

ARMY, MARINE CORPS, NAVY, AIR FORCE



**AIR LAND SEA
APPLICATION
CENTER**

JFIRE

***MULTI-SERVICE
PROCEDURES FOR
THE JOINT
APPLICATION OF
FIREPOWER***

***FM 3-09.32
MCRP 3-16.6A
NTTP 3-09.2
AFTTP(I) 3-2.6***

OCTOBER 2004

DISTRIBUTION RESTRICTION: Distribution authorized to the DOD and DOD contractors only to protect technical or operational information from automatic dissemination under the International Exchange Program or by other means. This determination was made on 20 October 2004. Other requests must be referred to HQ TRADOC, ATTN: ATFC-RD, Fort Monroe, VA 23651; HQ AFDC/DJ, Maxwell AFB, AL 36112; HQ MCCDC, C427, Quantico, VA 22134; or NWCD, ATTN: N5, Newport, RI 02841.

DESTRUCTION NOTICE: Destroy by any method that must prevent disclosure of contents or reconstruction of the document.

MULTI-SERVICE TACTICS, TECHNIQUES, AND PROCEDURES

FOREWORD

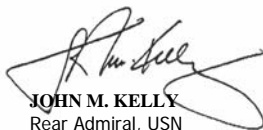
This publication has been prepared under our direction for use by our respective commands and other commands as appropriate.



ROBERT W. MIXON, JR.
Major General, US Army
Deputy Director/Chief of Staff
Futures Center
US Army Training and Doctrine
Center



ROBERT E. SCHMIDLE
Brigadier General, USMC
Director
Expeditionary Force
Development Center



JOHN M. KELLY
Rear Admiral, USN
Commander
Navy Warfare Development
Command



BENTLEY B. RAYBURN
Major General, USAF
Commander
Headquarters Air Force
Doctrine Center

This publication is available through the Army at the Army Knowledge Online (www.us.army.mil) and General Dennis J. Reimer Digital Library (www.adtdl.army.mil) Web sites, through the ALSA Web site (www.alsa.mil), and through the Air Force at the Air Force Publishing Web site (www.e-publishing.af.mil).

PREFACE

Purpose

JFIRE is a pocket-size, quick-reference guide for requesting fire support use in accordance with approved joint tactics, techniques, and procedures. JFIRE contains calls for fire, joint air attack team (JAAT) techniques, a format for joint air strike requests, close air support (CAS) coordination and planning procedures, communications architecture and weapons data.

Scope

JFIRE applies to the tactical and special operating forces of the Army, Navy, USMC, and Air Force. It is a United States (US) unilateral-only document, but includes some North Atlantic Treaty Organization (NATO) formats where appropriate. Information in JFIRE has been extracted from existing Service directives. It is primarily intended for use by members of battalion and squadron-level combat units.

Implementation Plan

Participating Service command offices of primary responsibility (OPRs) will review this publication, validate the information, and reference and incorporate it in Service manuals, regulations, and circulars as follows:

Army. Upon approval and authentication, this publication incorporates the procedures contained herein into the US Army Doctrine and Training Literature Program as directed by the Commander, US Army Training and Doctrine Command (TRADOC). Distribution is in accordance with applicable directives and the Initial Distribution Number (IDN) listed on the authentication page.

Marine Corps. The Marine Corps will incorporate the procedures in this publication in US Marine Corps training and doctrine publications as directed by the Commanding General, US Marine Corps Combat Development Command (MCCDC). Distribution is in accordance with the Marine Corps Publication Distribution System (MCPDS).

Marine Corps PCN: 144 000033 00

Navy. The Navy will incorporate these procedures in US Navy training and doctrine publications as directed by Commander, Navy Warfare Development Command (NWDC)[N5]. Distribution is in accordance with Military Standard Requisition and Issue Procedure Desk Guide (MILSTRIP Desk Guide) and Navy Standing Operating Procedure Publication 409 (NAV SOP Pub 409).

Air Force. The Air Force will incorporate the procedures in this publication in accordance with applicable governing directives. Distribution is in accordance with Air Force Instruction (AFI) 33-360.

User Information

- a. TRADOC, MCCDC, NWDC, Headquarters AFDC, and the 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 likewise 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 Training and Doctrine Command
ATTN: ATFC-RD
Fort Monroe, VA 23651-5000
DSN 680-3951 COMM (757) 788-3951
E-mail: doctrine@monroe.army.mil

Marine Corps

Commanding General
US Marine Corps Combat Development Command
ATTN: C42
3300 Russell Road, Suite 318A
Quantico, VA 22134-5021
DSN 278-6233/6234 COMM (703) 784-6234
E-mail: deputydirectordctrine@mccdc.usmc.mil

Navy

Commander
Navy Warfare Development Command
ATTN: N5
686 Cushing Road
Newport, RI 02841-1207
DSN 948-1164/4189 COMM (401) 841-1164/4189
E-mail: alsapubs@nwdc.navy.mil

Air Force

HQ AFDC/DJ
155 North Twining Street
Maxwell AFB AL 36112-6112
DSN 493-7442 COMM (334) 953-7442
E-mail: afdc.dj@maxwell.af.mil

ALSA

ALSA Center
ATTN: Director
114 Andrews Street
Langley AFB, VA 23665-2785
DSN 575-0902 COMM (757) 225-0902
E-mail: alsa.director@langley.af.mil

***FM 3-09.32
MCRP 3-16.6A
NTTP 3-09.2
AFTTP(I) 3-2.6**

**FM 3-09.32 US ARMY TRAINING AND DOCTRINE COMMAND
 FORT MONROE, VIRGINIA**

**MCRP 3-16.6A MARINE CORPS COMBAT DEVELOPMENT COMMAND
 QUANTICO, VIRGINIA**

**NTTP 3-09.2 NAVY WARFARE DEVELOPMENT COMMAND
 NEWPORT, RHODE ISLAND**

**AFTTP(I) 3-2.6 HEADQUARTERS, AIR FORCE DOCTRINE CENTER
 MAXWELL AIR FORCE BASE, ALABAMA**

29 OCTOBER 2004

JFIRE

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

TABLE OF CONTENTS

	Page
SECTION I: ARTILLERY/MORTAR FIRE	8
CALL FOR FIRE	8
TARGET LOCATION METHODS	9
MESSAGE TO OBSERVER (MTO)	9
ARTILLERY/MORTAR/NAVAL GUNFIRE DEFINITIONS	9
MISSION FORMATS	10
SECTION II: NAVAL SURFACE FIRE SUPPORT (NSFS)	21
SECTION III: JOINT AIR ATTACK TEAM (JAAT)	24
JAAT PLANNING	24
JAAT EXECUTION	27
JAAT COMMUNICATIONS	33
SECTION IV: CLOSE AIR SUPPORT (CAS)	34
CAS PLANNING CONSIDERATIONS (Day/Night)	34
URBAN CAS PLANNING CONSIDERATIONS	36
INS/GPS-GUIDED WEAPONS	37
JOINT TERMINAL ATTACK CONTROLLER (JTAC)	38
CAS EXECUTION WITH NON-JTAC PERSONNEL	41
CAS EXECUTION PROCEDURES	42

*This publication supersedes FM 3-09.32, 15 November 2002.

JTAC BREVITY CODES	50
NATO INFORMATION	51
APPENDIX A: LASER OPERATIONS	60
JTAC LASER RESPONSIBILITIES	60
LASER DESIGNATION ZONES	61
MARKING BREVITY CODES	62
LASER BREVITY CODES	62
NIGHT IR CAS BREVITY CODES	62
OTHER USEFUL BREVITY CODES	63
HELLFIRE DESIGNATOR EXCLUSION ZONE	64
APPENDIX B: FIRE SUPPORT COORDINATING MEASURES / AIRSPACE CONTROL MEASURES	65
PERMISSIVE AND RESTRICTIVE FSCMs	65
BATTLEFIELD COORDINATION LINE (USMC)	65
AIRSPACE CONTROL MEASURES	68
SEPARATION TECHNIQUES	69
COMMON GEOGRAPHIC REFERENCE SYSTEM (CGRS)	70
APPENDIX C: COMMUNICATIONS	71
APPENDIX D: MUNITIONS DESCRIPTIONS	77
GENERAL PURPOSE (GP) MUNITIONS	77
GUIDED MUNITIONS	78
MISSILES	79
GUNS	80
INERT AND PRACTICE MUNITIONS	80
ILLUMINATION FLARES	80
ROCKET WARHEADS	81
CLUSTER MUNITIONS	81
APPENDIX E: RISK-ESTIMATE DISTANCES	84
DANGER CLOSE	84
CANNON RISK ESTIMATE DISTANCES	84
AIRCRAFT MUNITION RISK ESTIMATE ASSUMPTIONS	86
APPENDIX F: GENERAL INFORMATION	88
CONVERSION TABLES	88
FIRES INTEGRATION DIAGRAMS	90
FIGURES	
Figure 1: JAAT Mission Flow Example	27
Figure 2: Sample JAAT Communications Net	33
Figure 3: Risk Assessment	38

Figure 4: TTFCOR Technique	42
Figure 5: Joint Tactical Air Strike Request Form	44
Figure 6: LASER Acquisition Areas and Safety Zones	61
Figure 7: Hellfire Designator Exclusion Zone	64
Figure 8: Common Geographic Reference System Example.....	70
Figure 9: Example of a Combined Attack	90
Figure 10: Example of a Sectored Attack	90
Figure 11: Fires Lateral Separation.....	91
Figure 12: Fires Altitude Separation	91
Figure 13: Fires Altitude and Lateral Separation	92

TABLES

Table 1: Artillery/Mortar Targets and Suggested Ammunition.....	16
Table 2: MLRS/HIMARS Family of Munitions (MFOM).....	17
Table 3: Field Artillery Cannons.....	18
Table 4: Mortars	19
Table 5: Artillery/Mortar Illumination Factors	20
Table 6: 5"/54 and 5"/62 Naval Gun Data.....	21
Table 7: Coordinated Attack Types.....	30
Table 8: CAS Terminal Attack Control Attributes.....	39
Table 9: Types of CAS Control Advantages/Disadvantages.....	40
Table 10: Abort Call Illustration	50
Table 11: Fixed Wing Aircraft Weapons and Capabilities	55
Table 12: Rotary Wing Aircraft Weapons and Capabilities	58
Table 13: Attack Helicopter Weapons Capabilities	59
Table 14: Permissive Measures	66
Table 15: Restrictive Measures	67
Table 16: Example of Airspace Coordination Area Terminology	68
Table 17: Separation Techniques	69
Table 18: JTAC/Observer Communication Equipment	71
Table 19: Control Node Communications Equipment	72
Table 20: Rotary Wing Communications Equipment	73
Table 21: Fixed Wing Aircraft Communications Equipment.....	74
Table 22: USMC Fire Support Request Nets	75
Table 23: Army Fire Support Request Nets	76
Table 24: Cannon Risk-Estimate Distances	85
Table 25: Risk-Estimate Distances for Aircraft-Delivered Ordnance.....	86
Table 26: Speed and Time Conversions	88

Table 27: Distance Conversion Table (1 meter = 3.28 feet)	89
Table 28: Recommended Target-Weapons Pairings for Aircraft Ordnance	93

PROGRAM PARTICIPANTS

The following commands and agencies participated in the development of this publication:

Joint

US Joint Forces Command, Norfolk, VA
 US Central Command, MacDill AFB, FL
 US European Command, Vaihingen, GE
 US Pacific Command, Camp H.M. Smith, HI
 US Southern Command, Miami, FL
 US Strategic Command, Offutt AFB NE
 US Special Operations Command, MacDill AFB, FL

Army

Joint and Allied Doctrine Division, USA TRADOC, Fort Monroe, VA
 Combined Arms Doctrine Directorate, CAC, Ft Leavenworth, KS
 USA Field Artillery School, Ft Sill, OK
 USA Armor Center, Ft Knox, KY
 USA JFK Special Warfare Center and School, Ft Bragg, NC
 Army Joint Support Team – Nellis, AGOS, Nellis AFB, NV

Marine Corps

Marine Corps Combat Development Command, Quantico, VA
 Marine Aviation Weapons and Tactics Squadron 1, MCAS Yuma, AZ

Navy

Navy Warfare Development Command (Norfolk Det), Norfolk, VA

Air Force

Air Force Doctrine Center, Maxwell AFB, AL
 Air Combat Command/DOYA, Langley AFB, VA
 93 Air Control Wing, Robins AFB, GA
 USAF Air Ground Operations School, Nellis AFB, NV

NOTE: Per CJCSI 3900.01 B, users will reference coordinates to the WGS 84 system for all joint operations. Users will also report the vertical model referenced within WGS 84. See CJCSI 3900.01 B for further details.

SECTION I: ARTILLERY/MORTAR FIRE

CALL FOR FIRE

A call for fire is a concise message prepared by the observer. It contains all information needed by the fire direction center (FDC) to determine the method of target attack. It is a *request* for fire, not an order. Six elements of the call for fire are sent to the FDC in three transmissions: the observer identification, warning order, target location, target description, method of engagement, and method of fire and control. There is a break after each transmission as the FDC reads back data. Expect a challenge and response after the last readback.

