.) if there are multiple desired points of impact.</p> <p>3. The K02.57 is the most accurate representation of elevation and target location. The JTAC retains the right to request verbal readback of elevation and target location derived from the K02.57. Verbal readbacks can be accomplished using either lat/long or MGRS format, as requested by the JTAC. If monitoring the strike net with a ground kit, the engagement authority also will receive a K02.57 from the aircraft to determine attack approval.</p> <p>4. The JFO should provide target correlation and may use the K02.57 as a starting point. If the JTAC is conducting target correlation, the JFO must advise all CAS participants, over voice, of any updates to targeting information or friendly positions.</p> <p>5. The JTAC K02.59 aids ground participants in determining aircraft attack position and ensures the aircrew is still designated onto the correct target. Pilot action is not required.</p> <p>6. An additional digital clearance may be sent using a CAS air final attack (K02.58) message. There is no intention to disrupt the critical phase of attack with a digital clearance.</p>	
Legend:	
BDA—battle damage assessment	IP—initial point
BOC—bomb on coordinate	JFO—joint fires observer
BOT—bomb on target	JTAC—joint terminal attack controller
CAS—close air support	Tx—transmission
D—digital	V—voice
FTM—free text message	

Appendix F GENERAL INFORMATION

1. Conversion Tables

Use table 77 to calculate the number of minutes and seconds it will take an aircraft to go from the initial point to the target at various ground speeds. Ground speed is airspeed adjusted for winds at altitude. Table 78 shows aircraft run-in speeds and table 79 shows ground speed and time conversions. Table 80 converts meters to feet for use on 9-line briefings and table 81 shows target location error (TLE) categories.

Table 77. Aircraft Speed and Time Conversions									
GS (knots)	km/ mins	10 km	12 km	14 km	16 km	18 km	20 km	22 km	24 km
60	1.9	5:24	6:30	7:42	8:36	9:42	10:48	11:54	13:00
80	2.5	4:06	4:54	5:42	6:30	7:18	8:06	8:54	9:42
90	2.8	3:36	4:18	5:00	5:48	6:30	7:12	7:54	8:36
110	3.4	2:54	3:30	4:06	4:42	5:18	5:54	6:30	7:06
120	3.7	2:42	3:12	3:48	4:18	4:54	5:24	5:54	6:30
150	4.6	2:12	2:36	3:00	3:30	3:54	4:18	4:48	5:12
270	8.3	1:12	1:24	1:42	1:54	2:12	2:24	2:36	2:54
300	9.3	1:06	1:18	1:30	1:42	1:54	2:12	2:24	2:36
330	10.2	1:00	1:12	1:24	1:36	1:48	2:00	2:12	2:24
360	11.1	0:54	1:06	1:18	1:24	1:36	1:48	2:00	2:12
420	13.0	0:48	0:54	1:06	1:12	1:24	1:30	1:42	1:54
450	13.9	0:42	0:54	1:00	1:12	1:18	1:24	1:36	1:42
480	14.8	0:42	0:48	0:54	1:06	1:12	1:24	1:30	1:36
510	15.7	0:36	0:48	0:9	1:00	1:06	1:18	1:24	1:30
540	16.7	0:36	0:42	0:48	1:00	1:06	1:12	1:18	1:24
Legend: GS—ground speed mins—minute km—kilometer									

Table 78. Aircraft Run-in Speeds					
Aircraft	Ground Speed	Aircraft	Ground Speed	Aircraft	Ground Speed
A-10	270–350	B-1	440–540	MH-60	60–120
AC-130W/J	150–240	B-2	400–460	MQ-1B/C	40–100
AH/UH-1	60–120	B-52	380–440	MQ-9	80–220
AH-6	60–90	Fighters	420–540	RQ-5	65–70
AH-64	60–120	KC-130J	150–200	RQ-7B	65–70

Note: Ground speed is expressed in knots.

Table 79. Ground Speed (GS) and Time Conversions							
GS (mph)	1 mi	5 mi	10 mi	20 mi	30 mi	40 mi	GS (kph)
5	00:12:00	01:00:00	02:00:00	04:00:00	06:00:00	08:00:00	8
10	00:06:00	00:30:00	01:00:00	02:00:00	03:00:00	04:00:00	16
15	00:04:00	00:20:00	00:40:00	01:20:00	02:00:00	02:40:00	24
20	00:03:00	00:15:00	00:30:00	01:00:00	01:30:00	02:00:00	32
25	00:02:24	00:12:00	00:24:00	00:48:00	01:12:00	01:36:00	40
30	00:02:00	00:10:00	00:20:00	00:40:00	01:00:00	01:20:00	48
35	00:01:43	00:08:34	00:17:09	00:34:17	00:51:26	01:08:34	56
40	00:01:30	00:07:30	00:15:00	00:30:00	00:45:00	01:00:00	64
45	00:01:20	00:06:40	00:13:20	00:26:40	00:40:00	00:53:20	72
50	00:01:12	00:06:00	00:12:00	00:24:00	00:36:00	00:48:00	80
55	00:01:05	00:05:27	00:10:55	00:21:49	00:32:44	00:43:38	89
60	00:01:00	00:05:00	00:10:00	00:20:00	00:30:00	00:40:00	97
65	00:00:55	00:04:37	00:09:14	00:18:28	00:27:42	00:36:55	105
70	00:00:51	00:04:17	00:08:34	00:17:09	00:25:43	00:34:17	113
	1.6 km	8 km	16 km	32 km	48 km	64 km	

Legend:

GS—ground speed

km—kilometer

mi—mile

mph—mile per hour

kph—kilometer per hour

Table 80. Distance Conversion Table (1 meter = 3.28 feet)					
Meters	Feet	Meters	Feet	Meters	Feet
25	82	525	1,722	1,025	3,362
50	164	550	1,804	1,050	3,444
75	246	575	1,886	1,075	3,526
100	328	600	1,968	1,100	3,608
125	410	625	2,050	1,125	3,690
150	492	650	2,132	1,150	3,772
175	574	675	2,214	1,175	3,852
200	656	700	2,296	1,200	3,936
225	738	725	2,378	1,225	4,018
250	820	750	2,460	1,250	4,100
275	902	775	2,542	1,275	4,182
300	984	800	2,624	1,300	4,264
325	1,066	825	2,706	1,325	4,346
350	1,148	850	2,788	1,350	4,428
375	1,230	875	2,870	1,375	4,510
400	1,312	900	2,952	1,400	4,592
425	1,394	925	3,034	1,425	4,674
450	1,476	950	3,116	1,450	4,756
475	1,558	975	3,198	1,475	4,838
500	1,640	1,000	3,280	1,500	4,920
Notes: 1 statute mile (5,280 feet) = 1,610 meters. 1 nautical mile (6,076 feet) = 1,852 meters.					

Table 81. TLE Categories		
Target Location Error Category (CAT)	Circular Error (Feet)	Circular Error (Meters)
CAT I	0–20	0–6
CAT II	21–51	7–15
CAT III	51–100	16–30
CAT IV	101–300	31–91
CAT V	301–1,000	92–305
CAT VI	>1,000	>305
Note: All error predictions are 90 percent confidence.		

2. Radio Frequency Bands

Table 82 contains a list of frequency bands commonly used in military applications.

Table 82. Frequency Band Descriptions	
Band Designator	Frequency Range
HF	2–30 megahertz
VHF	30–300 megahertz
UHF	300–3000 megahertz
L	1–2 gigahertz
S	2–4 gigahertz
C	3.7–4.2 gigahertz
X	9–12 gigahertz
Ku	12–18 gigahertz
K	18–27 gigahertz
Ka	27–40 gigahertz
Legend:	
HF—high frequency VHF—very high frequency	
UHF—ultrahigh frequency	

3. Surface-to-air Threat Capabilities

Tables 83 and 84 provide unclassified range and altitude capabilities of specific surface-to-air threats. For detailed threat information and mission planning resources, refer to own unit's intelligence personnel or classified service manual (e.g., Air Force Tactics, Techniques, and Procedures 3-1v1, Threat Reference Guide and Counter Attacks).