Format 1: Call for FIRE
1 st Transmission (Mandatory Call)
1. Observer identification (ID). (Call Signs) 2. Warning order (adjust fire; fire for effect; immediate suppression; immediate smoke; SEAD; suppress; mark; adjust fire, polar; adjust fire, shift), " _____ " (insert the known point or target number)
2 nd Transmission (Mandatory Call)
3. Target location (can be given in three ways: grid, polar plot, and shift from a known point).
3 rd Transmission (Mandatory Call)
4. Target description (brief but accurate statement describing the target). 5. Method of engagement (danger close, high angle, ammo type requested, mark). 6. Method of fire and control (at my command, request time of flight, request splash, request time on target [TOT], direction).

TARGET LOCATION METHODS

There are three methods to define target location: grid coordinates, polar plot, and shift from a known point. The most common method is grid coordinates. The call for fire formats listed here are set up for the grid coordinates method. If other methods are desired, substitute these formats into the second (mandatory) transmission (3. target location)

MESSAGE TO OBSERVER (MTO)

After the FDC processes the call for fire, it will send the following:

- a. Call sign of the unit firing the mission (mandatory). This is given as the last letter of the call sign of the unit firing the mission. If two letters are given, the first letter is the unit that will fire for effect and the second is the unit firing the adjusting rounds.
- b. Changes to the call for fire (if any are made).
- c. Number of rounds (mandatory). Number of rounds per tube that will fire for effect.
- d. Target number (mandatory). For tracking subsequent missions or to record as a target for future use.
- e. Time of flight (if requested by observer). Time in seconds from shot to impact. Announced when time of flight is requested by observer or when firing high angle, aerial observer, moving target, or coordinated illumination missions. ("H,1 round, Target AA7742, over).

ARTILLERY/MORTAR/NAVAL GUNFIRE DEFINITIONS

AT MY COMMAND – Command used when observer desires to control exact delivery time of fires.

CHECK FIRING – Command from anyone in the fire support net to halt firing immediately.

DANGER CLOSE – Term included with the method of engagement segment of a call for fire which indicates friendly troops are within close proximity of the target. The exact distance is determined by the munition fired. The creeping method of adjustment will be used exclusively during danger close missions.

DIRECTION – Used by spotter/observer to indicate the direction from the observer to the target. Also known as the observer target line (OTL). When the observer anticipates he will be required to adjust fire, he will send a direction to the FDC.

MARK – Spotting or illumination round on the deck. Used to indicate targets to aircraft, ground troops, or fire support.

REPEAT – During adjustment, request by the observer to fire again using the same firing data. During fire for effect, a request to fire the

same number of rounds using the same method of fire.

SHOT – Rounds fired. Announced by the FDC to alert the observer.

SPLASH – Rounds will impact in 5 seconds. Announced by FDC.

SURVEILLANCE – Battle damage assessment (BDA).

TIME ON TARGET – Time the observer desires round(s) to impact.

MISSION FORMATS

Format 2: Adjust FIRE mission (Grid Method)	
Observer: " _____ this is _____, Adjust Fire, Over"	(FDC Call Sign) (Observer's Call Sign)
"Grid _____, Over"	(8-Digit UTM)
Target Description: " _____,"	(Target Description, Size, Activity)
Method of Engagement (optional)	(Danger Close, Mark, High Angle, Ammo/Fuze Type)
Method of Fire and Control (optional)	(At My Command, Time on Target, Request Splash, Request Time of Flight, Request Ordinate Altitude Information)
"Over"	
FDC may challenge after they read back the above. The observer should be prepared to authenticate.	
Message to Observer (*= Mandatory Call)	
Units to Fire*	(Firing Unit, Adjusting Unit)
Changes to Call for Fire	(If Any)
Number of Rounds*	(Per Tube)
Target Number*	
Time of Flight	(Seconds)
Ordinate Altitude Information	
Given After Message to Observer	
"Direction _____, Over"	(Mils or Degrees*)
[*Mils is the default--specify if using degrees]	
Adjustments	
"Left/Right _____"	(Meters, Distance from Impact to OTL)
"Add/Drop _____"	(Meters, Distance from Impact to Tgt) "Over"
Mission Completion	
"End of Mission _____, Over."	(BDA and Target Activity)

Format 3: Adjust FIRE Mission (Polar Plot)
<p>"Direction _____" in mils/degrees grid <i>(observer to target line - nearest 10 mils/1 deg)</i> (NOTE: Must specify degrees to FDC if direction is given in degrees)</p> <p>"Distance _____" in meters <i>(to nearest 100 m)</i> "Up/Down _____" in meters <i>(to nearest 5 m)</i> (NOTE: Difference in target altitude is with respect to observer, not given if less than a 35-meter elevation difference between the observer and target.)</p>
Shift from a Known Point
<p>"Direction _____" in mils/degrees grid <i>(observer to target line - nearest 10 mils/1 deg)</i> (NOTE: Must specify degrees to FDC only if direction is given in degrees)</p> <p>"Left/Right (Lateral Shift) _____" in meters <i>(to nearest 10m)</i> "Add/Drop (Range Shift) _____" in meters <i>(to nearest 100m)</i> "Up/Down (Vertical Shift) _____" in meters <i>(to nearest 5m)</i> (NOTE: Difference in target altitude with respect to known point altitude.)</p>
<p>EXAMPLE - MIL RELATION FORMULA</p> <p>The observer knows that the distance from his location to a known point (church) is 2,500 meters. With binoculars, the observer measures an angular deviation of 62 mils from the church to the target. The observer calculates the lateral shift as follows:</p> <p>$W = R \times \text{mils}$ (Width of lateral shift = Range (km) x mils) $W = 2500/1000 \times 62 = 155 \text{ meters} = \text{approximately } 160 \text{ meters}$ (lateral shift expressed to nearest 10 meters.)</p> <p>"LEFT 160" (NOTE: one degree = 17.8 mils)</p>

Format 4: Fire for Effect Mission (Grid Method)	
Observer: " _____ this is _____, Fire for Effect, Over"	(FDC Call Sign) (Observer's Call Sign)
"Grid _____, Over"	(6-Digit UTM)
Target Description: " _____"	(Target Description, Size, Activity)
Method of Engagement _____	(Danger Close, Mark, High Angle, Ammo/Fuze Type)
Method of Fire and Control _____	(Optional) (At My Command, Time on Target, Request Splash, Request time of flight, Request Ordinate Altitude Information)
FDC may challenge after the read-back above. The observer should be prepared to authenticate.	
Message to Observer (* = Mandatory Call)	
Units to Fire*	(Firing Unit, Adjusting Unit)
Changes to Call for Fire	(If Any)
Number of Rounds*	(Per Tube)
Target Number*	
Time of Flight	(Seconds)
Ordinate Altitude Information	
Adjustments	
Prior to 1st Adjustment: "Direction _____, Over"	(Mils or Degrees*)
[NOTE: *Mils is the default--must specify if using degrees]	
"Left/Right _____"	(Meters, Distance from Impact to Observer Target Line)
"Add/Drop _____"	(Meters, Distance from Impact to Target)
"Repeat, Over"	
Mission Completion	
"End of Mission _____, Over."	(BDA and Target Activity)

Format 5: Marking Mission (Grid Method)	
Observer: " _____ this is _____ , Fire for Effect, Over"	
<i>(FDC Call Sign) (Observer's Call Sign)</i>	
"Grid _____, Over"	
<i>(6-Digit UTM)</i>	
"Marking round, WP, at my command, request time of flight, Over"	
Method of Engagement	<i>(Danger Close, Mark, High Angle, Ammo/Fuze Type)</i>
<i>(Optional)</i>	
Method of Fire and Control	<i>(At My Command, Time on Target, Request Splash, Request Time of Flight, Request Ordinate Altitude Information)</i>
<i>(Optional)</i>	
"Over"	
FDC may challenge after they read back the above.	
The observer should be prepared to authenticate.	
Message to Observer (* = Mandatory Call)	
Units to Fire*	<i>(Firing Unit, Adjusting Unit)</i>
Changes to Call for Fire	<i>(If Any)</i>
Number of Rounds*	<i>(Per Tube)</i>
Target Number*	
Time of Flight	<i>(Seconds)</i>
Ordinate Altitude Information	
Mission Completion	
"End of Mission, Over."	

Format 6: SEAD Mission (USMC - Grid Method)	
Observer: "	this is _____, SEAD, Over
(FDC Call Sign)	(Observer's Call Sign)
"Grid to Suppress _____,	"Grid to Mark" _____, Over
(6-Digit UTM)	(6-Digit UTM)
" _____ , _____ , _____	CAS TOT/TTT, Over
(Target description)	(Continuous, Interrupted), (Timing)
Non-Standard	

Format 7: Artillery / Mortar – Quick Smoke Request	
Observer: "	this is _____, Adjust Fire, Over
(FDC Call Sign)	(Observer's Call Sign)
"Grid _____,	Over"
(6-Digit UTM)	
Target Description: " _____ "	
a. L: Length of smoke screen desired _____	
b. A: Attitude (mils) _____	
c. M: Maneuver Target Line _____	
d. D: Direction of Wind: _____	
(Head, Tail, Right/Left Cross, Head/Tailwind)	
e. Duration: Time or Duration the smoke screen is to be effective	
"Smoke/WP in Effect, Over"	
Adjust Fire Up/Down	
For Ground Burst: "Up 100"	
NOTE: If using high explosive (HE) rounds to adjust onto the desired target area, the observer will request shell smoke once the 200 meter bracket is broken. The Observer will then request "Fire for Effect."	

Format 8: Artillery / Mortar Illumination Request – Call for FIRE
WARNING: Use of illumination requires care and adequate coordination to avoid adverse impact on the operations of adjacent and supporting units using night-vision devices.
Observer: " _____ this is _____." (FDC Call Sign) (Observer's Call Sign) Warning Order: " _____, Over" Target Location: " _____, Over" (such as Grid, Polar, Shift) Target Description: " _____" (Target Description Size, Activity) Method of Engagement: "Illumination" Method of Fire and Control: " _____ Over" ("By Shell", "At My Command", "Request Ordinate Information") "Direction _____, Over" (Adjustment of Illumination)
NOTE: Observer will give direction if grid mission.
Adjustments include— "Right/left _____" in 200m increments "Add/drop _____" in 200m increments "Up/down _____" in 50m increments Adjust illumination over adjusting point/target. When maximum illumination is obtained, the observer transmits: "illumination mark."
When target is verified, observer transmits "coordinated illumination" and attacks with desired munitions using the call for fire format. NOTE: Coordinated illumination directs the FDC to calculate and direct the firing of the illumination and the attack munitions at a time that should result in the attack munitions impacting when the target is at maximum illumination. Observers desiring to control the firing of both the illumination and the attack munitions transmit: "By shell, at my command."
To receive 2- or 4-gun illumination during an illumination mission, transmit the following: For 2 -gun illumination: "range spread" or "lateral spread." For 4 -gun illumination: "range and lateral spread."

Table 1: Artillery/Mortar Targets and Suggested Ammunition			
<i>Targets</i>	<i>Cannons</i>	<i>Mortars</i>	
Personnel or light vehicles in open	ICM, DPICM, HE/VT, HE/TI	HE/MOF, HV/VT, HE/TI, HE/PD	
Personnel or light vehicles in light overhead cover	ICM, DPICM, HE/TI, HE/PD, HE/D	HE/MOF, HV/TI, HE/PD, HE/D	
Personnel or light vehicles in trees	HE/TI, HE/D	HE/MOF, HV/TI, HE/PD, HE/D	
Covered positions or heavy vehicles in the open	DPICM, HE/PD, HE/D	HE/MOF, HE/PD, HE/D	
Large bunker complexes	HE/CP, HE/D, HE/PD	HE/MOF, HE/PD, HE/D	
Small bunkers	Copperhead, HE/CP, HE/PD, HE/D	HE/MOF, HE/PD, HE/D	
Armored vehicles	DPICM, Copperhead, HE/PD, HE/D	HE/MOF, HE/PD, HE/D	
CP = concrete piercing PD = point detonating	D = Delay TI = time	HE = high explosive VT = variable time	MOF = multi-option fuze
NOTE: MOF has the following actions: Impact (IPM), Delay (DLY), Near Surface Burst (NSB), and Proximity (PRX)			

Table 2: MLRS/HIMARS Family of Munitions (MFOM)				
Munition	Variant	Payload	Range	Targets
Rockets	M26	644 M77 DPICM	10-32 Km	Personnel, Light Armor, Soft Vehicles (Stationary)
	M26A2 ER-MLRS	518 PI M77	13-45 Km	
ATACMS	Block I M39 (JEE)	950 M74 APAM bomblets	25-165 Km	Personnel, Light Armor, Soft Vehicles (Stationary)
	Block IA M39A1 (JEN)	300 M74 APAM bomblets	70-300 Km	
	Block II M39A3 (JTC)	13 Brilliant Anti-armor submunitions (BAT)	35-145 Km	C2 nodes, log sites, SRBMs, ACV assembly areas (stationary) or SRBMs, MRLs, SP artillery, ACV moving formations
	Quick Reaction Unitary (QRU)	Single Burst, HE PD Fuze	70-270 Km	Block I – IA Targets When Duds/ Collateral Damage Are Precluded.
	ATACMS Unitary	Single Unitary Warhead w/multifunction fuze – Proximity, PD, or Delay	70-300 Km	Fixed Infrastructure Sites (Buildings, etc.)
<p> <i>ACV – Armored Combat Vehicle</i> <i>MRL – Multiple Rocket Launch(er)</i> <i>APAM – Anti-Personnel, Anti-Armor</i> <i>ATACMS – Army Tactical Missile System</i> <i>C2 – Command and Control</i> <i>HIMARS – High Mobility Artillery Rocket System</i> <i>DPICM – Dual Purpose, Improved Conventional Munitions</i> <i>ER-MLRS – Extended Range Multiple Launch Rocket System</i> <i>JEE, JEN, JTC, etc. – Computer Munitions Identification Codes</i> </p> <p> <i>PD – Point Detonating</i> <i>HE – High Explosive</i> <i>PI – Product Improved</i> <i>SP – Self Propelled</i> <i>SRBM – Short Range Ballistic Missiles</i> <i>GMLRS – Guided MLRS</i> </p> <p>NOTES:</p> <p>- Risk estimate distances for above published in the Joint Munitions Effectiveness Manual Surface-to-Surface Weapons Effectiveness Systems (JWES) CD ROM.</p> <p>- Default rates of fire are 5 seconds between rockets and 15 seconds between missiles.</p>				

Table 3: Field Artillery Cannons						
Artillery	Ammunition		Danger Close	Range (Meters)		Rates of Fire/Notes
	Projectile	Fuze		Max	DPICM	
105mm M119A1	HE, HC, WP ILLUM, APICM, DPICM	PD, VT, MT, MTS, Delay	600m ¹	11,500	14,100	Sustained rate of fire: 3 rds/min. Max rate of fire: 10 rds/min
155mm M198	HE, HC, WP ILLUM, CPHD, APICM, DPICM, M825 Smoke SCAT-MINE	PD, VT, MT, MTSO, Delay	600m ¹	18,300 or 22,000 with M795 HE, M825 Smoke	18,000 or 28,200 with M864	Sustained rate of fire: 2 rds/min. Max rate of fire: 4 rds/min
155mm M109A5/A6	HE, HC, WP ILLUM, CPHD, APICM, DPICM, M825 Smoke SCAT-MINE	PD, VT, MT, MTSO, Delay	600m ¹	18,200 or 21,700 with M795 HE, M825 Smoke	17,900 or 28,100 with M864	Sustained rate of fire: 1 rd/min. Max rate of fire: 4 rds/min.
APICM—anti-personnel improved conventional munition CPHD—Copperhead DPICM—dual-purpose improved convention munition HC—hexachloroethane HE—high explosive ILLUM—illumination MT—mechanical time	MTSO—mechanical time superquick PD—point detonating SADARM—sense and destroy armor VT—variable time WP—(white phosphorus) ¹ See Appendix E: Cannon Risk Estimate Distances for detailed discussion of “Danger Close.”					

Table 4: Mortars						
Wpn	Ammunition		Danger Close	Range (Meters)		Rates of Fire
	Model	Type		Min	Max	
60mm M224	M720/	HE	600m	70	3,489 ¹	30 rds/min for 4 min ² then 20 rds/min sustained. Diameter of Illumination: M721–500m M83A3–300m
	M888	HE		70	3,489	
	M722	WP		70	3,489	
	M721	ILLUM		200	3,489	
	M302A1	WP		35	1,830	
	M83A3	ILLUM		725	950	
	M49A4	HE		45	1,830	
81mm M29A1	M374A2	HE	600m	70	4,600	25 rds/min for 2 min then 8 rds/min sustained. Diameter of Illumination: 360m
	M374A3	HE		73	4,800	
	M375A2	WP		70	4,595	
	M301A3	ILLUM		100	3,150	
81mm M252	M821/	HE	600m	80	5,800	18 rds/min for 2 min, then 15 rds/min sustained. Diameter of Illumination: 650m
	M889	HE		83	5,800	
	M374A3	HE		73	4,800	
	M819	RP		300	4,875	
	M375A2	WP		73	4,595	
	M853A1	ILLUM		300	5,060	
	M301A3	ILLUM		100	3,950	
120mm M120	M57	HE	600m	200	7,200	16 rds/min for 1 min, then 4 rds/min sustained. Diameter of Illumination: 1,500m
	M68	WP		200	7,200	
	M91	ILLUM		200	7,100	
	M933	HE (PD)		200	7,200	
	M934	HE		170	7,200	
	M929	(MOF)		170	7,200	
	M930	WP illum		170	7,200	
HE–High Explosive WP–White Phosphorus ILLUM–Illumination RP–Red Phosphorus			¹ Bipod-mounted, charge 4 (maximum handheld is 1,300 meters) ² Charge 2 and over. (30 rounds per minute can be sustained with charge 0 or 1).			

Table 5: Artillery/Mortar Illumination Factors				
WEAPON	TYPE	HOB (meters)	Burn Time (seconds)	Rate of Fall (m/sec)
60mm	M83A1	160	25	6
60mm	M83A2/3	160	32	6
81mm	M301A3	600	60	6
105mm	M314A2	750	60	10
105mm	M314A3	750	70–75	10
120mm	M930	500	50	5
155mm	M118	750	60	10
155mm	M485A	600	120	5

SECTION II: NAVAL SURFACE FIRE SUPPORT (NSFS)

Table 6: 5"/54 and 5"/62 Naval Gun Data	
Maximum Range:	23,100m (Full Charge) 12,200m (Reduced Charge)
Danger Close:	750 m
Sustained Fire Rate: Maximum/Sustained	20/20 rounds per minute
Ammo:	HE, Illumination, WP
Fuzes:	quick (Q), mechanical time (MT), controlled variable time (CVT), variable time (VT), delay (del)
Illumination:	<u>Mk 88</u> : Height of burst (HOB) = 500m Burn Time (sec) = 45-72 Rate of Fall (m/sec) = 5m/sec <u>Mk 91</u> : HOB 325m (65-70 second burn time) Rate of Fall = 5m/sec
NOTE: Data applies to 5"/62 firing conventional munitions.	

Danger Close Mission (<750m for NSFS), Give cardinal direction and distance to friendlies. Use first salvo offset and "creeping" method for adjustments in 50 meter increments.

Directions: Normally given in mils relative to grid north. Any other combination may be used but must be specified (e.g. "Direction 180 degrees magnetic").

Format 9: NSFS Polar Plot	
"Direction _____"	in mils/deg (to nearest 10 mils/1 deg)
"Distance _____"	in meters (to nearest 100m)
"Up/Down _____"	in meters (to nearest 5m (vertical shift) if greater than 30 meters)
SHIFT FROM A KNOWN POINT:	
"Shift _____"	(target number/reference point)
"Direction _____"	in mils/degrees (to nearest 10 mils/1 degree) (from observer to target)
"Right/Left _____"	in meters (to nearest 10 m) (lateral shift)
"Add/Drop _____"	in meters (to nearest 100 m) (range shift)
"Up/Down _____"	in meters (to nearest 5 m) (vertical shift)

Format 10: NSFS Call for FIRE (Grid Method given in two transmissions)	
" _____ this is _____	Fire Mission,
(Ship Call Sign)	(Observer's Call Sign)
Target # _____, Over"	
(Assigned by Observer)	
"Grid _____, Altitude _____,	
(6-digit UTM)	(Meters MSL)
Direction _____, Over"	
(mils/grid)	
Target Description:	(Target Description, Size, Activity)
Method of Engagement:	(Danger Close, Ammo/Fuze Type, # Salvos, # Guns, Reduced Charge, TOT, Request Summit)
Method of Control:	(Fire for Effect, Ship Adjust, Spotter Adjust, Cannot Observe, At My Command)
Message to Observer	
Gun-Target Line	(From Gun to Target)
Ready/Time of Flight/ line of fire (if firing Illum)	(Time of Flight in Seconds)
First Salvo at Offset	(Danger Close Missions Only)
Summit	(Max Ord in Feet for Air Spotter, Meters for Ground Spotter)
"Fire"	(Command from Spotter after Message to Observer is read back)
Changes to Call for Fire	

SECTION III: JOINT AIR ATTACK TEAM (JAAT)

JAAT is a method of integrating rotary-wing and fixed-wing aircraft to locate and attack high-priority targets and targets of opportunity. JAAT is a method of employment, not a mission. JAAT fires are integrated, mutually supportive, and synergistic, not simply deconflicted.

The land force commander typically determines when to employ a JAAT but any commander (air, land, or maritime) may request one. JAAT can be employed anywhere on the battlefield across the spectrum of operations. CAS procedures may/may not be required depending on the proximity of friendly forces and requirement for detailed integration.

JAAT PLANNING

A mission commander will be designated for JAAT operations. The mission commander should be the element with the highest situational awareness and ability to provide command and control.

JAAT can be accomplished with minimum coordination, provided that the participants are trained and proficient. Maximum JAAT synergy occurs when the JAAT mission commander at the tactical level, normally an Air Mission Commander (AMC), possesses the authority to coordinate attack execution directly with the other team members.

In non-CAS JAAT application, direct attack coordination is more efficient because there is no requirement for JTAC/FAC(A) control.

When JAAT is employed where CAS procedures are required, Type 2 or 3 control options offer increased control flexibility that can preserve JAAT synergy if the tactical risk assessment allows.

JAAT Planning Guideline

- a. Mission (Maneuver Cmdr/S-3)
 - (1) Commander's Guidance
 - (2) Objectives
 - (3) Friendly situation
 - (4) Enemy situation
 - (5) Success criteria
 - (6) Tactical risk assessment
- b. Enemy. (S-2/Intel)
 - (1) Target type, size and activity
 - (2) Enemy strengths, weaknesses, and possible courses of action
 - (3) Enemy air, air defense, and surface threat/type/location
 - (4) Target priorities
 - (5) Weapons-to-target / environment match

- (6) Intelligence collection plan/products request
- (7) Plan for intelligence updates before launch and enroute
- c. Terrain / Weather. (S-2/Intel/S-3)
 - (1) Visibility (impact of obscurants)
 - (2) Clouds / Ceiling (effect on employment/weapon options)
 - (3) Day versus night (See JAAT Night Considerations Page 27)
 - (a) Transition from day to night
 - (4) Diurnal / thermal crossover
 - (a) Sensor employment plan
 - (b) Electro-optical tactical decision aids (EOTDA)
- d. Assets available (S-3/FSO/ALO)
 - (1) Rotary Wing
 - (2) Fixed Wing
 - (3) Other capability integration (when available/required)
 - (a) Indirect Fires (Artillery, Mortar, NSFS)
 - (b) Aviation (EW/SEAD/Airborne)
 - (c) C2/ISR/JSTARS/UAV/Tankers/Fighters)
 - (d) Ground observers (TACP, SCOUT, COLT, FIST, SOF)
- e. Command and control (Maneuver Cmdr/Aviation Unit Cmdr/S-3)
 - (1) Designation / Location of AMC
 - (2) Communications plan (frequencies, IFF, Have Quick procedures, authentication, ingress / target area / egress C2, etc.)
 - (3) ROE and training rules
 - (4) Risk Management
 - (5) Critical information flow
 - (6) Mission abort criteria / considerations (weather, aircraft availability, SEAD, EW, fire support, C3, ADA, logistics, etc.)
 - (7) Mission abort authority
 - (8) Mission abort notification procedures
 - (9) Laser code deconfliction
- f. Execution (S-3/AMC/FSO/ALO/F/W LNOs)
 - (1) Ingress/egress considerations
 - (a) Routes / altitudes
 - (b) Mutual support
 - (c) Fires
 - (d) Sensor support
 - (e) Communications
 - (f) PR (embedded or on-call) (CSAR / TRAP)
 - (2) Employment altitudes.

- (3) Tactics and attack options
 - (a) R/W - Diving, running, hovering
 - (b) F/W - Level / diving / popup / loft / standoff deliveries
 - (c) Attack methods (combined / sectored).
 - (d) Firepower timing options (simultaneous, sequential, random).
 - (e) Deconfliction
 - Lateral/Geographic
 - Altitude
 - Time (TOT/TTT)
 - Combination
- (4) Fire Support Coordinating Measures/Airspace Control Measures
 - (a) Coordinating altitude
 - (b) Ordnance trajectory (direct / indirect fires, standoff weapons, bombs delivered from altitude)
 - (c) Fragmentation
 - (d) Illumination effects
- (5) Aircraft positioning - Marshalling area, contact points (CPs), initial points (IPs), release point, attack by fire / battle positions
- (6) Lethal and non-lethal SEAD/J-SEAD
- (7) EW considerations
- (8) Friendly location and coordination.
 - (a) Friendly fire support locations, capabilities and planning
 - (b) Friendly ADA weapons coordination
 - (c) Locations of other friendly units
- (9) Establish common target area reference (geo-ref, map datum MGRS / latitude and longitude, target reference point (TRP), target sortie, etc).
- (10) Target marking options (direct / indirect fires, laser, IR pointer, talk-on, combination).
- (11) Collection of BDA / BHA.
- (12) Contingencies (alternate targets, lost communications, lame duck, fallouts, downed pilot / crew)

JAAT EXECUTION

a. JAAT Sample Mission Flow:

- (1) Supporting aircraft contacts the AMC on check-in or strike frequency.
- (2) AMC verifies aircraft received the current target/threat information.
 - (a) AMC briefs situation updates followed by the JAAT attack plan.