Table 83. Surface-to-air Missile Threat Capabilities						
System	Maximum Effective Range (nm/km)	Minimum Effective Range (nm/km)	Altitude (feet)	Guidance	Associated Radars	Remarks
SA-2f	18.4/34	5.4/10	1.6 k–98 k	Radar	Fan Song	Area defense
SA-2d	23.2/43	4.3/7	1.3 k–98 k	Radar	Fan Song	Area defense
SA-3	13/24	2/3.5	100–46 k	Radar	Low Blow	Area defense, 2/4 rail launcher
SA-5	162/300	3.8/7	1.0k–114 k	Radar	Square Pair	High speed, high altitude, HVAA threat
SA-6	13.4/25	2/4	100–46 k	Radar	Straight Flush	Tracked, 3-missile launcher
SA-7	2.3/4.2	0.2/1.2	82–7.5 k	IR		MANPADS, tail only
SA-8	5.5/10	0.8/1.5	90–16.5 k	Radar	Land Roll	6-wheeled vehicle
SA-9	2.3/4.2	0.4/0.8	98–11.5 k	IR		BRDM-2, 4 missile canisters
SA-10	40/75	2.7/5	33–82 k	Radar	Flap Lid	Cruise missile defense
SA-11A	17/32	1.6/3	49–72 k	Radar	Fire Dome	Tracked, 4-missile launcher
SA-12A	40/75	4/7	820–98 k	Radar	Grill Pan	High-performance, anti-ARM
SA-12B	54/100	7/13	2.0 k–98 k	Radar	Grill Pan	Standoff jamming aircraft threat
SA-13	2.7/5	0.3/0.6	32–11.5 k	IR	Snap Shot	MT-LB chassis, tracked
SA-14	3.2/6	0.3/0.6	165–19.7 k	IR		MANPADS, all aspect
SA-15	6.5/12	0.8/1.5	50–19.6 k	Radar	Scrum Half	Mobile, SA-8 follow on
SA-16	2.7/5	0.27/0.5	0–11.5 k	IR		MANPADS, improved SA-14
SA-17	17/32	1.6/3	49–82 k	Radar	Fire Dome	Mobile, SA-11 follow on
SA-18	2.8/5.2	0.26/0.5	32–11.5 k	IR		MANPADS, SA-16 follow on
SA-19	6.5/12	0.5/1	16–26.2 k	IR/DF	Hot Shot	Mobile, mounted on 2S6
SA-20	74/200	2.69/5	32–88.5 k	Radar	Tomb Stone	Mobile, SA-10 follow on
SA-21	64.8/120	0.53/1	16–98.5 k	Radar	64N6	Mobile, wheeled
SA-22	10.8/20	0.53/1	16.4–49 k	IR/Radar	Snap Shot	Mobile, wheeled or tracked

Table 83. Surface-to-air Missile Threat Capabilities (Cont'd)						
System	Maximum Effective Range (nm/km)	Minimum Effective Range (nm/km)	Altitude (feet)	Guidance	Associated Radars	Remarks
SA-24	4.3/8	0.53/1	32–11.5 k	IR	9E435 2-color seeker	MANPADS, SA-18 follow on
SA-26	15.1/28	1.8/3.5	60–65.6 k	Radar	Low Blow	Area defense, 2/4 rail launcher
Stinger Basic	4/7.4	2.2/4.1	0–9.8 k	IR		MANPADS, effective against low altitude, high speed
Roland II	4.3/8	0.3/0.5	33–18 k	Radar	Thomson-CSF	4.3/8
Crotale/Shahine	15/28	8.1/15	49–18 k	Radar	TRS 2630	Wheeled, 4 missile launcher
Hawk	21.6/40	0.8/1.5	197–58 k	Radar	AN/NPQ 46	
CSA-2	32.4/60		0–59.1 k	Radar	SJ-202	Similar to SA-2
CSA-9	54/100		0–65.6 k	Passive Radar		8 wheeled vehicle
QW1	2.7/5	0.3/0.5	98–13.1 k	IR		MANPADS
Legend ARM—antiradiation missile DF—direction finding HVAA—high-value airborne asset IR—infrared k—thousand km—kilometer MANPADS—man-portable air defense system MT-LB—multi-purpose light-armored towing vehicle nm—nautical mile						

Table 84. Air Defense Artillery Threat Capabilities

System	Barrel(s) x Caliber (mm)	Tactical Range (km/feet)	Maximum Horizontal (km)/ Vertical (feet)	Radar	Remarks
2S6	4 x 30	4.0/13,100	8.3/20,300	Yes	Tracked with 8 x SA-19
KS-12A, M1939/1944	1 x 85	10.2/33,500	15.5/33,500	Yes	4 wheel, towed
KS-19/KS-1A	1 x 100	13.7/45,000	21.0/49,200	Yes	Towed
M1985	2 x 57	4.0/13,100	12.0/28,900	Yes	Tracked vehicle
M38/M46	1 x 12.7	1.0/3,300	7.9 /13,800	No	Tripod mounted heavy machinegun
M53/M59	2 x 30	3.0/9,800	9.7 /, 20,700	No	Large, 8-wheel vehicle
S-60/Type 59	1 x 57	6.5/21,300	12.0/30,800	Yes	4-wheel, towed
Type 80	1 x 57	5.5/18,000	12.0/28,900	Yes	Tracked vehicle
Twin 37	2 x 37	4.0/13,100	8.0/22,000	Yes	Tracked T-69 chassis
ZPU-1/2/4	1/2/4 x 14.5	1.4/4,600	6.3/15,100	No	Towed or armored personnel carrier (APC) mounted
ZSU 23-4	4 X 23	2.5/8,200	7.0/16,400	Yes	Tracked vehicle
ZSU 57-2	2 x 57	4.0/13,100	12.0/30,800	No	Tracked vehicle
ZU-23	2 x 23	2.0/6,600	7.0/16,700	No	Towed or APC mounted

Note: All radar-capable systems can be fired optically.

Legend:
 km—kilometer
 mm—millimeter

4. Surface-to-surface Threat Capabilities.

- a. Tables 85–88 provide unclassified range capabilities of specific surface-to-surface threats.

Table 85. Antitank Guided Missile Threats

System	Max Range (kilometers)
Kornet-E Launcher	5
Starstreak-SL AD	8
AT-5B	4
AT-11	5

Table 86. Indirect Fire Threats		
System	Caliber (mm)	Max Range (km)
2B9	82	5
D-30	122	15.3
2S1 (SP)	122	15.3
2S3M (SP)	152	17.4
2S5 (SP)	152	28.4
2S19M1 (SP)	152	24.7
Type-83	152	30.4
2AG5	152	29
2S30 (SP)	155	41
G5	155	30
M1978/M1989	170	40
Legend: km—kilometer mm—millimeter		
SP—self-propelled		

Table 87. Multiple Launch Rocket System Threats		
System	Caliber (mm)	Max Range (km)
9A51/Prima	122	20.5
BM-21-1	122	20.4
Type 63-1	60	1.5
Legend: km—kilometer mm—millimeter		

Table 88. Tanks and Armor Threats		
System	Caliber (mm)	Max Range (km)
T-55	100	4
T-72BM	125	5
T-80B	125	5
T-90A	125	5.2
Type 96	125	5
Type 98/99A2	125	3
Type-90 (Al Khalid)	125	5
Legend: km—kilometer mm—millimeter		

Appendix G
MEDICAL AND CASUALTY EVACUATION, LANDING ZONE,
AND AIRDROP OPERATIONS

1. Medical Evacuation (MEDEVAC) and Casualty Evacuation (CASEVAC)

- a. MEDEVAC. MEDEVAC is moving patients using dedicated MEDEVAC platforms; equipped and staffed with medical attendants for en route care.

Note: The Geneva Convention places aircraft conducting MEDEVAC missions in a protected status. For MEDEVAC aircraft to enjoy protected status, there must be an agreement made with the enemy for their use in the conflict. Aircraft must be clearly marked (e.g., a red cross); be used exclusively in moving the wounded and sick; and fly at the height, time, and route agreed to with the enemy.

- b. CASEVAC. CASEVAC uses available assets, not equipped and staffed with medical attendants, for en route care unless augmentation is included in the operation plan.

Note: The Geneva Convention does not place aircraft conducting CASEVAC missions in a protected status.

- c. Table 89 contains MEDEVAC or CASEVAC capabilities.

Table 89. Medical and Casualty Transport Capabilities				
Type		Configuration	Litters	Ambulatory
Medical Evacuation	HH-60M	Maximum (max) litter	6	0
		Max ambulatory	0	6
	UH-60	Standard (max ambulatory)	0	6
		Max litter	4 (6 with carousel)	0
	UH-72	Max litter (deviation) ^{Note}	2 (-1)	0 (+3)
		Max ambulatory	0	6
Casualty Evacuation	UH-60	Standard	3–4	1
		Max litter	6	1
		Max ambulatory	0	7
	CH-47	Standard (max ambulatory)	0	31
		Max litter (deviation) ^{Note}	24 (-4)	1 (+6)
	CH-53	Standard	0	20
		Max litter (deviation) ^{Note}	24 (-4)	0 (+3)
		Max ambulatory	0	31
	V-22	Standard (max ambulatory)	0	12
		Max litter (deviation) ^{Note}	12 (-3)	0 (+5)

Note: Removing litters adds more ambulatory capacity and vice versa. For example, to apply CH-47's 24 (-4) litter and 1 (+6) ambulatory deviation; configurations could be 20 litters/7 ambulatory, 16/13, or 12/19. Listed deviations are quick approximations. Verify specific load guidance with the aircrew.

d. Use the format shown in table 90 when requesting a MEDEVAC.