Supporting aircraft passes CAS Check-in Brief (JFIRE format 12).
AMC passes target information in 9-Line format (JFIRE Format 14)
AMC: "HOG 01, 9-line to follow... lines 1 through 3 N/A."
AMC: "2014 feet, target is column of 5 tanks in choke point, PL385211"
AMC passes remainder of 9-line brief: "Laser 1688, SW 2500, Egress South."
If conducting a CAS mission, readback of lines 4, 6 and restrictions (Required IAW JP 3-09.3).
AMC passes remarks (as applicable): "Laser to target line 340"
AMC confirms associated threat: **"ZSU located 4km north of target area."**
AMC passes attack method and firepower timing option **"Sectored, sequential, your sector east of road running through target area. Helos will be west of the road with a coordinating altitude of 2500 ft conducting diving fire."**
AMC passes targeting plan and TOT: "HOG 01, hit eastern tanks, helos have western. Your TOT is 1350, call 60 seconds out."
AMC passes attack restrictions (if any): "HOG 01, attack south to north only."
Supporting aircraft verifies receipt of information and compliance:
"HOG 01, WILCO."
At 60 seconds from TOT, supporting aircraft calls: **"HOG 01, 60 seconds."**
AMC: "HOG 01, roger". Supporting aircraft makes laser calls as required.
AMC maintains the ability to abort the attacking aircraft, as necessary
HOG 01 conducts target attacks IAW mission brief.

Figure 1: JAAT Mission Flow Example

b. Key JAAT Components:

(1)**Check-in and Briefing.** JAAT participants check in with the AMC IAW check in briefing (JFIRE Format 12). The 9-line JCAS brief is the standard for providing information and will be used whenever possible. If items in the JCAS 9-line are unknown or do not apply they will be briefed as such. However, JP 3-09.3 readback requirements must be adhered to. The following items are required: attack method (combined or sectored), firepower timing option (simultaneous, sequential, or random), targeting plan within engagement area (target sort, fire distribution).

(2)**Clearance Authority:** When JAAT is employed using CAS procedures, the JTAC/FAC(A) must provide clearance for aircraft to expend ordnance. When CAS procedures are not in effect, clearance to expend ordnance rests with individual shooters IAW theater ROE. In both situations, all participants retain abort authority.

(3)**Attack Methods:** The attack methods describe control techniques for attacking targets within an objective area. Methods may apply to the joint attack as a whole and within the attacking flight or unit's individual plan of attack. The two methods are illustrated in Figures 9 and 10.

(a) **Combined Method:** During this attack, JAAT aircraft may utilize the same avenue of approach to a common engagement area.

(b) **Sectored Method:** During this attack, JAAT aircraft will utilize different avenues of approach that are separated by an acknowledged and well defined boundary/terrain feature.

(4)**Firepower Timing Options:** Firepower timing options integrate and deconflict fires. Timing options apply to any altitude option (low, medium or high). *AMC will clearly deconflict altitudes for all JAAT participants.*

(a) **Simultaneous:** All elements attack at the same time.

- Advantages of simultaneous timing option: Masses fires, maximizes shock effect, complicates enemy ADA targeting scheme, unpredictable.
- Disadvantages of simultaneous timing option: Complicates target array sorting and direct fire planning, simultaneous impacts can interfere with one another.

(b) **Sequential:** All elements attack in a predetermined sequence.

- Advantages of sequential timing option: Target area marked for subsequent attackers, continuous pressure on target over time, allows attackers to reposition while other attackers shoot, less weapons interference for subsequent shooters, ensures targets are not double-

targeted.

- Disadvantages of sequential timing option: Air defenses can target airborne participants, takes longer, less shock effect; could provide opportunities to enemy.

(c) **Random:** All elements attack at will.

- Advantages of random timing option: Easiest on pilots, no timing required, reduced C2 requirements, unpredictable.

- Disadvantages of random timing option: Complicates deconfliction, no guarantee of effects, possibly less pressure on enemy, can complicate fire support plan.

(5) **Targeting Plan:** Integrates and deconflicts fires and targets within the engagement area (target sort, fire distribution). Examples include but are not limited to:

- (a) Target reference point (TRP)
- (b) Sectored
- (c) Quadrant
- (d) Fire Pattern
- (e) Target Array

(6) **Weapons Delivery Considerations:** Information should be passed from the attacking aircraft to the AMC to coordinate specific weapons delivery profiles and/or effects. These items are not required, but may include the following:

- (a) Attack heading
- (b) Weapons selection
- (c) Ingress and release altitudes
- (d) Dive angle
- (e) Distance from target

(7) **Coordinating Instructions:** Establishing the attack method and the timing option are vital. If all else fails, use plain language.

(8) **Deconfliction:** Four common methods to deconflict airspace and weapons effects in the target area are listed below. See Joint Publication 3-09.3, "Joint Tactics, Techniques, and Procedures for Close Air Support" along with JFIRE Figures 11, 12, and 13 for a detailed description of each:

- (a) Lateral/geographic separation
- (b) Altitude separation
- (c) Time separation
- (d) Any combination of the above

Table 7: Coordinated Attack Types			
Type of Attack	Simultaneous	Sequential	Random
COMBINED Same avenue of Attack	Visual, TOT or TTT	Visual Separation, TOT or TTT	NOT normally used for low altitude
SECTORED Acknowledged sector	Visual, TOT or TTT	Visual Separation, TOT or TTT	Free flow*
* Must ensure strafe fan/bomb and missile fragmentation deconfliction.			

(9)**Battlefield Handover:** When the AMC must hand over the target area to another asset, the following information should be covered:

- (a) Friendly situation (ground order of battle, airborne assets, ordnance, time on station, location)
- (b) Enemy situation (targets destroyed/remaining, ADA)
- (c) Control measures in effect
- (d) Clearance authority (if applicable)
- (e) Frequencies and call signs

(10)**Disengagement:** Consideration must be given to the disengagement phase of the operation. Considerations include:

- (a) Covering Fires – suppressive fires, artillery, SEAD, etc.
- (b) Egress Route – mutual support/escort may be required.
- (c) Battle Damage Assessment (BDA) – in accordance with inflight report format from JP 3-09.3.

c. JAAT Night Considerations

Night JAAT procedures remain the same as for day. However, tactics require a more deliberate tempo. The following are considerations when conducting night operations:

(1)**Visual Descriptions:** Perspective/target resolution varies based on aircraft systems. A terrain feature visible by a NVG/FLIR equipped rotary-wing aircraft at 50 ft may not be recognized by an NVG equipped pilot or a FLIR/targeting pod equipped aircraft at 20,000 ft.

(2)**Night vision capabilities:** These vary greatly between weapons systems. A thorough understanding of these capabilities will enhance success during night JAAT.

- (3) **Increased friendly and threat situational awareness is necessary:** A thorough understanding of friendly positions, intentions, movements, and methods of mark will reduce the risk of fratricide.
- d. JAAT Pre-Mission Coordination Briefing Guide
- (1) Time hack
 - (2) Introduce team members
 - (3) Ground situation (S2/intelligence)
 - (4) Electronic Attack Considerations
 - (5) Weather
 - (6) Call signs
 - (7) ATO, ACO, SPINS, ROE
 - (8) Working frequencies, communications net. Communications jamming
 - (9) Code words
 - (10) Appropriate take-off times
 - (11) Route of flight, altitude, time en route, and airspace control measures
 - (12) Contact point
 - (13) Authentication procedures
 - (14) Map datum
 - (15) Air Mission Commander's briefing sequence
 - (16) Situation update.
 - (17) Indirect fires (artillery/NSFS)
 - (a) Assets available
 - (b) Positions
 - (c) Ammunition
 - (d) Planned fires
 - (18) Communication nets and agencies
 - (19) Fire support coordinating measures (ACAs, FSCL, RFLs)
 - (20) Restrictions (ordnance, etc.)
 - (21) 9-Line briefing items 1-9 (if known)
 - (a) Remarks
 - (b) Laser to target line
 - (c) Timing calls (TOT/TTT, etc.)
 - (22) Attack/Employment method (e.g. sectored sequential visual)
 - (23) Abort codes
 - (24) Restrictions. (e.g. NFAs, run-in headings, etc)
 - (25) Reattack Information

- (26) Weapon information (detail as required)
 - (a) Rotary-wing
 - (b) Fixed-wing
- (27) Ordnance fan deconfliction
 - (a) Rotary-wing weapon employment tactics (meters)
 - (b) Fixed-wing tactics (detail as required)
- (28) Attack formations
 - (a) Altitudes
 - (b) Coordination procedures
- (29) TACP/FAC(A)
- (30) AMC
- (31) Fixed-wing radio procedures (detail as required)
 - (a) Departing IP call
 - (b) Timing/laser coordination calls
 - (c) Actual/simulated attacks call weapons usage (rockets, bombs, guns)
- (32) Reattack/regroup
 - (a) Coordination between/within flights
 - (b) Timing
 - (c) Coordination with TACP/FAC(A)/AMC
 - (d) Coordination with rotary-wing attack elements
 - (e) Regroup areas
- (33) Egress to IP
- (34) When to leave
- (35) Formation
- (36) Route considerations
- (37) New target information
- (38) BDA procedures
- (39) Battlefield hand over (as required)
- (40) Disengagement
- (41) Contingencies. Deconfliction during emergencies
 - (a) "KNOCK IT OFF" procedures
 - (b) Target run abort criteria/procedures
 - (c) Pop-up threat engagement
 - (d) Personnel Recovery (PR)/Battle Damage Procedures
 - (e) Weather abort criteria
 - (f) Minimum package requirements
 - (g) Mission abort authority/criteria
 - (h) Aircraft emergencies
 - (i) Hung/unsafe ordnance

JAAT COMMUNICATIONS

a. JAAT communication nets depend upon the availability of different radios in the various aircraft and on the tactical situation.

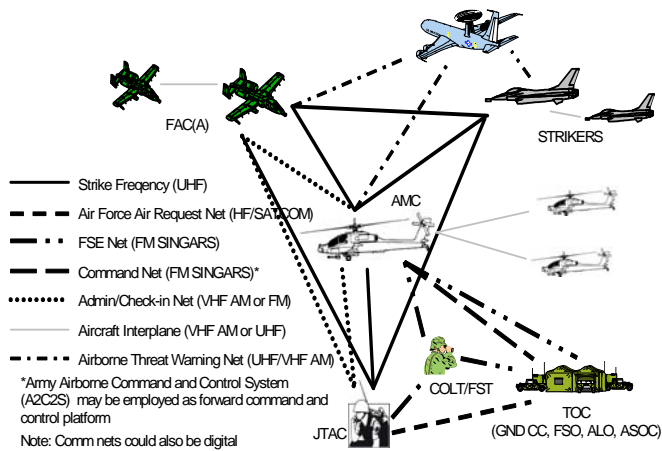


Figure 2: Sample JAAT Communications Net

b. **Command Net:** The AMC uses this net to coordinate the JAAT with other maneuver unit commanders and to keep them informed on the situation in the battle area.

c. **Admin/Check-in Frequency:** If required/desired, all participants should check-in on this frequency to reduce clutter on strike frequency. Used to pass updates for mission and build situational awareness of aircraft arriving after the JAAT has begun.

d. **Strike Frequency/TAD:** The AMC uses the strike frequency to coordinate the ongoing JAAT with all participants.

e. **Authentication:** Service authentication tables differ: The mission commander should coordinate authentication between all participants.