Table 90. MEDEVAC Request (9-line)		
Line	Item	Explanation
1	Location of pickup.	Encrypt grid coordinates. The military grid reference system (MGRS) is primary.
2	Radio frequency, call sign, and suffix (if used).	Call sign and suffix may be transmitted in the clear.
3	Number of patients by precedence.	A—Urgent. B—Urgent-surgery. C—Priority. D—Routine. E—Convenience.
4	Special equipment required.	A—None. B—Hoist. C—Extraction equipment. D—Ventilator.
5	Number of patients by type.	Litter + number of patients. Ambulatory + number of patients.
6	(Wartime) Security of pickup site.	N—No enemy in the area. P—Possible enemy in the area, use caution. E—Enemy in the area, approach with caution. X—Enemy in the area, armed escort required.
	(Peacetime) ^{Note} Number and type of wound, injury, or illness	M—Mechanism of injury (e.g., gunshot wound, stab wound). I—Injury sustained (e.g., laceration, break); location (e.g., head, leg). S—Symptoms and signs (e.g., conscious, breathing, pulse). T—Treatment given (e.g., tourniquet, immobilization, pain relief).
7	Method of markings pickup site.	A—Panels. B—Pyrotechnic signal. C—Smoke (color). D—None. E—Other.
8	Patient nationality and status.	A—United States (US) military or unified partner military. B—US citizen or unified partner citizen. C—Non-US military or nonunified partner military. D—Non-US citizen or nonunified partner citizen. E—Enemy prisoner of war.
9	(Wartime) Contamination (only if required).	C—Chemical. B—Biological. R—Radiological. N—Nuclear.
	(Peacetime) Terrain description.	Describe obstacles and prominent features around the landing site (e.g., lake, tower).
Note: Do not delay the medical evacuation (MEDEVAC) request while waiting for injury information. Based on medical benefit, send injury information after sending the 9-line MEDEVAC request.		

2. Landing Zone (LZ) Operations

a. LZ Considerations. Consider the following criteria for all helicopter/tilt-rotor LZs.

- (1) Look for a level area clear of debris and obstacles (especially power lines) within a 50 meter radius, free of excessive loose dirt and dust.
- (2) If the LZ is on a road, ensure traffic from both directions is cordoned from the entry into the LZ, even if the LZ is on only one section of a divided highway or on a one-way road.
- (3) Ensure the area is checked, swept, and clear of improvised explosive devices.
- (4) Use the following markings.
 - (a) Day. Use a VS-17 panel. Add smoke once directed by the aircrew.
 - (b) Night. Use an infrared (IR) strobe; "buzz-saw" or inverted "Y" with IR or red chem-lights only (aviation night vision goggles will not detect blue or green chem-lights).

Note: Keep signalmen clear of the LZ and aircraft until directed otherwise by the aircrew.

b. Table 91 shows helicopter and tilt-rotor LZ considerations.

Table 91. Helicopter or Tilt-rotor LZ Considerations			
Aircraft Type	Landing Zone (LZ) Size (Length x Width) feet		Remarks
	Single Ship	Two Ship	
AH-1/64	100 x 100	200 X 200	Narrow footprint; requires a smooth, flat surface.
A/OH-6, H-6	65 x 65	130 x 130	Require a smooth, flat surface.
H-47	120 x 120	240 X 240	Large rotor wash.
H-53	200 x 300	300 x 400	Large rotor wash.
H-60	100 x 100	200 x 200	Large rotor wash.
UH-1	100 x 100	200 x 200	Requires a 25 foot clearance from the helicopter.
CV-22	240 x 240 (170 x 170 visual conditions)	240 x 740	Significant rotor wash. Brown-out conditions should be anticipated. Numbers listed are for brown-out conditions.
MV-22	200 x 200 (160 x 180 night visual conditions)	600 x 600	
Note: Service or unit standard operating procedures or aircrew proficiency may require adjusting the LZ size.			

c. Helicopter or Tilt-rotor LZ Brief. Table 92 is used to inform aircraft about a particular zone.

Table 92. Helicopter or Tilt-rotor LZ Brief	
Controller: “ _____, this is _____ call ready LZ [landing zone] brief.” (aircraft call sign) (controller call sign)	
1. LZ name or location: “ _____;” (Send grid if not preplanned)	
2. Approach and departure direction: “ _____;” (magnetic or cardinal direction)	
3. Sequence/formation: “ _____;” (simultaneous/phased)/(file, echelon, staggered)	
4. Door load: “ _____;” (left/right)	
5. Number of passengers (pax) per chalk: “ _____;”	
6. LZ mark: “ _____;” (sparkle, strobe, smoke, VS-17, none)	
7. Hazards/obstacles/enemy disposition: “ _____.”	
Remarks (as appropriate): a. Timing. b. Threats to aircraft, deconfliction measures in place, additional friendly aircraft in the area, follow-on instruction to other supporting aircraft. c. Weather.	
<u>Clearance for exfiltration (exfil):</u> Controller: “ _____, exfil, exfil, exfil.” (aircraft call sign)	
Example LZ brief	
Controller: “ LZ Napier, heading 270; simultaneous echelon right; left door load; chalk one 15 pax, chalk two 18 pax; chalk one marked by SPARKLE, chalk two marked by strobe; expect brown out, antenna tower 100 meters north of LZ. ”	
Key Terms	
CHERRY: Enemy forces exceed the threshold for landing zone (LZ) operations. ICE: Enemy forces do not exceed the threshold for LZ operations. LZ [status]: Postured: Ground elements are in position and awaiting extraction. Fouled: LZ is unusable for aircraft operations. Clean: All friendly elements have been extracted.	

3. Airdrop Planning Considerations

- Make an attempt to find a large open area with access to friendlies. Attempt to keep friendlies 200 yards outside of the desired point of impact.
- If able, minimize the effect of terrain on ingress and egress routing due to airlift aircraft performance limitations (i.e., engine-out performance).

c. The airdrop briefing format in table 93 can be used for a high altitude or joint precision aerial delivery system.

Table 93. Airdrop Brief	
Do not transmit line numbers. Units of measure are standard unless briefed. Lines 1, 2, and 7 (restrictions only) are mandatory readbacks. The controller may request additional readback.	
Controller: “ _____, this is _____ for airdrop control. ” (aircraft call sign) (controller call sign)	
1. Point of impact location: “ _____ ”	(MGRS, latitude/longitude; include map datum (e.g., WGS 84))
2. Point of impact elevation: “ _____ ”	(feet mean sea level)
3. Run-in course (magnetic): “ _____ ”	
4. Drop zone (DZ) visual description “ _____ ”	(road intersection, open field north/south)
Point of impact marking: “ _____ ”	(code letter, mirror, strobe, smoke)
5. Location of friendlies: “ _____ ”	
Position marked by: “ _____ ”	
6. Surface Winds: “ _____ ”	(“from 240 (magnetic) at 8 (knots)”) (15 C, 29.92)
Temperature and altimeter settings (if available): “ _____ ”	
7. Restrictions: “ _____ ”	
Remarks (as appropriate):	
a. Time on target: “ _____ ” or Time to target: “ _____, ready, ready, HACK ”	
b. Ground threats to aircraft, suppression coordinated, hazards (terrain, towers), surface winds, estimated ceiling and visibility, gun-target line, additional friendly aircraft in the area, and egress direction.	
Clearance:	
Controller: “ _____, CLEARED to drop. ” (aircraft call sign)	
Note: MGRS coordinates are standard.	
Legend: MGRS—military grid reference system WGS 84—World Geodetic System 1984	

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Appendix H

RISK-ESTIMATE DISTANCES (REDS)

1. Background

- a. The values in tables 94–100 assume a 0.1% probability of incapacitation (P_i), indicating a horizontal distance from the intended point of weapon impact to the closest friendly forces.

Note: RED methodology and assumptions are discussed in the 2018 JFIRE Risk Estimate Distances Methodology white paper. The paper is available on the Air Land Sea Application (ALSA) Center's classified web site:
<https://intelshare.intelink.sgov.gov/sites/alsa> under "ALSA Home", "JFIRE" documents "JFIRE REDs."

WARNING

The REDs in this document are general and will not apply to all cases encountered on the battlefield.

- b. Forward observers or joint terminal attack controllers (JTACs) will pass the phrase DANGER CLOSE, during a fire mission, with the method of engagement or the close air support (CAS) attack brief remarks. DANGER CLOSE alerts fire direction centers, ground commanders, and aircrew of the proximity of the closest friendly troops to the intended point of weapon impact. DANGER CLOSE is a warning of the proximity of friendly forces and possibility of an increased risk to them.

Note: DANGER CLOSE does not restrict ground force maneuver or fires employment.

WARNING

Commanders, controllers, and aircrew will apply DANGER CLOSE procedures at, or inside, the ranges listed under the Standing column for air-to-surface REDs.

WARNING

The REDs in the Prone Protected column should not be used without understanding the detailed assumptions used to develop these values. View a comprehensive explanation on the ALSA classified website.

2. Surface-to-surface REDs

Surface-to-surface DANGER CLOSE distances are more generic than air-to-surface distances, and are not directly tied to P_i , in most cases.

WARNING

The 60-millimeter (mm) mortar (all except M1061) and 81 mm mortar REDs were calculated assuming an observer has adjusted fires onto the target. Unadjusted fire for effect missions may significantly increase the 0.1% P_i distances. All other unguided mortar, cannon, and rocket REDs are calculated assuming predicted fire.

Table 94. Unguided Mortar REDs

System	Description	DANGER CLOSE (meters)	Range	0.1% Probability of Incapacitation (meters)	
				Standing	Prone
M224	60-mm Mortar (All except M1061)	600	1/3	150	140
			2/3	155	145
			Maximum	175	165
M224	60-mm Mortar (M1061)	600	1/3	180	175
			2/3	215	210
			Maximum	240	230
M252	81-mm Mortar (All)	600	1/3	190	175
			2/3	210	195
			Maximum	220	205
M120/M327	120-mm Mortar (All)	600	1/3	310	295
			2/3	340	330
			Maximum	375	355

Table 95. Unguided Cannon and Rocket REDs					
System	Description	DANGER CLOSE (meters)	Range	0.1% Probability of Incapacitation (meters)	
				Standing	Prone
M119/ M119A2	105-mm Howitzer HE PFF (M1130)	600	1/3	285	275
			2/3	355	345
			Maximum	505	495
	105-mm Howitzer HE (M1 Comp B/ M760)	600	1/3	360	320
			2/3	400	375
			Maximum	540	515
	105-mm Howitzer HERA (M913 HERA/ M927 HERA)	600	1/3	330	295
			2/3	460	435
			Maximum	660	635
M109A6/ M777A2	155-mm Howitzer HE (M795/M795 IM)	600	1/3	385	355
			2/3	515	485
			Maximum	730	710
	155-mm Howitzer DPICM (M483A1)	600	1/3	225	215
			2/3	295	285
			Maximum	410	405
	155-mm Howitzer DPICM (M864)	600	1/3	265	260
			2/3	405	395
			Maximum	715	705
	155-mm Howitzer RAP (M549A1 RAP)	600	1/3	380	350
			2/3	600	565
			Maximum	1045	1025
M142 HIMARS/ M270A1	227-mm M26A2 DPICM Rocket	600	1/3	415	410
			2/3	760	755
			Maximum	1410	1405
Legend: comp—composition DPICM—dual-purpose improved conventional munitions HIMARS—high mobility artillery rocket system HE—high explosives HERA—high-explosive rocket- assisted IM—insensitive munition mm—millimeter PFF—preformed fragmentation RAP—rocket-assisted projectile					

Table 96. Precision-guided Munitions REDs						
System	Description	DANGER CLOSE (meters)	Fuze Type	0.1% Probability of Incapacitation (meters)		
				Standing	Prone	Prone Protected
M120	120 mm XM395 AMPI	600	PD	190	140	135
			Proximity	210	195	170
M109A6/ M777A2	155 mm M549A1 PGK	600	PD	235	180	170
			Proximity	265	260	235
	155 mm M795/M795 IM PGK	600	PD	300	210	195
			Proximity	370	345	320
	155 mm M982/M982A1 Excalibur	600	PD	160	130	125
			Proximity	180	155	145
M142 HIMARS/ M270A1	M30A1 GMLRS AW	600	Proximity	395	395	395
	M31A1 GMLRS Unitary	600	PD	225	175	165
			Proximity	240	225	205
	M48 ATACMS QRU	600	PD	250	170	150
	M57 ATACMS T2KU	600	PD	165	115	95
	M57A1 ATACMS	600	Proximity	185	150	140
	M39A1 ATACMS Block 1A	600		285	260	250
Note: Surface-to-surface precision-guided munition risk-estimate distances are not range dependent.						
Legend: AMPI—accelerated precision mortar initiative ATACMS—Army Tactical Missile System AW—alternative warhead GMLRS—guided multiple launch rocket system HIMARS—high mobility artillery rocket system IM—insensitive munition PD—point detonating (fuze) PGK—precision guidance kit QRU—quick-reaction unitary						

Table 97. Naval Gunfire REDs					
System	Description	DANGER CLOSE (meters)	Range	0.1% Probability of Incapacitation (meters)	
				Standing	Prone
5 inch/54/62	5 inch gun	750	1/3	420	405
			2/3	385	330
			Maximum	415	365

Table 98. Tomahawk Land-attack Missile REDs				
System	Description	DANGER CLOSE (meters)	0.1% Probability of Incapacitation (meters)	
			Standing	Prone
Tomahawk land-attack missile (TLAM)	1,000 pound unitary warhead	315	315	285
Note: TLAM risk-estimate distances are not range dependent.				

3. Air-to-surface REDs

Aviation delivered fires are more complex than surface-to-surface fires due to the greater variety of weapons effects and delivery conditions. Each air-to-surface weapon will have a unique RED, which varies by release parameters, terminal ballistics, and fusing. JTACs, aircrew, and commanders will refer to the standing posture column to determine when DANGER CLOSE procedures apply, regardless of friendly force posture. These REDs are listed in tables 99 and 100.

Table 99. Fixed-wing REDs				
Weapon	Description	0.1% Probability of Incapacitation (in meters)		
		DANGER CLOSE or Standing	Prone	Prone Protected
Mk-82/BLU-111 contact (airburst)	500 lb GP bomb	285 (375)	185 (315)	165 (265)
Mk-83/BLU-110 contact (airburst)	1,000 lb GP bomb	390 (415)	205 (360)	180 (300)
Mk-84/BLU-117 contact (airburst)	2,000 lb GP bomb	405 (405)	220 (385)	200 (320)
CBU-87 ¹	CEM	245	230	225
CBU-103 ¹	WCMD-CEM	225	210	205

Table 99. Fixed-wing REDs (Cont'd)				
Weapon	Description	0.1% Probability of Incapacitation (in meters)		
		DANGER CLOSE or Standing	Prone	Prone Protected
GBU-10 contact	2,000 lb LGB	380	195	180
GBU-12 contact	500 lb LGB	270	160	150
GBU-16 contact	1,000 lb LGB	345	195	170
GBU-24/B contact	2,000 lb LGB	380	200	180
GBU-31 contact (airburst)	2,000 lb JDAM	380 (385)	205 (360)	180 (300)
GBU-32 contact (airburst)	1,000 lb JDAM	340 (390)	205 (345)	180 (330)
GBU-38 contact (airburst)	500 lb JDAM	270 (350)	160 (295)	145 (245)
GBU-38v4 contact (airburst)	500 lb LCDB (BLU-126)	185 (230)	135 (185)	120 (160)
GBU-38v5 contact (airburst)	500 lb LCDB (BLU-129)	145 (160)	95 (145)	80 (115)
GBU-39 contact (airburst)	250 lb SDB	225 (290)	140 (225)	125 (195)
GBU-39 FLM contact (airburst)	250 lb SDB	100 (140)	90 (105)	75 (95)
GBU-49 contact (airburst)	500 lb Enhanced Paveway II	270 (355)	160 (300)	145 (250)
GBU-49 contact (airburst) (BLU-126)	500 lb Enhanced Paveway II	190 (235)	135 (190)	120 (170)
GBU-49 contact (airburst) (BLU-133)	500 lb Enhanced Paveway II	565 (690)	330 (590)	225 (485)
GBU-51 contact	500 lb LCDB (BLU-126)	175	125	115
GBU-54 contact (airburst)	500 lb LJDAM	270 (355)	160 (295)	145 (245)

Table 99. Fixed-wing REDs (Cont'd)				
Weapon	Description	0.1% Probability of Incapacitation (in meters)		
		DANGER CLOSE or Standing	Prone	Prone Protected
GBU-54v4 contact (airburst)	500 lb LJDAM LCDB (BLU- 126)	185 (230)	135 (185)	120 (160)
GBU-54v5 contact (airburst)	500 lb LJDAM LCDB (BLU- 129)	145 (160)	95 (145)	85 (115)
GBU-58/59 contact (airburst)	250 lb LGB (Mk-81)	210 (290)	145 (210)	135 (195)
GBU-69 contact (airburst)	SGM			
AGM-65 ²	Maverick (All)	175	115	100
AGM-84	SLAM-ER	230	180	155
BLU-109 PGM (B/B and C/B)	2,000 lb penetrator	510	225	195
AGM-114 FA/K/L/ M/N(4/6)/P(2A)	Hellfire	115	95	80
AGM-114R	Hellfire	130	100	90
AGM-114R2	Hellfire	145	120	110
AGM-114R9E/H contact (airburst)	Hellfire			
AGM-158A	JASSM	350	170	150
AGM-176 II contact (airburst)	Griffin	120 (130)	90 (105)	75 (105)
AGM-176 III contact (airburst)	Griffin	165 (230)	110 (140)	90 (120)
Brimstone ³	UK Hellfire	175		90
Paveway IV ³	500 lb PGM	480		320
SBU-64 ³	500 lb AASM+IR	200		
AGR-20A/B/C/D rockets (M151/282)	2.75 inch rockets	105	70	65
M151/229 unguided	2.75 inch rockets	270	265	260
Mk-24 unguided	5 inch Zuni rocket	250	220	215