SECTION IV: CLOSE AIR SUPPORT (CAS)
CAS PLANNING CONSIDERATIONS (Day/Night)

- a. Ground Commander's Intent/Mission Objectives
- b. Prepare Maps (coordinate with S-2, Intel, S-3)
 - (1) Map datum, CGRS
 - (2) Contact Points, Initial Points, Observation Points, Battle Positions
 - (3) Friendly Order of Battle
 - (a) Scheme of Maneuver
 - (b) Scheme of Fires
 - (c) Unit Locations
 - (d) Observation/Terminal Attack Control Positions
 - (4) Enemy Order of Battle
 - (a) Unit Location
 - (b) Target Locations
 - (c) Threats
- c. Review of ACO, ATO, SPINS, ROE, Communications Plan; verify appropriate forms, worksheets, and formats in use to request and control CAS.
- d. Weather
 - (1) Ceiling/Visibility
 - (2) Winds (surface and at altitude)
 - (3) Sunrise/Begin Morning Nautical Twilight (BMNT)
 - (4) Sunset/End Evening Nautical Twilight (EENT)
 - (5) Solar elevation/azimuth
 - (6) Moon Data (rise/set, elevation, azimuth, percent illumination)
- e. Agency Coordination
 - (1) Theater C2 (AWACS, CRC, JSTARS etc)
 - (2) ASOC/DASC
 - (3) TAC(A)/DASC(A)
 - (4) JTAC/FAC(A)
- f. Prepare Situation Update (JFIRE Format 13)
- g. Fire Support Coordination
 - (1) ACM/FSCM, kill box Plans
 - (2) Artillery/Mortar Position Areas (PA)
 - (3) Gun-Target Line (GTL)
 - (4) Minimum/Maximum Ordinate
 - (5) Attack plan
 - (6) Support by fire and maneuver
 - (7) High Payoff Target List (HPTL)
 - (8) Attack Guidance Matrix (AGM)

- (9) Target Marking (Smoke/LASER/ILLUM)
- (10) SEAD
- (11) Schedule of Fires Worksheet
- h. Fighter Holding Plan
 - (1) Location
 - (2) Altitude
- i. Rotary Aviation Coordination
 - (1) JAAT Opportunities
 - (2) Battle/Firing Positions
 - (3) Altitudes
 - (4) Minimum Risk Routes (MRRs)
 - (5) Deconfliction Plan
 - (6) Frequencies
 - (7) Spider routes (CSAR assets)
- j. Target Area Operations
 - (1) Authentication Procedures
 - (2) Friendly location marking procedures
 - (3) Prepare CAS 9-Line Briefing (JFIRE Format 14/NATO Format 20)
 - (4) 9-Line Remarks Considerations
 - (a) Target Description
 - (b) Threats
 - (c) Artillery
 - (d) Clearance (Final Control/Abort Code)
 - (e) Desired Ordnance Effects
 - (f) Restrictions
 - (g) Timing/Deconfliction Plan
 - (h) Airspace Coordination Areas (ACAs)
 - (i) Weather
 - (j) SEAD and location
 - (k) Laser, illumination, night vision capability
 - (l) Danger Close
 - (5) Prepare Target Mark Devices
 - (a) Artillery
 - (b) Laser/IR Pointers
 - (c) FAC(A)
- k. Pass BDA
 - (1) Fighters
 - (2) ASOC
 - (3) DASC

URBAN CAS PLANNING CONSIDERATIONS

- a. Effective Targeting
 - (1) Large Scale (1:25,000) maps with street names
 - (2) Gridded overhead photos
 - (3) RPV/UAV Support
 - (4) Other standardized maps with geo-ref overlay
- b. Responsive C2
- c. SEAD
- d. Target marking capabilities
- e. Weapons effects and fragmentation patterns
 - (1) Penetration capability
 - (2) Proportional response
- f. Capable Platforms/Sensors
- g. Proficient and trained participants
- h. Rules of engagement and CDE considerations

NOTE: Additional references are found in JP 3-09.3 and FM 3-06.1/MCRP 3-35.3A/NTTP 3-01.04/AFTTP 3-2.29, *Multi-Service Procedures for Aviation Urban Operations*.

INS/GPS-GUIDED WEAPONS

- ADVANTAGES

Accuracy: These weapons can be very accurate if precise target location data is known. Accuracy is also unaffected by launch range (assuming GPS-aided guidance).

Standoff: These weapons can provide standoff capability at very long distances. Aircraft and aircrew can thereby effectively avoid many point defense systems while employing these weapons.

All weather capability: INS/GPS-guided munitions normally offer an all-weather capability because they do not require designators for guidance. Unlike unguided munitions, INS/GPS-guided weapons do not require the aircrew to see the target or to maintain a clear LOS to the target like laser-guided munitions.

Multiple target capability: Depending on platform and weapon variety, the weapons allow one aircraft to strike multiple stationary targets in one pass.

- LIMITATIONS

Moving Targets: These weapons have no direct capability against moving targets. GPS/INS weapons fly to pre-programmed coordinates. If the target moves between the time it is targeted and the time the weapon impacts, the weapon will miss.

Location Error: These weapons require accurate horizontal and vertical target location. If that information is not available, the commander must be advised. (World Geodetic System-84 is the DOD standard reference system unless stated in the SPINs).

Malfunctions: GPS/LGBs are very accurate; however, they could be extremely hazardous when used during CAS if they fail. Their footprint is very large and if they fail, they increase the probability of fratricide. When practical, precision-guided munitions should be employed parallel to the FLOT.

These weapons may be affected by strong winds after release.

Tactics, Techniques, and Procedures. Significant issues exist when using weapons that transit over or around friendly forces and use pre-programmed flight paths and impact points. These weapons cannot be recalled once released. Therefore, the JTAC must take great care to ensure the best possible target location is obtained and aircrew must verify the correct target coordinates have been input into the weapon. All personnel must deconflict high release profiles with systems operating below.

JOINT TERMINAL ATTACK CONTROLLER (JTAC)

A qualified (certified) Service member who, from a forward position, directs the action of combat aircraft engaged in close air support and other offensive air operations. A qualified and current joint terminal attack controller is recognized across the Department of Defense as capable and authorized to perform terminal attack control.

Terminal attack control is the authority to control the maneuver of and grant weapons release authority to attacking aircraft. Based on a risk assessment, the supported commander will weigh the benefits and liabilities of authorizing a particular type of terminal attack.

JTACs will broadcast the type of control (1, 2, 3) upon aircraft check-in.

Risk Assessment

What: *processing of available information to ascertain a level of acceptable risk to friendly forces or noncombatants. - JP3-09.3*

Who: *Lowest level supported commander with advice from CAS experts... JTAC, AO ALO, and FSE.*

Why... *To authorize a particular type of terminal attack control.*

NOTE: JTAC may change the type of terminal attack control only within guidelines established by the supported commander

Figure 3: Risk Assessment

Table 8: CAS Terminal Attack Control Attributes			
<i>Type</i>	<i>Results of Risk Assessment</i>	<i>JTAC Observes Target and Aircraft</i>	<i>Timely and Accurate Target Data Provided</i>
1	Commander assesses a high risk of fratricide to friendlies or non-combatants	Required	By JTAC. (Inherent to Type 1 Control)
2	Lower risk to friendlies or non-combatants but JTAC maintains control of individual attacks	Not Required	By Observer or through other JTAC sensors ¹
3	Commander assesses the lowest risk of fratricide to friendlies or non-combatants. JTAC may provide blanket clearance	Not Required	By JTAC or Observer or by Aircrew if targets comply with prescribed guidance ²
¹ Observer: Scout, COLT, FIST, UAV, SOF, or assets that provide real-time targeting information ² Supported commander delegates weapons release authority to the JTAC for all types of control. JTAC will provide "cleared hot" as appropriate for each attack in type 1 and 2 control and "cleared to engage" for type 3			

Table 9: Types of CAS Control Advantages/Disadvantages		
Type	Advantages	Disadvantages
1	<p>Most JTAC control over fratricide concerns</p> <p>Real time abort provides greatest fratricide prevention</p> <p>Simpler target verification process</p>	<p>JTAC must see target and aircraft</p> <p>May restrict aircraft tactics</p> <p>May limit useable munitions due to typical proximity of friendlies</p>
2	<p>Permits use of stand-off weapons and full range of aircraft sensors</p> <p>Greater aircraft tactics flexibility</p> <p>Allows full use of observation assets</p> <p>Greater battlefield CAS coverage</p> <p>JTAC has control of individual attacks</p>	<p>More difficult target verification</p> <p>More intensive communication requirements when using observers and remote sensors</p> <p>Less direct JTAC control over weapons effects and abort situations</p>
3	<p>Least restrictive to CAS aircraft</p> <p>Expedites ordnance employment on multiple targets in an engagement area</p> <p>Reduced JTAC workload</p> <p>Least communication load</p> <p>Maximum CAS battlefield coverage</p>	<p>Most difficult to quickly ascertain target validity and confirm BDA</p> <p>CAS aircraft may be required to find their own target</p> <p>JTAC may not control individual attacks</p> <p>Least direct JTAC control of weapons effects on nearby friendlies</p>

CAS EXECUTION WITH NON-JTAC PERSONNEL

a. Units that have a reasonable expectation to conduct terminal attack control need to have certified JTACs available. In rare circumstances, the ground commander might require CAS when no JTAC is available. Non-JTAC controllers must clearly state to attacking aircraft that they are "non-qualified JTACs." In these instances, qualified JTACs, FAC(A)s, and/or CAS aircrew should assist these personnel/units to greatest extent possible in order to bring fires to bear.

b. Due to the complexity of CAS, the commander must consider the increased risk of fratricide when using personnel who are not qualified JTACs and accepts full responsibility for the results of the attacks. The requester must notify/alert his command element when a JTAC or FAC(A) is unavailable to conduct Type 1, 2, or 3 controls. If the maneuver commander accepts the risk, he forwards the request to the CAS controlling agency. This information will alert the CAS controlling agency (ASOC/DASC or JAOC) that aircrew will be working with non-JTAC-qualified personnel.

c. Ground Personnel will:

- (1) Identify themselves as "non JTAC qualified" on aircraft check-in
- (2) Make every effort to involve a qualified JTAC/FAC(A) in the situation
- (3) Provide as much of the 9-line briefing as possible
- (4) As a minimum, pass target elevation, target location, and

restrictions

d. Aircrew in this situation will:

- (1) Make every effort to involve a qualified JTAC/FAC(A) in the situation
- (2) Be prepared to "pull" information to complete the CAS briefing
- (3) Exercise vigilance with target identification, weapons effects, and

friendly location

CAS EXECUTION PROCEDURES

CAS Pre-Execution Considerations: The JTAC must coordinate with ground maneuver forces and obtain required CAS information before building the CAS briefing. "TTFACOR" is a memory tool that ensures JTACs coordinate the minimum information required for a CAS mission.

CAS Pre-Execution Information Checklist:*

Target	CC intent, valid, hostile target ID, coordinates
Threat	Intel update/PIREPS, SEAD
Friendlylies	Update / confirm location, troops in contact, Danger Close
Artillery	ACA activation, SEAD coordination
Control	CC Approval, risk assessment, type control
Ordnance	CAS ordnance type, effects
Restrictions	Arty, weapons effects, friendlylies, collateral damage

Also useful as **TACP to FAC(A) and **Situation Update** briefing guide.*

Figure 4: TTFACOR Technique

Tactical Operations Center (TOC) Coordination: The CAS battle drill is a procedure the ALO, as part of the fire support element (FSE), or JTAC uses to ensure CAS is integrated with surface fires and maneuver forces to meet the commander's intent. Include the TOC staff and rehearse the battle drill so that it can be executed quickly.

Format 11: CAS Battle Drill
<p>Aircraft 30 minutes from check-in with JTAC</p> <p>ALO/JTAC- Initiates battle drill, verifies deconfliction (ACA) plan, alert JTACs</p> <p>XO/S3 - Initiate tactical risk assessment (verify friendly locations) based on commander's guidance</p> <p>S2 - Verify enemy <u>s</u>ize, <u>a</u>ctivity, <u>l</u>ocation, <u>u</u>nit, <u>t</u>ime, <u>e</u>quipment (SALUTE)</p> <p>FSO - Alert SEAD/marketing battery, alert observers for targeting</p> <p>ADO - Inform AD community of inbound friendly air</p>
<p>Aircraft 15 minutes from check-in with JTAC</p> <p>ALO/JTAC – Brief aircraft/ordnance and deconfliction (ACA) plan,</p> <p>XO/S3 – Approve/disapprove mission based on tactical risk assessment</p> <p>S2 – Brief enemy SALUTE</p> <p>FSO – Report location of SEAD/marketing battery and status of observers</p> <p>ADO – Report ADA status</p>
<p>Aircraft conducting check-in with JTAC</p> <p>ALO/JTAC – Verify aircraft/ordnance, deconfliction (ACA) plan, confirm timing</p> <p>XO/S3 – Monitor the mission</p> <p>S2 – Continue to monitor enemy SALUTE</p> <p>FSO – Activate ACA plan, pass SEAD/marketing CFF, coordinate TTT/TOT</p> <p>ADO - Disseminate "White Hold"</p>
<p>Aircraft depart (Post Attack)</p> <p>ALO/JTAC – Collect and disseminate BDA and pilot reports (PIREPS)</p> <p>XO/S3 – Assess mission effectiveness and next course of action</p> <p>S2 – Collect and process BDA and PIREPS</p> <p>FSO – Deactivate ACAs, terminate SEAD/marketing missions</p> <p>ADO – Inform AD friendly air is off-station and adjust ADA status</p>