Table 99. Fixed-wing REDs (Cont'd)				
Weapon	Description	0.1% Probability of Incapacitation (in meters)		
		DANGER CLOSE or Standing	Prone	Prone Protected
FW gun ⁴	20 mm	100	90	90
FW gun ⁴	25 mm or 30 mm	100	90	80
AC-130 ⁴	25 mm	105	95	90
	40 mm	90	75	70
	105 mm	155 (195)	120 (180)	105 (160)
AC-130W ⁴	30 mm	100	90	80
Notes: 1. Cluster munitions are not recommended for use in proximity to friendly forces. 2. Seeker type and environmental background should be considered before use in proximity to friendly forces. 3. The risk-estimate distances for the Brimstone, Paveway IV, and SBU-64 were calculated using the North Atlantic Treaty Organization methodology. 4. Controllers must be aware of the possible gun ricochet fan.				
Legend: AASM—advanced air-to-surface missile CEM—combined effects munition FLM—focused-lethality munition FW—fixed-wing GP—general purpose IR—infrared JASSM—joint air-to-surface standoff missile JDAM—Joint Direct Attack Munition lb—pound LCDB—low collateral damage bomb LGB—laser-guided bomb LJDAM—laser-guided joint direct attack munition mm—millimeter PGM—precision-guided munition SDB—small diameter bomb SGM—small glide munition SLAM-ER—standoff land-attack missile-expanded response UK—United Kingdom WCMD—wind corrected munitions dispenser				

Airframe/ Weapon	Firing Range (meters)	0.1% Probability of Incapacitation (meters)		
		DANGER CLOSE Standing	Prone	Prone Protected
AH-1/ 20 mm (M56)	300	45	35	35
	800	95	80	80
	1,500	155	140	140
AH-64/ 30 mm (M789)	500	55	50	50
	1,000	70	65	60
	1,500	100	90	90
2.75 inch HE rockets (M151/229)	300	110	95	90
	800	135	115	110
	1,500	170	155	150
2.75 inch flechette (M255)	1,000	235	235	235
5 inch HE rockets (Mk-24)	1,000	160	125	115
	1,500	175	150	145
AGR-19/20	All	105	70	65
AGM-114 FA/K/L/ M/N(4/6)/P(2A)	All	115	95	80
AGM-114R	All	130	100	90
AGM-114R2	All	145	120	110
Notes:				
1. Door gun risk-estimate distances (REDs) are not available due to the inability to model crew-served weapon employment without a fire control system.				
2. The .50 caliber, fixed forward platforms are not able to be modeled at this time. REDs will be released as rotary-wing delivery accuracy programs increase in fidelity for systems without fire control computers.				
3. Over the shoulder methodology used for guns and rockets.				
Legend:				
HE—high explosives		mm—millimeter		

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Appendix I
MINIMUM SAFE DISTANCES (MSDs)

WARNING

Users must adhere to all local range procedures and Service directives; the MSDs provided are not intended to allow personnel to deviate from any published guidance. They are authorized only for aircrew and joint terminal attack controllers conducting close air support training in accordance with tactics, techniques, and procedures in Joint Publication 3-09.3, *Close Air Support*.

1. Applicability

- a. Table 101 establishes minimum distances for ground personnel relative to the target or impact area. MSDs are not to be confused with range-specific weapon danger zones (WDZs). WDZs establish how an aircraft can safely employ munitions within the confines of specified ranges. No weapons employment restrictions exist when ground personnel are outside WDZ distances. All ground personnel not participating in weapons training events should remain outside WDZ footprints.
- b. MSDs establish how close ground parties can be to the point of desired impact (with the associated assumptions met) when training necessitates personnel be located inside WDZ distances. MSDs do not account for gross miss distances due to a fin failure or other guidance issues.
- c. The area inside distances listed in table 101 is designated as the danger area. MSDs are from the target or impact area and for ground function fuzed weapons only (no airburst munitions). Only use MSDs for listed weapons. If a munition is not listed, ground personnel must adhere to WDZs.

2. Parameter Assumptions

- a. Unguided Munitions. Aircraft attack parameters for unguided munitions must be at or below 15,000 feet above ground level, employing level or diving deliveries with a maximum of 550 knots true air speed. For exceptions, AC-130s must refer to note 5 and B-1s and B-52s must refer to note 6 in table 101.
- b. Multiple Deliveries. General purpose ripple, string, or stick deliveries must be less than 500 feet in total length, with a maximum of six weapons.
- c. GBU-31/32/38/39. Altitude and release airspeeds are limited by range regulations and weapon battery life. Munitions must use category (CAT) IV or better coordinates. For pattern-managed inertially aided munition (IAM) deliveries, use a 200 foot maximum impact distance from the primary target

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location. When using pattern-managed employment, use CAT III, or better, coordinates.

d. Ammunition/Bullet Numbers. For AC-130 operations, MSD numbers are taken from Air Force Manual 11-2AC-130UV3, *AC-130U Operations Procedures* and Air Force Manual 11-2AC-130JV3 Interim Supplemental Guidance, *AC-130J General Operations Procedures*. All other numbers are derived from Joint Munitions Effectiveness Manual, Weaponing System.

e. Rocket Deliveries. Employ them inside a 12,000 foot slant range to adhere to published MSD for 2.75 inch rockets. For 5-inch rockets, employ them inside a 7,000 foot slant range.

f. Rotary-wing Assumptions. Ensure all helicopter deliveries of unguided ordnance occur inside a 2,000 meter slant range. Employ unguided rockets in a diving profile.

g. Other Munitions. Not all munitions have MSDs calculated due to software and data limitations. Forward requests for weapon MSD calculations not listed in table 101 to Air Combat Command Weapons and Tactics (United States Air Force) or Marine Aviation and Weapons Tactics Squadron-1 (United States Marine Corps).

Table 101. Minimum Safe Distances for Ground Parties (Training Use Only)			
Weapon	Minimum Safe Distance (meters)	Ricochet Fan (degrees/meters)	Notes
Guided Munitions (All Platforms)			
GBU-10 (2,000 lb LGB)	1,300	N/A	1 and 2
GBU-12 (500 lb LGB)	1,000	N/A	1 and 2
GBU-16 (1,000 lb LGB)	1,300	N/A	1 and 2
GBU-10/12/16 inert	500	N/A	1 and 2
GBU-31 (2,000 lb JDAM)	1,300	N/A	1
GBU-32 (1,000 lb JDAM)	1,400	N/A	1
GBU-38/54 (500 lb JDAM)	1,100	N/A	1
GBU-39 (250 lb SDB)	1,200	N/A	1
GBU-31/32/38 inert	500	N/A	1
GBU-39 inert	500	N/A	1
Fighters and Helicopters			
Mk-82 LD/HD (500 lb)	1,300	N/A	
Mk-83 LD/HD (1,000 lb)	1,500	N/A	
Mk-84 LD/HD (2,000 lb)	1,600	N/A	
Mk-82/83/84 inert	500	N/A	
CBU-87/103	1,800	N/A	4
CBU-99/100, Mk-20	1,400	N/A	4
BDU-33/38/45/50/56	500	N/A	
Mk-76	500	N/A	
LGTR I	500	N/A	1 and 2

Table 101. Minimum Safe Distances for Ground Parties (Training Use Only) (Cont'd)				
Weapon		Minimum Safe Distance (meters)	Ricochet Fan (degrees/meters)	Notes
AGM-65 (WDU-24)		1,300	N/A	1
2.75 inch rockets WP or HE		700	60°/2,300	3
2.75 inch rockets TP or signal practice		500	60°/1,700	3
5 inch rockets WP or HE		750	60°/2,800	3
5 inch rockets TP or signal practice		500	60°/2,200	3
20 mm (fighter and helicopter)		500	60°/2,500	3
25 mm (fighter)		500	60°/2,400	3
30 mm (fighter and helicopter)		500	60°/3,400	3
7.62 mm (helicopter)		500	60°/1,700	3
.50 caliber (helicopter)		500	60°/3,000	3
AC-130				
25 mm		400 (500)	60°/2,000	3 and 5
30 mm		500	N/A	3 and 5
40 mm		300 (500)	N/A	3 and 5
105 mm		600 (650)	60°/700	3 and 5
General Purpose Bombs Medium Altitude Bombers (Live or Inert)				
B-1	Mk-82	1,300	N/A	6
	Mk-84	1,500	N/A	6
B-52	Mk-82	1,800	N/A	6
	Mk-84	2,000	N/A	6
Other Munitions				
AGM-114 Hellfire		900	N/A	1
AGM-176 Griffin		N/A	N/A	1
Notes:				
1. Guided Weapon Hazard Areas. Hazard areas for guided weapons (AGM-65, AGM-114, LGBs, and JDAMs) are depend upon launch conditions and, in some cases, coordinate accuracies. Coordinate target location error and coordinate passage errors present significant risks to ground personnel for coordinate-seeking weapons release. Use caution to prevent mishaps. Weapon malfunctions, such as fin failures, are not included.				
a. JTACs may tactically derive coordinates. These coordinates must be confirmed using all available means, including target coordinates listed in range supplements, if applicable.				

Table 101. Minimum Safe Distances for Ground Parties (Training Use Only) (Cont'd)
<p>b. Aircraft may tactically derive coordinates (i.e., targeting pod or synthetic aperture radar) for employing coordinate-seeking weapons. Aircraft-derived coordinates must be confirmed. CAT IV coordinates, or better, must be used for all coordinate-seeking weapon deliveries to adhere to MSD assumptions.</p> <p>c. Guided-weapon MSDs are not platform specific. Minimum distances apply to all delivery platforms. Release parameters must be in accordance with range regulations.</p> <p>2. Environmental Factors for Laser-guided Weapons. Data assumes environmental conditions are conducive to seeker or weapon acquisition, and reflected laser energy is sufficient to guide the weapon to the target.</p> <p>3. Bullet/Rocket Ricochet Fans. A 60° fan will be drawn 30° right and 30° left of the final attack headings (FAHs) and restriction parameters (e.g., FAH 060–090°, no personnel will be 030–120° from the target within the ricochet fan). Ricochet fans for all platforms (except AC-130) are derived using weapon danger zone distances provided by headquarters Air Combat Command, A3A. The ricochet fan must be applied to each target so:</p> <ul style="list-style-type: none"> a. Ground personnel are not within the ricochet fan. b. The aircraft flight path or firing direction will bisect the ricochet fan. <p>4. CBU-87/99/100/103. CBU data is for fighter employment only. Data assumes intact canister detonations and is based on a 650 by 300 foot total pattern size. Delivery assumptions are for four canisters or less, and at a maximum of 150 foot spacing. For patterns that exceed these parameters, the MSD must be expanded to include the larger pattern. Indicated distances must be added to the radius of the calculated bomblet pattern.</p> <p>5. AC-130 parameters and restrictions.</p> <ul style="list-style-type: none"> a. With radar as the primary fire control sensor, attack targets no closer to the ground party than: <ul style="list-style-type: none"> (1) 650 m for 105 mm TP/HE. (2) 500 m for 40 mm HEI and 25 mm TP/HEI. b. With a visual sensor as the primary fire control sensor (the system has been tweaked a minimum of 750 m away from friendlies), attack targets no closer to ground parties than: <ul style="list-style-type: none"> (1) 600 m for 105 mm HE. (2) 400 m for 105 mm TP. (3) 300 m for 40 mm HEI. (4) 400 m for 25 mm TP/HEI.

**Table 101. Minimum Safe Distances for Ground Parties
(Training Use Only) (Cont'd)**

<p>c. No-fires are relative to the ground party's location from the target and based on aircraft heading; not the gun-to-target line. For ricochet risk mitigation with TP ammunition, use no-fire zones if the ground party is within:</p> <p>(1) 700 m for 105 mm TP.</p> <p>(2) 2,000 m for 25 mm TP.</p> <p>d. No-fire zone aircraft headings:</p> <p>(1) Beginning of zone = (friendly position to target bearing) - 60°.</p> <p>(2) End of zone = (beginning of zone) - 60°.</p> <p>(3) For example, the friendly position to target bearing is 180°. The no-fire zone aircraft heading would encompass 120° to 060°.</p> <p>e. Ricochet distances are found in Air Force Manual 13-212v1, <i>Range Planning and Operations</i>. Specialized weapon danger zone footprints are available from headquarters, Air Force Special Operations Command, A3TW, and the AC-130 (gunship safety footprint program).</p>																					
<p>6. Bombers (B-1, B-2, B-52).</p> <p>a. Guided Weapons. Bombers must adhere to note 1 for guided weapon employment. The maximum pattern distance for IAM weapons deliveries using pattern management tactics will not exceed 200 feet from the intended target passed from the JTAC. When dropping patterns of weapons, CAT III, or better, coordinates must be used to adhere to MSD assumptions.</p> <p>b. GP Bombs. Bombers conducting aircraft-computed Mk-82/Mk-84 deliveries are limited to 30,000 feet AGL and below. Airspeeds will not exceed 540 KTAS, and the maximum stick length of weapons will not exceed 500 feet and six weapons. Weapon releases above the listed maximums will not meet weapon accuracy criteria used in the MSD calculations and, therefore, will not be used.</p> <p>c. Bombers will not use modifiable ballistic winds.</p> <p>d. B-2 deliveries are restricted to GBU-31/38 only.</p>																					
<p>Legend:</p> <table> <tr> <td>AGL—above ground level</td><td>lb—pound</td></tr> <tr> <td>CAT—category</td><td>LD—low drag</td></tr> <tr> <td>GP—general purpose</td><td>LGB—laser-guided bomb</td></tr> <tr> <td>HD—high drag</td><td>LGTR—laser-guided training round</td></tr> <tr> <td>HE—high explosives</td><td>m—meter</td></tr> <tr> <td>HEI—high explosives incendiary</td><td>mm—millimeter</td></tr> <tr> <td>IAM—inertially aided munition</td><td>N/A—not applicable</td></tr> <tr> <td>JDAM—Joint Direct Attack Munition</td><td>SDB—small diameter bomb</td></tr> <tr> <td>JTAC—joint terminal attack controller</td><td>TP—target practice</td></tr> <tr> <td>KTAS—knots true airspeed</td><td>WP—white phosphorous</td></tr> </table>		AGL—above ground level	lb—pound	CAT—category	LD—low drag	GP—general purpose	LGB—laser-guided bomb	HD—high drag	LGTR—laser-guided training round	HE—high explosives	m—meter	HEI—high explosives incendiary	mm—millimeter	IAM—inertially aided munition	N/A—not applicable	JDAM—Joint Direct Attack Munition	SDB—small diameter bomb	JTAC—joint terminal attack controller	TP—target practice	KTAS—knots true airspeed	WP—white phosphorous
AGL—above ground level	lb—pound																				
CAT—category	LD—low drag																				
GP—general purpose	LGB—laser-guided bomb																				
HD—high drag	LGTR—laser-guided training round																				
HE—high explosives	m—meter																				
HEI—high explosives incendiary	mm—millimeter																				
IAM—inertially aided munition	N/A—not applicable																				
JDAM—Joint Direct Attack Munition	SDB—small diameter bomb																				
JTAC—joint terminal attack controller	TP—target practice																				
KTAS—knots true airspeed	WP—white phosphorous																				

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GLOSSARY

PART I – ABBREVIATIONS AND ACRONYMS

A

A/A	air-to-air
A/S	air-to-surface
AAA	antiaircraft artillery
AAS	advanced aerial sensor
AASM	advanced air-to-surface missile
ACM	airspace coordinating measure
ADAM/BAE	air defense and airspace management/brigade aviation element
AESOP	Afloat Electromagnetic Spectrum Operations Program
AFTTP	Air Force tactics, techniques, and procedures
AGL	above ground level
AI	air interdiction
AIR-MAR	maritime air
AIS	automated information system
ALSA	Air Land Sea Application [Center]
AM	amplitude modulation
AMPI	accelerated precision mortar initiative
ANG	Air National Guard
ANW2	Adaptive Networking Wideband Waveform
AO	area of operations
AOS	aircraft on station
AP	armor-piercing
APAM	antipersonnel/antiarmor
APC	armored personnel carrier
API	armor-piercing incendiary
APKWS	Advanced Precision Kill Weapon System
APP	allied procedural publication
ARM	antiradiation missile
ASOC	air support operations center
ATACMS	Army Tactical Missile System
ATFLIR	advanced targeting forward-looking infrared

ATP	Army techniques publication
AUP	advanced unitary penetrator (munition)
AUS	Australia
AW	alternative warhead
AWACS	Airborne Warning and Control System
B	
BDA	battle damage assessment
BFT	blue force tracker
BHO	battle handover
BOC	bomb on coordinate
BOT	bomb on target
BP	battle position
C	
C2	command and control
CA	coordinating altitude
CALCM	conventional air-launched cruise missile
CAS	close air support
CASEVAC	casualty evacuation
CAT	category
CBU	cluster bomb unit
CCD	charge-coupled device
CCS	Counter-Communications System
CDE	collateral damage estimation
CDL	common data link
CDM	collateral damage methodology
CEM	combined effects munition
CEP	circular error probable
CESAS	Communications Emitter Sensing and Attack System
CFF	call for fire
CJCSI	Chairman of the Joint Chiefs of Staff instruction
CNR	combat net radio
CONOPS	concept of operations
CRC	control and reporting center