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	
						TIME BY	
2. PREPLANNED:		A. PRECEDENCE		B. PRIORITY		RECEIVED	
IMMEDIATE:		C. PRIORITY				TIME BY	
3. TARGET IS/NUMBER OF							
A. PERS IN OPEN		B. PERS DUG IN		C. WPNS/MG/RR/AT		D. MORTARS, ARTY	
E. AAA ADA		F. RKTS MISSILE		G. ARMOR		H. VEHICLES	
I. BLDGS		J. BRIDGES		K. PILLBOX, BUNKERS		L. SUPPLIES, EQUIP	
M. CENTER (CP, COM)		N. AREA		O. ROUTE		P. MOVING N E S W	
4. TARGET LOCATION IS							
A. (COORDINATES)		B. (COORDINATES)		C. (COORDINATES)		D. (COORDINATES)	
E. TGT ELEV		F. SHEET NO.		G. SERIES		H. CHART NO.	
5. TARGET TIME/DATE							
A. ASAP		B. NLT		C. AT		D. TO	
6. DESIRED ORD/RESULTS							
A. DESTROY		B. NEUTRALIZE		C. ORDNANCE		D. HARASS/INTERDICT	
7. FINAL CONTROL							
A. FAC/RABFAC		B. CALL SIGN		C. FREQ			
D. CONT PT							
8. REMARKS							
1. IP				9. EGRESS			
2. HDWG MAG OFFSET: L/R				THE FOLLOWING MAY BE INCLUDED IN THE "REMARKS", IF REQUIRED:			
3. DISTANCE				BCN-TGT MAG BCN GRID			
4. TOT ELEVATION FEET MSL				BCN-TGT METERS TGT GRID			
5. TOT DESCRIPTION				BCN ELEVATION FEET MSL			
6. TOT LOCATION							
7. MARK TYPE CODE							
8. FRIENDLIES							
SECTION II - COORDINATION							
9. NSFS		10. ARTY		11. AIO/G-2/G-3			
12. REQUEST		13. BY		14. REASON FOR DISAPPROVAL			
APPROVED							
DISAPPROVED							
15. RESTRICTIVE FIRE/AIR PLAN		16. IS IN EFFECT		17. LOCATION		18. WIDTH (METERS)	
A. IS NOT IN EFFECT		B. NUMBER		A. (FROM TIME) B. (TO TIME)		A. (MAXIMUM/VERTEX) B. (MINIMUM)	
C. (FROM COORDINATES) D. (TO COORDINATES)							
SECTION III - MISSION DATA							
20. MISSION NUMBER		21. CALL SIGN		22. NO. AND TYPE AIRCRAFT		23. ORDNANCE	
24. EST/ACT TAKEOFF		25. EST TOT		26. CONT PT (COORDS)		27. INITIAL CONTACT	
28. FAC/FACIA/TACIA CALL SIGN/FREQ		29. AIRSPACE COORDINATION AREA		30. TGT DESCRIPTION		*31. TGT COORD/ELEV	
32. BATTLE DAMAGE ASSESSMENT (BDA) REPORT (J/SMTF INFLTRP)							
LINE 1/CALL SIGN		LINE 4/LOCATION		LINE 5/TOT		LINE 6/RESULTS	
LINE 2/MSN NUMBER							
LINE 3/REQ NUMBER							
		REMARKS		*TRANSMIT AS APPROPRIATE			

DD FORM 1972, APR 2003

PREVIOUS EDITION MAY BE USED.

Figure 5. Joint Tactical Air Strike Request Form

NOTE: While the focus of this section is CAS operations, these techniques may also be used for non-CAS missions that require terminal attack control but do not require detailed integration with artillery or ground force assets.

Format 12: CAS Check-In (Aircraft Transmits to Controller)	
Aircraft: "	_____, this is _____"
(Controller Call Sign)	(Aircraft Call Sign)
Identification/Mission Number: "	_____"
NOTE: Authentication (initiated by the net control agency) and appropriate response suggested here. The brief may be abbreviated for brevity/security (" as fragged " or " with exception ").	
Number and Type of Aircraft: "	_____"
Position and Altitude: "	_____"
Ordnance: "	_____"
	(Fusing, Laser code)
Play Time: "	_____"
*Abort Code: "	_____"
**Remarks: "	_____"
	(NVG, LST, Special Mission Items)
*Flight lead will establish abort code	
**Optional Entry	

Format 13: Situation Update
Situation Update # _____ (JTAC to Fighter) <i>(see notes below)</i>
Target- General Enemy Situation
Threat Activity
Friendly Situation
Artillery Activity
Clearance Authority
Ordnance Requested
Restrictions/Remarks
Localized SEAD efforts (suppression/EW)
Hazards (WX/Terrain/Obstructions)
<p><i>NOTE:</i> Situation update is normally given once when a fighter first checks in. Higher echelons (e.g., Division/Brigade) may assign an alphanumeric tracking number to facilitate subsequent check-ins at lower echelons.</p> <p>- For example, "Icebox 21, Hog Flight checking in as fraggged with situation update Hotel" This briefing should be broad in scope. More specific information is passed in the 9-line briefing.</p> <p>- Situation update may be passed to supporting airborne platforms (JSTARS) to speed information flow.</p>

Format 14: CAS Briefing (9-Line)

Do not transmit line numbers. Units of measure are standard unless briefed. Lines 4, 6, and restrictions are mandatory readback (*). JTAC may request additional readback:

JTAC: "_____, **this is** _____"
(Aircraft Call Sign) (JTAC)

"Type _____ **(1, 2, or 3) Control"**

1. IP/BP: "_____"

2. Heading: "_____"

(Deg Magnetic) (IP/BP to Target)

Offset: "_____"

(Left/Right) (When required)

3. Distance: "_____"

(IP-to-Target in nautical miles/BP-to-Target in meters)

4.* Target Elevation: "_____"

(in feet/MSL)

5. Target Description: "_____"

6.* Target Location: "_____"

*(Lat/Long, grid coords to include map datum
[e.g., WGS-84], offsets or visual description)*

7. Type Mark: "_____ " Code: "_____ "

(WP, Laser, IR, Beacon)

(Actual Code)

8. Location of Friendlies: "_____ "

(from target, cardinal directions and distance in meters)

Position marked by: "_____ "

9. Egress: "_____ "

Remarks (as appropriate): "_____ "

(Restrictions, Ordnance Delivery, Threats, FAH, Hazards, ACAs, Weather, Tgt Info, SEAD, LTL, GTL (degrees magnetic north), Night Vision, Danger Close [plus commander's initials])*

Time on Target (TOT): "_____ " or

Time to Target (TTT): "_____ "

"Standby _____ **plus** _____, **Hack.**"

(minutes)

(seconds)

NOTE: When identifying position coordinates for joint ops, include map data. Grid coordinates must include 100,000 meter grid identification

Format 15: CAS Briefing Worksheet		
Call Sign		
Mission #		
Number/Type Aircraft		
Position and Altitude		
Ordnance (Fusing/Laser Code)		
Playtime		
Abort Code		
	LST / Datum / NVG	LST / Datum / NVG
1. IP/BP		
2. Heading Offset Left/Right		
3. Distance (Fixed Wing-NM, Helo-M)		
4*. Tgt Elevation (MSL)*		
5. Tgt Description		
6*. Tgt Location*		
7. Mark Laser Code		
8. Friendlies		
9. Egress		
<i>Remarks (as appropriate): (Ordnance Delivery, Threats, Final Attack Hdg/Cone, Hazards, ACAs, Weather, Additional Tgt Info, SEAD & Location, LTL, IR Pointer line, Illumination, Night Vision, Danger Close [with commander's initials], Follow-on [Re-attack])</i>		
RESTRICTIONS* <hr/> <i>* Mandatory Readback Items</i>		

Format 16: AC-130 Gunship Call for FIRE
<p>1. Observer/Warning Order: "_____, this is _____," <small>(AC-130 C/S) (Observer C/S)</small></p> <p>FIRE Mission, Over."</p> <p>2. Friendly Location/Mark: "My Position _____" <small>(TRP, Grid, etc.)</small></p> <p>Marked by _____, Over." <small>(Strobe, Beacon, IR Strobe, etc.)</small></p> <p>3. Target Location: "_____" <small>(magnetic bearing & range [meters], TRP, Grid, etc.)</small></p> <p>4. Target Description/Mark: "Marked by _____, Over." <small>(Target Description) (IR Pointer, Tracer, etc.)</small></p> <p>5. Remarks: "_____" <small>(Threats, Danger Close Clearance, Restrictions, At My Command, etc.)</small></p> <p>AS REQUIRED</p> <p>1. Clearance: Transmission of the fire mission is clearance to fire (unless Danger Close). For AC-130, Danger Close is 200m with the 105mm, and 125m with the 40mm and the 25mm. For closer fire, the observer must accept responsibility for increased risk. State "Cleared Danger Close" (with commander's initials) on line 5. This clearance may be preplanned.</p> <p>2. At my command: For positive control of a gunship, state "At my Command" on line 5. The gunship will call "Ready to Fire" when ready.</p>
<p align="center">Adjusting AC-130 Gunship FIRE</p> <ul style="list-style-type: none"> • If significant miss distance or wrong target, adjust round impact by giving range (meters) and cardinal direction (north, south, east, west) • Marking/confirming targets can also be accomplished using covert illumination (Burn) or with the laser pointer (Sparkle). • To move Burn or Sparkle, say, "MOVE BURN/SPARKLE 300M WEST" or "ROLL BURN/SPARKLE 100M EAST". • Once burn or sparkle is over target, say "FREEZE BURN/SPARKLE" (If you say "STOP BURN/SPARKLE" the gunship will turn it off)
<p>Don'ts:</p> <ol style="list-style-type: none"> 1. Do not ask the gunship to identify colors 2. Do not reference clock positions. 3. Do not pass run-in headings/no-fire headings (give no-fire areas and friendly troop positions only) 4. Do not correct left/right or short/long

JTAC BREVITY CODES

ABORT - (include abort code). Directive call to cease action/attack/event/mission. *Abort the pass. Do not release ordnance.*

CLEARED HOT – Ordnance release is authorized.

CLEARED TO ENGAGE – JTAC Type III control clearance. Attack aircraft flight leaders may initiate attacks within the parameters imposed by the JTAC. Attack platform will provide "attack complete" call to JTAC, indicating completion of ordnance release.

CONTINUE – Continue present maneuver, does not imply a change in clearance to engage or expend ordnance. *Used to acknowledge aircraft without providing clearance to release ordnance.*

CONTINUE DRY – 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* controls.

*JTAC must use "**Type 3, Continue Dry**" for dry Type 3 controls.

WARNING: The words "CLEARED" or "ENGAGE" will only be used when ordnance is actually to be delivered. Use standard radio calls to the maximum extent possible. This will reduce the chance of dropping ordnance on dry passes and reduce the risk of fratricide.

Table 10: Abort Call Illustration	
The JTAC is "NAIL 11," the CAS attack flight is "SPIKE 41." SPIKE 41 flight has chosen abort code "BR" (authenticated "D")	
RADIO CALL	ACTION TAKEN
(During the CAS check-in briefing): "NAIL 11, this is SPIKE 41, abort code BRAVO ROMEO."	NAIL 11 notes the correct reply for "BR" is "D".
(The JTAC calls for an abort): "SPIKE 41, NAIL 11, ABORT DELTA, ABORT DELTA, ABORT DELTA."	SPIKE 41 aborts the pass.
NOTE: Some NATO countries use "STOP" rather than "ABORT." Controllers must verify procedures in use.	

NATO INFORMATION

Format 17: NATO Standard Rear Briefing
Rear Briefing. Briefing information passed by a rear briefing agency should normally be divided into what is mandatory and what may also be required by the tactical situation. The briefing should comprise the following items in the order shown:
1. Mandatory Items: <ul style="list-style-type: none"> a. Target location in UTM/grid or LAT/LONG with target elevation in feet above mean sea level (mandatory readback and recording of actions). b. Target description (may include advisory or mandatory attack headings). c. "No friendlies within" distance or nearest friendlies location (mandatory readback and record action).
2. Additional Items: <ul style="list-style-type: none"> a. Target area threats b. Navigation hazards c. Hazards d. Other items

Format 18: NATO CAS Worksheet (Check-in Information)			
Call Sign			
Mission #			
Authentication			
Number /Type Aircraft			
Ordnance			
Position			
Playtime			
Abort Code			
	LST /Datum/NVG	LST/Datum/NVG	LST/Datum/NVG

Format 19: NATO CAS Check-In Briefing	
1. Permissive Environment	
Aircraft transmits to controller:	
<i>Item</i>	<i>Transmission</i>
Aircraft Call Sign	"Hog 01"
Mission Number	"3M106"
Authentication	"Authenticate Alpha Bravo" (JTAC should authenticate before continuing with the brief)
Number and type of aircraft	"Two F-16s"
Ordnance	"Eight Mk-82s, two AGM-65s"
Position	"Two minutes east of CP India"
Playtime	"15 minutes"
Rear Briefing Identifier	"Got briefing Echo"
Abort Code	"Charlie Sierra"
2. Non-permissive Environment	
Aircraft transmits to controller	
<i>Item</i>	<i>Transmission</i>
Aircraft Call Sign	"Hog 01"
Mission Number	"3M106"
Authentication	"Authenticate Alpha Bravo" (JTAC should authenticate before continuing with the brief)
Briefing Termination	"As fragged with briefing Echo"

Format 20: NATO 15-Line JTAC-to-Attack Aircraft Briefing

MISSION C/S _____		ABORT CODE _____	
<p>- Items A through J are mandatory, K through O are optional. - Items A, D, G, H (Bold) are mandatory readback (even if "NONE"). - Heading and bearings Magnetic unless True is requested</p>			
A.	IP	"	"
B.	BEARING	"	degrees"
C.	DISTANCE	"	nm"
D.	TARGET LOCATION		
	1. (UTM)	"	"
	2. (LAT/LONG)	"	"
E.	TARGET ELEVATION	"	ft"
F.	TARGET DESCRIPTION	"	"
G.	ATTACK HEADING	"	"
H.	FRIENDLY FORCES	"	"
I.	ATTACK TIME TOT/TTT	"	"
J.	ATTACK CLEARANCE JTAC	"	TAD _____"
CALLSIGN _____			

K.	TARGET INDICATION:		
	1. REFERENCE PT	[]
	2. SMOKE	[]
	3. LIGHT/MIRROR	[]
	4. LASER CODE	"	"
	- LASER TO TARGET LINE	"	DEGREES"
	5. BEACON FREQUENCY	"	"
	BEARING	"	DEGREES"
	DISTANCE	"	METERS"
	ELEVATION	"	FT"
L.	THREATS "	"	"
M.	WEATHER (IF SIGNIFICANT) "	"	"
N.	HAZARDS "	"	"
O.	EGRESS "	"	"

Format 21: NATO CAS Worksheet (JTAC to Attack Aircraft Information)			
A. IP			
B. Bearing			
C. Distance (NM)			
D. Target Location (UTM) (Lat/Long)			
E. Tgt Elevation (Ft MSL)			
F. Tgt Description			
G. Mandatory Attack Heading			
H. Friendly Forces			
I. Attack Time TOT/TTT			
J. Atk Clearance TAC C/S & TAD			
K. Target Indication Laser Code Laser to Target Beacon Freq Bearing Distance (m) Elevation (MSL)	Ref Pt. Smoke Lt/Mirror	Ref Pt. Smoke Lt/Mirror	Ref Pt. Smoke Lt/Mirror
L. Threats			
M. Weather (if significant)			
N. Hazards			
O. Egress			
- A through J are Mandatory Brief items, K through O are optional. - Items A, D, G, H Bold are mandatory readback (even if "NONE") - Heading and bearings Magnetic unless True is requested.			

Table 11: Fixed Wing Aircraft Weapons and Capabilities						
Aircraft	Ordnance	Laser		Marking Capability	Beacon Option	Other Systems
		LST	LTD			
AV-8B Harrier II	LGB MAVERICK GP bombs CBU Aerial mines	YES	NO	Rockets 25mm HEI IR marker LUU-2 flares	None	CCD TV NVG GPS (N) FLIR
	Litening Pod ¹	YES ¹	YES ¹	Laser ¹ IR Pointer ¹		(T) FLIR ¹ CCD ¹
Harrier II Plus ²	SIDEARM	NO ²	NO ²			SAR Rdr ^{2,3}
A-10 / OA-10A	LGB AGM-65 GP bombs CBUs Aerial mines 2.75" rockets 30mm cannon	YES	YES ¹	WP rockets 30mm HEI IR Pointer LUU-1/-2/-5/-6/-19 Laser ¹ M-257/-278 illum rockets	None	NVG GPS FLIR ¹ CCD ¹
AC-130H	105mm howitzer (176 rds) 40mm cannon (512 rds)	NO	YES (1688 only)	105mm 40mm IZLID ATI	PPN-19 SST-181	FLIR LLTV Radar ⁴ GPS, PLS
AC-130U	105mm howitzer (100 rds) 40mm cannon (256 rds) 25mm cannon (3000 rds)	NO	YES	105mm 40mm 25mm LIA	PPN-19 SST-181	FLIR ALLTV SAR Rdr ³ GPS
¹ If equipped with LITENING pod ² AV-8B Harrier "II Plus" (with Radar) ³ Synthetic Aperture Radar with ground mapping modes ⁴ Beacon Tracking Radar						

Table 11: Fixed Wing Aircraft Weapons and Capabilities						
<i>Aircraft</i>	<i>Ordnance</i>	<i>Laser</i>		<i>Marking Capability</i>	<i>Beacon Option</i>	<i>Other Systems</i>
		<i>LST</i>	<i>LTD</i>			
B-1B	JDAM GP bombs CBUs+WCMD	NO	NO	None	PPN-19 SMP-1000	SAR Rdr ³ GPS NVG
B-2	JDAM, JSOW GP bombs CBUs Aerial mines	NO	NO	None	X Band KU Band	SAR Rdr ³ GPS
B-52H	JDAM GP bombs CBUs+WCMD LGBs Aerial mines	NO	YES	None	PPN-19 PPN-20 SMP-1000	(T)FLIR LLTV Radar NVG GPS
F-14 LANTIRN	JDAM, LGB GP Bombs CBUs 20mm cannon	NO	YES	Laser Rockets LUU-2 Flares	None	NVG (T)FLIR GPS LINK16 ⁵
F-15E LANTIRN	JDAM, LGB Maverick GP bombs CBUs+WCMD JSOW AGM-130 GBU-15 & 24 GBU / EGBU-28 20mm cannon	NO	YES	Laser	None	SAR Rdr ³ GPS NVG FLIR LINK16
³ Synthetic Aperture Radar with ground mapping modes						
⁵ F-14D only						

Table 11: Fixed Wing Aircraft Weapons and Capabilities						
Aircraft	Ordnance	Laser		Marking Capability	Beacon Option	Other Systems
		LST	LTD			
F16	GP LGB CBU,				None	GPS, NVG, IDM/IDT ^{7,8} SADL ⁶ LINK-16 ⁹
LANTIRN ^{8,9} IR only	Aerial Mines, WCMD JDAM	NO	YES	Laser Rockets		
LITENING ⁶ IR & CCD	HARM ⁷ , 2.75" Rockets, 20mm cannon	YES	YES	Laser Rockets		
HTS ⁷		NO	NO	None		
F/A-18 A/C/D/E/F	JDAM/JSOW ¹⁰ Maverick SLAM (+ER) LGB, HARM GP bombs CBU, Aerial Mines 2.75"rocket 20mm cannon	YES	YES	Laser WP rockets HE rockets LUU-2 flares	None	(T)FLIR GPS NVG SAR Rdr ³
F-117	LGB, JDAM	NO	YES	None	None	FLIR GPS NVG
S-3B	GP bombs CBU's Maverick Aerial Mines	NO	NO	LUU-2 flares	None	FLIR Radar GPS
P-3	Various	NO	NO		None	SAR Rdr ³
MQ-1B Predator	Hellfire ¹¹	NO	YES	Laser/IR Illuminator	None	GPS FLIR, EO ¹²
Pioneer						FLIR EO
³ Synthetic Aperture Radar with ground mapping modes ⁴ Beacon Tracking Radar ⁶ Block 25/30/32 ⁷ Block 50/52 ⁸ Block 40/42 ⁹ Some Block 50/52 ¹⁰ F/A-18 Lot 10 and above ¹¹ Predator equipped with Hellfire has no SAR radar capability ¹² Real-time C-band video broadcast						

Table 12: Rotary Wing Aircraft Weapons and Capabilities						
Aircraft	Service	Ordnance			Marking Capability	Other Systems
			LST	LTD		
UH-1N	USMC	7.62 MG .50 cal MG 2.75" rockets	NO	NO	Rockets, WP	NVG, FLIR, GPS
AH-1F ³	USA	BGM-71 TOW 2.75" rockets 20mm cannon	NO	NO	Rockets, WP	NVG
AH1W ¹	USMC	BGM-71 TOW Hellfire 5", 2.75" rockets 20mm cannon LUU-2 flares Sidearm	NO	YES	Rockets, Laser, WP	FLIR, NVG, GPS, CCDTV, DVO
AH-64A	USA	Hellfire 2.75" rockets 30mm cannon	YES	YES ²	Laser, Rockets	FLIR, NVG, GPS, DTV/ DVO
AH-64D including Longbow	USA	Hellfire (Laser or RF) 2.75" rockets 30mm cannon	YES	YES ²	Laser, Rockets, WP	FLIR, NVG, DTV/DVO, MMW, Radar, IDM, INS/GPS
OH-58D (Kiowa Warrior)	USA	Hellfire 2.75" rockets .50 cal MG	NO	YES	Laser, Rockets	FLIR TVS NVG IDM
MH-60/ HH-60	USN	Hellfire .50 cal MG GAU-17 GAU-16	YES	YES	Laser	NVG GPS FLIR
¹ The AH-1W can designate codes 1111-1788, but has max effectiveness from 1111-1148.						
² The AH-64 can designate codes 1111-2888, but cannot designate codes containing "9."						
³ The AH-1F is no longer in service in the US Army, but is widely used in other nations.						

Table 13: Attack Helicopter Weapons Capabilities	
<i>Weapon</i>	<i>Maximum Effective Range (meters)</i>
2.75" Rocket, 10-lb (Mk66/M151)	7,500
2.75" Rocket, 17-lb (Mk66/M229)	7,000
2.75" Mk 66/M151, 22.95-lb (USMC only)	6,900
2.75" Rocket, MPSM (Mk66/M261) ¹	7,000
2.75" Illumination M257(overt)	3,500
2.75" Illumination M278 (covert)	3,000
7.62 mm mini-gun	1,000
.50 cal. machine gun	1,830
20-mm cannon (PGU)/(AH-1W)	1,800/2200
30-mm cannon (AH-64A/D)	3,500
TOW (BGM-71)	3,750
Hellfire (AGM-114)	8,000
5" Rocket (USMC)	7,200
¹ Recommended minimum employment range 2,500 meters due to sub munition arming and dispersion pattern considerations	

APPENDIX A: LASER OPERATIONS

JTAC LASER RESPONSIBILITIES

- Avoid the 20-degree safety zone whose apex is at the target and extends 10 degrees on either side of the laser-target-line (LTL) for aircraft run-ins (See Figure 6, Laser Designation Zones).
- The best acquisition area for attack is a 90-degree fan whose apex is at the target and extends to 45 degrees on either side of the LTL. The allowable acquisition area extends an additional 15 degrees on either side of the best acquisition area, excluding the safety zone.
- Prebrief pilot if possible.
- Plan early - get the Laser Target Designator (LTD) ready for mission.
- Laser code: ensure code in LTD matches code that pilot passed.
- Ensure LTD in designate/mark mode.
- Explain ordnance and aircraft characteristics.
- Explain minimum safe distances of ordnance used. (Risk-Estimate Distances for aircraft-delivered ordnance (JFIRE Table 25).
- Immediately prior to execution, confirm actual LTL is no more than 5 degrees off briefed LTL.
- Explain that the LTD is operated at YOUR command.
- Ensure communications are in place—the simpler the better.
- Update friendly locations and determine if they are a factor.

LASER DESIGNATION ZONES

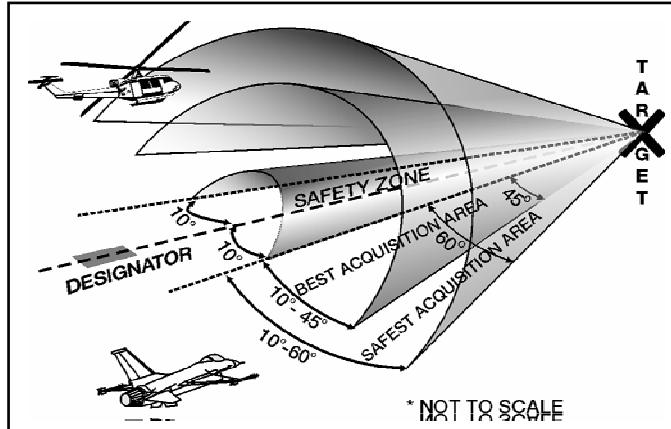


Figure 6: LASER Acquisition Areas and Safety Zones

WARNING: IR pointers or laser sources should not be used as the sole source for target mark/verification. Attack aircraft may confuse IR pointer or laser energy source with the intended target. When using IR pointers or lasers to mark, include "IR POINTER" or "LASER" in the marks portion of the CAS briefing. JTACs should also provide the Pointer-Target-Line or Laser-Target-Line, also known as the Designator-Target-Line, in degrees magnetic from the operator to the target. JTACs should consider the use of a discriminate target mark whenever possible.

MARKING BREVITY CODES

BLIND – No visual contact with friendly aircraft/ground position.
Opposite of VISUAL.

CAPTURED – Aircrew has acquired and is able to track a specified surface target with an onboard sensor.

CONTACT – 1) Sensor contact at the stated position. 2) Acknowledges sighting of a specified reference point.

NO JOY – Aircrew does not have visual contact with the target / bandit / landmark. Opposite of TALLY.

TALLY – Sighting of a target, non-friendly aircraft, landmark, or enemy position. Opposite of NO JOY.

VISUAL – Sighting of a friendly aircraft or ground position. Opposite of BLIND.

LASER BREVITY CODES

DEADEYE – Laser designator system is inoperative.

LASER ON – Start laser designation.

LASING – The speaker is firing the laser.

NEGATIVE LASER – Aircraft has not acquired laser energy.

SHIFT (direction) – Shift laser/IR/radar device energy. 1) Can be used to shift from the offset position onto the target. 2) Also used during multi aircraft attack to shift laser energy to the next target.

SPOT – Acquisition of laser designation.

STARE (with laser code and reference point) – Cue the laser spot search/tracker function on the specified reference point.

TEN SECONDS – Stand by for “LASER ON” call in approximately 10 seconds.

TERMINATE – Stop laser illumination of a target.

NIGHT IR CAS BREVITY CODES

BURN – EO/IR illuminator is being used to provide illumination of surface points of interest.

PULSE – Illuminate(ing) an enemy position with flashing IR energy.

ROPE – Circling an IR pointer around an aircraft to help the aircraft identify the friendly ground position.

SNAKE – Oscillate / jiggle an IR pointer about a target.

SPARKLE – 1) Target marking by IR pointer. 2) Target marking by gunship/FAC(A) using incendiary rounds.

STEADY – Stop oscillation of IR pointer.

STOP – Stop IR illumination of a target.

OTHER USEFUL BREVITY CODES

ARIZONA – No anti-radiation (ARM) ordnance remaining.

BINGO – Fuel state needed for recovery.