CREW	counter radio-controlled improvised explosive device electronic warfare
CT	cipher text
CVN	aircraft carrier, nuclear
CVT	controlled variable time (fuze)

D

D	digital
DACAS	digitally aided close air support
DALS	downed aviator locator system
DAS	distributed aperture system
DASC	direct air support center
DCO	defensive cyberspace operations
DD	Department of Defense (form)
DF	direction finding
DMS	dual-mode seeker
DODIN	Department of Defense information network
DPI	desired point of impact
DPICM	dual-purpose improved conventional munition
DPIP	departing initial point
DTE	data terminal equipment
DTG	date-time group
DTV	day television
DVO	direct-view optics
DWE	desired weapon effects

E

EA	electronic attack
EARF	electronic attack request form
EGBU	enhanced guided bomb unit
EMS	electromagnetic spectrum
EO	electro-optical
ES	electronic warfare support
ET	electronically timed
ETR	external timing reference
EU	European Union
EW	electronic warfare

exfil	exfiltration
F	
FAAT	friendlies, artillery, airspace, and threats
FAC(A)	forward air controller (airborne)
FAH	final attack heading
FDC	fire direction center
FFE	fire for effect
FLIR	forward-looking infrared
FLM	focused-lethality munition
FM	frequency modulation
frag	fragmentation
FSCC	fire support coordination center (USMC)
FSCM	fire support coordination measure
ft	foot
FTM	free text message
FW	fixed-wing
G	
GEOREF	geographic reference
GFC	ground force commander
GLINT	gated laser intensifier
GMLRS	guided multiple launch rocket system
GMTI	ground moving target indicator
GP	general purpose
GPS	Global Positioning System
GRG	gridded reference graphic
GS	ground speed
GTL	gun-target line
GURF	guns up ready to fire (report)
H	
HA	holding area
HAE	height above ellipsoid
HARM	high-speed antiradiation missile
HAT	height above target
HD	high drag
HE	high explosives

HEI	high explosives incendiary
HEI-T	high explosive incendiary-tracer
HERA	high-explosive rocket-assisted
HF	high frequency
HIMARS	High Mobility Artillery Rocket System
HOB	height of burst
HPW	high-performance waveform (satellite communications)
HQ	HAVE QUICK
HTS	high-speed antiradiation missile targeting system
HVAA	high-value airborne asset

I

IAM	inertially aided munition
ID	identification
IDL	initialization data load
IDM	improved data modem
IDT	interflight data transfer
ILLUM	illumination
IM	insensitive munition
INS	inertial navigation system
IO	information operations
IP	initial point
IR	infrared
ISAR	inverse synthetic aperture radar
ISR	intelligence, surveillance, and reconnaissance
IZLID	infrared zoom laser illuminator designator

J

JAGIC	joint air-ground integration center
JAGM	joint air-to-ground missile
JAOC	joint air operations center
JASSM	joint air-to-surface standoff missile
JCA	jamming control authority
JDAM	Joint Direct Attack Munition
JFMCC	joint force maritime component commander
JFO	joint fires observer

JMPS	Joint Mission Planning System
JP	joint publication
JREAP	Joint Range Extension Applications Protocol
JRFL	joint restricted frequency list
JSOW	joint standoff weapon
JTAC	joint terminal attack controller
JTAR	joint tactical air strike request
JTF	joint task force
JTIDS	Joint Tactical Information Distribution System
JU	Joint Tactical Information Distribution System unit
JWICS	Joint Worldwide Intelligence Communications System

K

k	thousand
km	kilometer
kph	kilometers per hour
KTAS	knots true airspeed

L

LAR	launch acceptability region
lat/long	latitude and longitude
lb	pound
LCDB	low collateral damage bomb
LD	low drag
LGB	laser-guided bomb
LGTR	laser-guided training round
LJDAM	laser-guided joint direct attack munition
LLTV	low-light level television
LRF	laser range finder
LST	laser spot tracker
LTD	laser target designator
LTL	laser-to-target line
LWIR	long-wave infrared
LZ	landing zone

m	meter
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MA	mission assignment
MALD	miniature air-launched decoy
MANPADS	man-portable air defense system
max	maximum
MAXORD	maximum ordinate
MCM	maneuver control measure
MCRP	Marine Corps reference publication
MEDEVAC	medical evacuation
MEWSS	mobile electronic warfare support system
MFAS	multifunction active sensor
MFF	multifunction fuze
MGRS	military grid reference system
mi	mile
mil	milliradian
min	minimum
mins	minutes
mIRC	Microsoft Internet relay chat
MIST	mechanism of injury, injury sustained, location, symptoms and signs, treatment given
MLRS	multiple launch rocket system
mm	millimeter
MMW	millimeter wave
MOA	method of attack
MOF	multi-option fuze
MOFN	multi-option fuze (for) Navy
mph	miles per hour
MPSM	multipurpose submunition
MSD	minimum safe distance
msec	millisecond
MSL	mean sea level
MSR	main supply route
MT	mechanical time (artillery fuze)
MTADS	modernized target acquisition and designation sight
MTI	moving target indicator
MT-LB	multipurpose light armored towing vehicle

MTO	message to observer
MTS	multispectral target system
MTSQ	mechanical time superquick
MTTP	multi-Service tactics, techniques, and procedures
MTV	mobile tactical video
MWIR	mid-wavelength infrared

N

NAD	network access delay
NATO	North Atlantic Treaty Organization
NAVWAR	navigation warfare
NDL	network design load
NGF	naval gunfire
NGFS	naval gunfire support
nm	nautical mile
NPG	network participation group
NSFS	naval surface fire support
NTR	network timing reference
NTS	night targeting system
NTSU	night targeting system upgrade
NTTP	Navy tactics, techniques, and procedures

O

OCO	offensive cyberspace operations
OP	observation post
OPE	operational preparation of the environment
ORD	ordinate
OSC	on-scene commander
OSR	on-station report
OTL	observer-target line

P

pax	passengers
PBX	plastic-bonded explosive
PD	point detonating (fuze)
PFF	preformed fragmentation
PGK	precision guidance kit
PGM	precision-guided munition

P_i	probability of incapacitation
PPLI	precise participant location and identification
PRF	pulse repetition frequency
PSS-SOF	Precision Strike Suite-Special Operations Forces
PTT	push-to-talk

Q

QRU	quick-reaction unitary
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R

RAP	rocket-assisted projectile
RCIED	radio-controlled improvised explosive device
RED	risk-estimate distance
RFS	request for support
R-NAD	random-network access delay
RP	red phosphorus
RPA	remotely-piloted aircraft
RW	rotary-wing

S

S/A	Surface-to-air
S/S	surface-to-surface
SA	situational awareness
SACC	supporting arms coordination center (USMC)
SADL	situation awareness data link
SALTR	size, activity, location, time, remarks
SAM	surface-to-air missile
SAPHEI	semi armor piercing high explosive incendiary
SAR	synthetic aperture radar
sat	satellite
SATCOM	satellite communications
SCAR	strike coordination and reconnaissance
SCATMINE	scatterable mine
SDB	small diameter bomb
SEAD	suppression of enemy air defenses
sec	second
SGM	small glide munition

SID	subsystem identification number
SINGARS	single-channel ground and airborne radio system
SIPRNET	SECRET Internet Protocol Router Network
SITREP	situational report
SLAM-ER	standoff land-attack missile-expanded response
SOF	special operations forces
SP	self-propelled
SQ	superquick
SSEE	ship's signal exploitation equipment
SSMS	surface-to-surface missile system
STANAG	standardization agreement (NATO)
sust	sustained
SWIR	short-wave infrared

T

TA	Target acquisition
TAD	tactical air direction
TAOC	tactical air operations center (USMC)
TCDL	tactical common data link
TD	time delay
TEFACHR	threat, enemy situation, friendly update, artillery, clearance authority, hazards, and remarks/restrictions
TFLIR	targeting forward-looking infrared
TIES	type, ingress, egress, sort
TLAM	Tomahawk land-attack missile
TOC	tactical operations center
TOF	time of flight
TOL	time-of-launch
TOS	time on station
TOT	time on target
TP	target practice
TP-T	target practice-tracer
TSS	target sight system
TT	target tracking
TTFACOR	targets, threats, friendlies, artillery, clearance, ordnance, and restrictions

TTOF	total time of flight
TTP	tactics, techniques, and procedures
TTT	time to target
Tx	transmission

U

UAS	Unmanned aircraft system
UHF	ultrahigh frequency
UK	United Kingdom
URN	unit reference number
US	United States
USCYBERCOM	United States Cyber Command
USMC	United States Marine Corps
USN	United States Navy

V

V	voice
VDL	video downlink
VHF	very high frequency
VMF	variable message format
VT	variable time (proximity fuze)
VT-RF	variable time-radio frequency (proximity fuze)

W, X, Y, Z

WCMD	Wind-corrected munitions dispenser
WDZ	weapon danger zone
WGS 84	World Geodetic System 1984
WP	white phosphorous

PART II – TERMS AND DEFINITIONS

air interdiction—Air operations conducted to divert, disrupt, delay, or destroy the enemy's military surface capabilities before they can be brought to bear effectively against friendly forces, or to otherwise achieve objectives that are conducted at such distances from friendly forces that detailed integration of each air mission with the fire and movement of friendly forces is not required. Also called AI. (DOD Dictionary. Source: JP 3-03)

airspace coordinating measures—Measures employed to facilitate the efficient use of airspace to accomplish missions and, simultaneously, provide safeguards

for friendly forces. Also called ACMs. See also airspace coordination area. (DOD Dictionary. Source: JP 3-52)

airspace coordination area—A three-dimensional block of airspace in a target area, established by the appropriate commander, in which friendly aircraft are reasonably safe from friendly surface fires. Also called ACA. (DOD Dictionary. Source: JP 3-09.3)

antiradiation missile—A missile which homes, passively, on a radiation source. Also called ARM. (DOD Dictionary. Source: JP 3-01)

battle damage assessment—The estimate of damage composed of physical and functional damage assessment, as well as target system assessment, resulting from the application of lethal or nonlethal military force. Also called BDA. (DOD Dictionary. Source: JP 3-0)

close air support—Air action by aircraft against hostile targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the fire and movement of those forces. Also called CAS. See also air interdiction. (DOD Dictionary. Source: JP 3-09.3)

collateral damage—A form of collateral effect that causes unintentional or incidental injury or damage to persons or objects that would not be lawful military targets in the circumstances ruling at the time. (DOD Dictionary. Source: JP 3-60)

desired point of impact—A precise point, associated with a target and assigned as the impact point for a single unitary weapon to create a desired effect. Also called DPI. (DOD Dictionary of Military and Associated Terms. Source: JP 3-60)

directed energy—An umbrella term covering technologies that relate to the production of a beam of concentrated electromagnetic energy or atomic or subatomic particles. Also called DE. (DOD Dictionary. Source: JP 3-13.1)

electromagnetic spectrum—The range of frequencies of electromagnetic radiation from zero to infinity. It is divided into 26 alphabetically designated bands. Also called EMS. (DOD Dictionary. Source: JP 3-13.1)

electronic attack—Division of electronic warfare involving the use of electromagnetic energy, directed energy, or antiradiation weapons to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying enemy combat capability and is considered a form of fires. Also called EA. See also electronic protection; electronic warfare; electronic warfare support. (DOD Dictionary. Source: JP 3-13.1)

fire support coordination measure—A measure employed by commanders to facilitate the rapid engagement of targets and simultaneously provide safeguards for friendly forces. Also called FSCM. (DOD Dictionary. Source: JP 3-0)

forward air controller (airborne)—A specifically trained and qualified aviation officer, normally an airborne extension of the tactical air control party, who exercises control from the air of aircraft engaged in close air support of ground troops. Also called FAC(A). (DOD Dictionary. Source: JP 3-09.3)

gun-target line—An imaginary straight line from gun to target. Also called GTL. (DOD Dictionary. Source: JP 3-09.3)

joint fires observer—A certified and qualified Service member who request, controls, and adjusts surface-to-surface fires; provides targeting information in support of close air support; and performs terminal guidance operations. Also called JFO. (DOD Dictionary. Source: JP 3-09.3)

strike coordination and reconnaissance—A mission flown for the purpose of detecting targets and coordinating or performing attack or reconnaissance on those targets. Also called SCAR. (DOD Dictionary. Source: JP 3-03)

suppression—Temporary or transient degradation, by an opposing force, of the performance of a weapons system below the level needed to fulfill its mission objectives. (DOD Dictionary. Source: JP 3-01)

suppression of enemy air defenses—Activity that neutralizes, destroys, or temporarily degrades surface-based enemy air defenses by destructive and/or disruptive means. Also called SEAD. See also electromagnetic spectrum; electronic warfare. (DOD Dictionary. Source: JP 3-01)

target location error—The difference between the coordinates generated for a target and the actual location of the target. Also called TLE. (DOD Dictionary. Source: JP 3-09.3)

time on target—The actual time at which munitions impact the target. Also called TOT. (DOD Dictionary. Source: JP 3-09.3)

time to target—The number of minutes and seconds to elapse before aircraft ordnance impacts a target. Also called TTT. (DOD Dictionary. Source: JP 3-09.3)

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***ATP 3-09.32
MCRP 3-31.6
NTTP 3-09.2
AFTTP 3-2.6
18 OCTOBER 2019**

By Order of the Secretary of the Army

Official:

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General, United States Army
Chief of Staff



KATHLEEN S. MILLER
*Administrative Assistant
to The Secretary of the Army*
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* Supersedes ATP 3-09.32/MCRP 3-31.6/NTTP 3-09.2/AFTTP 3-2.6, dated 21 January 2016.

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MEDEVAC Request (9-line)		
Line	Item	Explanation
1	Location of pickup.	Encrypt grid coordinates. The military grid reference system (MGRS) is primary.
2	Radio frequency, call sign, and suffix (if used).	Call sign and suffix may be transmitted in the clear.
3	Number of patients by precedence.	A—Urgent. B—Urgent-surgery. C—Priority. D—Routine. E—Convenience.
4	Special equipment required.	A—None. B—Hoist. C—Extraction equipment. D—Ventilator.
5	Number of patients by type.	Litter + number of patients. Ambulatory + number of patients.
6	(Wartime) Security of pickup site.	N—No enemy in the area. P—Possible enemy in the area, use caution. E—Enemy in the area, approach with caution. X—Enemy in the area, armed escort required.
	(Peacetime) ^{Note} Number and type of wound, injury, or illness	M—Mechanism of injury (e.g., gunshot wound, stab wound). I—Injury sustained (e.g., laceration, break); location (e.g., head, leg). S—Symptoms and signs (e.g., conscious, breathing, pulse). T—Treatment given (e.g., tourniquet, immobilization, pain relief).
7	Method of markings pickup site.	A—Panels. B—Pyrotechnic signal. C—Smoke (color). D—None. E—Other.
8	Patient nationality and status.	A—United States (US) military or unified partner military. B—US citizen or unified partner citizen. C—Non-US military or nonunified partner military. D—Non-US citizen or nonunified partner citizen. E—Enemy prisoner of war.
9	(Wartime) Contamination (only if required).	C—Chemical. B—Biological. R—Radiological. N—Nuclear.
	(Peacetime) Terrain description.	Describe obstacles and prominent features around the landing site (e.g., lake, tower).
Note: Do not delay the medical evacuation (MEDEVAC) request while waiting for injury information. Based on medical benefit, send injury information after sending the 9-line MEDEVAC request.		

Helicopter or Tilt-rotor LZ Brief
<p>Controller: “ _____, this is _____ call ready LZ [landing zone] brief.” (aircraft call sign) (controller call sign)</p> <p>8. LZ name or location: “ _____;” (Send grid if not preplanned)</p> <p>9. Approach and departure direction: “ _____;” (magnetic or cardinal direction)</p> <p>10. Sequence/formation: “ _____;” (simultaneous/phased)/(file, echelon, staggered)</p> <p>11. Door load: “ _____;” (left/right)</p> <p>12. Number of passengers (pax) per chalk: “ _____;”</p> <p>13. LZ mark: “ _____;” (sparkle, strobe, smoke, VS-17, none)</p> <p>14. Hazards/obstacles/enemy disposition: “ _____.”</p> <p>Remarks (as appropriate):</p> <ul style="list-style-type: none"> d. Timing. e. Threats to aircraft, deconfliction measures in place, additional friendly aircraft in the area, follow-on instruction to other supporting aircraft. f. Weather. <p><u>Clearance for exfiltration (exfil):</u></p> <p>Controller: “ _____, exfil, exfil, exfil.” (aircraft call sign)</p>
<p>Example LZ brief</p> <p>Controller: “LZ Napier, heading 270; simultaneous echelon right; left door load; chalk one 15 pax, chalk two 18 pax; chalk one marked by SPARKLE, chalk two marked by strobe; expect brown out, antenna tower 100 meters north of LZ.”</p>
<p>Key Terms</p> <p>CHERRY: Enemy forces exceed the threshold for landing zone (LZ) operations. ICE: Enemy forces do not exceed the threshold for LZ operations. LZ [status]: Postured: Ground elements are in position and awaiting extraction. Fouled: LZ is unusable for aircraft operations. Clean: All friendly elements have been extracted.</p>