BUSTER – Fly at maximum continuous speed (military power).

CHATTERMARK – Begin using briefed radio procedures to counter communications jamming.

HOLD FIRE – An emergency fire control order to stop firing on a designated target, to include destruction of any missiles in-flight.

HOSTILE – A contact identified as enemy upon which clearance to fire is authorized in accordance with theater rules of engagement. (Note: NATO definition differs)

JOKER – Fuel state above BINGO at which separation/bugout/event termination should begin.

MAGNUM (system/location) – Launch of friendly antiradiation missile.

OFFSET (direction) – Maneuver in a specified direction with reference to a target.

PIG(S) – Friendly glide weapons (e.g., JSOW) away.

PLAYTIME – Amount of time aircraft can remain on station, given in hours plus minutes.

POGO – 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.

RIFLE – Friendly air-to-surface missile launch.

SAUNTER – Fly at best endurance.

SPLASH – 1) (A/S) Weapons impact. 2) (S/S) Informative call to observer or spotter five seconds prior to estimated time of impact.

SUNSHINE – Illuminate(ing) a target with artificial illumination.

THUNDER – One minute until A/S weapons impact.

WINCHESTER – No ordnance remaining.

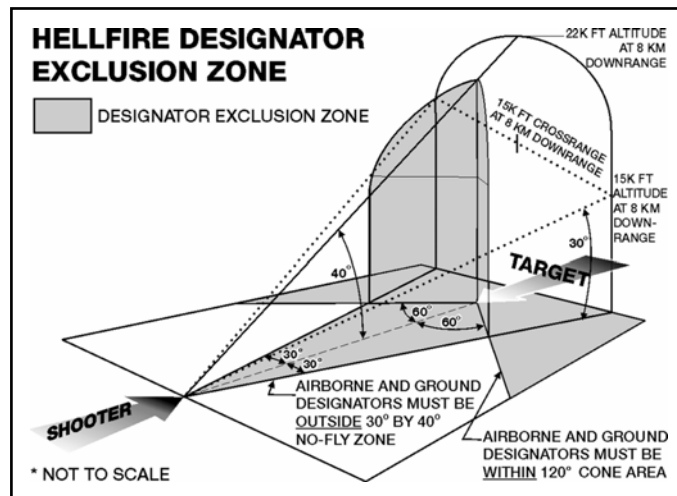


Figure 7: Hellfire Designator Exclusion Zone

HELLFIRE DESIGNATOR EXCLUSION ZONE

- Within 30 degrees of the shooter aircraft's line of fire (in the designator exclusion zone), there is a possibility that the missile may track and impact an obstruction (for example, trees, grass, or hills) near the designator operator if it is accidentally illuminated by the Laser beam.
- The designator shall have a clear, unobstructed line of sight to the target. Take care to ensure designator line of sight is unobstructed across the entire path of a moving target during the time of missile flight to impact.
- Ground designator operators must ensure that they do not inadvertently laze through dust caused by personnel, vehicles, etc.
- Airborne designators must ensure that they are either over ground conditions which do not create dust or are at altitudes where rotor downwash does not create dust.

APPENDIX B: FIRE SUPPORT COORDINATING MEASURES / AIRSPACE CONTROL MEASURES

For detailed descriptions of fire support coordinating measures (FSCMs) and airspace control measures (ACMs), see JP 3-09, *Joint Doctrine for Fire Support*, and JP 3-52, *Joint Airspace Command and Control in the Combat Zone*.

PERMISSIVE AND RESTRICTIVE FSCMs

Commanders employ permissive and restrictive FSCMs. With the exception of the fire support coordination line (FSCL), permissive measures normally require no further detailed coordination for the engagement of targets with conventional means. Restrictive measures impose requirements for specific coordination before engagement of targets with the primary purpose of safeguarding an asset.

Unit Boundaries – A boundary is a maneuver control measure but inherently acts as a fire support coordinating measure between adjacent units. It can be either permissive or restrictive. A boundary is a control measure used to define the right, left, rear, and forward limits of an area of operations. (FM 101-5-1)

BATTLEFIELD COORDINATION LINE (USMC)

The BCL is an exclusive Marine Corps FSCM, similar to a FSCL, which facilitates the expeditious attack of targets with surface indirect fires and aviation fires between this measure and the FSCL. To facilitate air-delivered fires and deconflict air and surface fires, an airspace coordination area (ACA) will always overlie the area between the BCL and the FSCL.

BCL location is graphically portrayed on fire support maps, charts, and overlays by a solid black line with the letters "BCL" followed by the establishing headquarters in parentheses above the line and effective date-time group below the line. BCL is not currently supported by automated systems for depiction.

Table 14: Permissive Measures						
NAME	Establishing HQ	COORDINATION REQUIRED FOR FIRES?				Notes
		SHORT OF / WITHIN MEASURE		BEYOND MEASURE		
		Surface to Surface	Air to Surface	Surface to Surface	Air to Surface	
Free Fire Area (FFA)	Normally Division or higher HQ. However, it can be established by any Commander who owns the ground such as BDE.	No	No	N/A	N/A	A specific area into which any weapon system may fire without additional coordination with establishing HQ. Normally on identifiable terrain.
CFL	Normally established by BDE or Division – can be consolidated by Division	Yes	Yes	No	Yes, IAW other control measures	Purpose is to expedite surface to surface attack beyond CFL.
BCL	MAGTF	No CFL Dependent	Yes Higher HQ	No, only if IAW with ACA	No, ACA	Note 1
FSCL	Land or Amphibious Forces Commander	No CFL Dependent	Yes Establish HQ	Yes Higher HQ	No	Does not divide an AO
Aviation may strike any target beyond the BCL and short of the FSCL without further coordination, including targets in an adjacent Marine commander's zone between the BCL and FSCL. Before firing, the ground commander should coordinate with the DASC, if surface delivered fires will violate ACAs associated with the BCL.						

Aviation may strike any target beyond the BCL and short of the FSCL without further coordination, including targets in an adjacent Marine commander's zone between the BCL and FSCL. Before firing, the ground commander should coordinate with the BCL, if surface delivered fires will violate ACAs associated with the BCL.

Table 15: Restrictive Measures					
NAME	Establishing HQ	COORDINATION REQUIRED FOR FIRES?			NOTES
		SHORT OF / WITHIN MEASURE		BEYOND MEASURE	
		Surface to Surface	Air to Surface		
Restrictive Fire Line (RFL)	Higher HQ of converging forces	N/A	N/A	Yes Affected Force	Yes Affected Force
No Fire Area (NFA)	Any HQ	Prohibits all fires or effects into the area with the following exceptions: - Establishing HQ approves fires or effects on a mission by mission basis - Enemy forces inside NFA engage friendly forces and engaged commander requests fires			Established between converging forces. Prevents fratricide & duplication of attacks. Located on identifiable terrain when possible
Restrictive Fire Area (RFA)	BN HQ or higher	Specifies certain restrictions on fires into the area - Fires which violate restriction prohibited - Fires which do not violate restriction allowed			Located on identifiable terrain or by radius from established point

AIRSPACE CONTROL MEASURES

AIRSPACE COORDINATION AREA (ACA): An ACA is a three-dimensional block of airspace in a target area, established by the appropriate authority, in which friendly aircraft are reasonably safe from friendly surface fires.

Formal ACAs: The airspace control authority approves a formal ACA at the request of the appropriate ground commander.

Informal ACAs: When time for coordination is limited, an informal ACA is used. An informal ACA is most often used and is preferred. Informal ACAs can be established using separation plans and may be established by any maneuver commander. Aircraft and surface fires may be separated by distance (laterally, in altitude, or a combination thereof) or by time.

Characteristics of Effective JAAT/CAS ACAs:

- Must cover holding, ingress, egress and employment
- Easily identified from the air
- Allows simultaneous use of artillery and CAS
- Simple to establish
- Deconflicted from known and templated threats.

Table 16: Example of Airspace Coordination Area Terminology	
Terminology	Meaning
<i>ACA established but not activated</i>	The ACA size and location have been defined and designated, usually by code name, but NO CLEARANCE has been given to enter the airspace. Fires allowed through the ACA without coordination.
<i>ACA activated</i>	ACA is activated. Aircraft are CLEARED to operate in the defined airspace. A time limit may be established. Fires prohibited through the ACA.

SEPARATION TECHNIQUES

There are numerous separation techniques used by JTACs in the field. There is no one favorite technique used, but JTACs should always plan on the one that allows for the most firepower on the target. If at all possible, never shut off artillery when flying CAS.

Table 17: Separation Techniques			
Parameters	CAS target same as or near surface target	CAS target distant from surface target	CAS target along gun-target line (GTL)
High/Medium Altitude Attack	<i>Time/Altitude Separation</i>	<i>Time/Altitude/Lateral Separation</i>	<i>Time/Altitude Separation</i>
Low/Very Low Altitude Attack	<i>Time Separation</i>	<i>Time/Altitude or Lateral Separation</i>	<i>Time/Altitude Separation</i>

COMMON GEOGRAPHIC REFERENCE SYSTEM (CGRS)

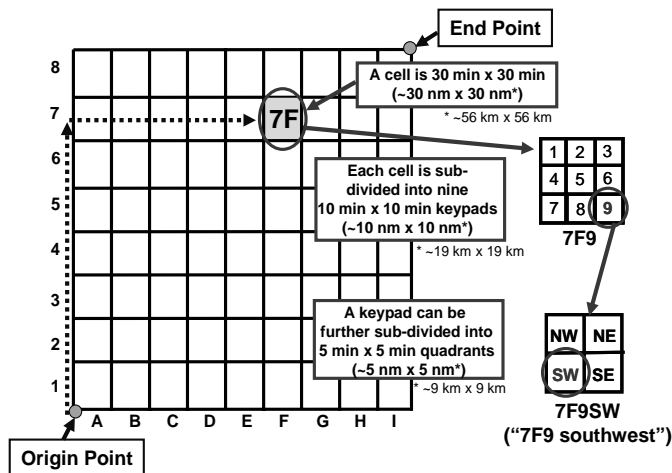


Figure 8: Common Geographic Reference System Example

A common geographic reference system (CGRS) is an administrative measure used to clearly define two-dimensional geographical areas for battlespace coordination, deconfliction, and synchronization. A CGRS may be used to define lateral ACM and FSCM boundaries. See theater-specific SOP for using a CGRS.

NOTE: A CGRS is not to be confused with a kill box. However, a CGRS may be used to define kill box lateral boundaries. For kill box operations, refer to theater-specific SOP.

APPENDIX C: COMMUNICATIONS

Table 18: JTAC/Observer Communication Equipment

<i>Service</i>	<i>Freq Band (Note 1)</i>	<i>Frequency Hopping</i>	<i>Secure Capable</i>
US Army Fire Support Team (FIST)	VHF-FM	SINCGARS	ICOM ²
Combat Observation Lasing Team (COLT)	VHF-FM UHF-SATCOM	SINCGARS	ICOM
USAF TACP	HF VHF/AM UHF/AM VHF/FM UHF/FM-TACSAT	No No HQ II SINCGARS No	KY-99 KY-57 KY-57 KY-57 KG-84 ICOM ³
USMC TACP	VHF-FM HF UHF	SINCGARS HQ II	KY-65/99
SOF Special Tactics Team	Multi-Band UHF SATCOM, HF UHF-AM/FM VHF-FM/AM	HQI / II SINCGARS	KY-38/57/58 KG-84(+data) KY-99, ANDVT VINSON KY-57

Note 1: Frequency bands for ground radios are as follows:

HF = 2.000 to 29.999 MHz in 1kHz increments.

VHF-FM = 29.950 to 75.950 MHz in 50 kHz increments.

VHF-AM = 116.000 to 149.975 MHz in 25 kHz increments.

UHF = 225.000 to 399.975 MHz in 25 kHz increments.

Note 2: Integrated COMSEC, built into SINCGARS.

Note 3: Integrated COMSEC, built into SATCOM.

NOTE: To request CAS, use the tactical air request net/Air Force air request net (AFARN). Conduct control of CAS aircraft on a tactical air direction net.

Table 19: Control Node Communications Equipment			
Agency	Frequency Band ¹	Freq Hopping	Secure Capable
ASOC USAF	HF/VHF, AM/FM/UHF Multi-Band, SATCOM, JTIDS Microwave	SINCGARS/HQ II	KY-57, KY-99
DASC(A) USMC	UHF-AM VHF-AM/FM HF UHF SATCOM Teletype	HQ I/II SINCGARS (Note 3)	KY-58 KY-58 KYV-5(ANDVT) KY-58 KG-84
DASC USMC	UHF/VHF-AM, HF SATCOM	HQ II	KY-58, KY-99
JSTARS ⁴ USAF	VHF-AM/FM		KY-58
	UHF-AM, UHF SATCOM JTIDS, Link-16, IDM, SCDL HF	HQ II	KY-58 KYV-5(ANDVT)
E-3 AWACS	VHF AM/FM, UHF-AM, UHF SATCOM, HF	HQ I/II	KY-58 KY-58 KY-75/KYV-5
E-2C NAVY	VHF-UHF AM/FM HF, SATCOM JTIDS/LINK 16	HQ II, JTIDS	KY-57/ 58, JTIDS
<p>Note 1: Frequency bands for ground radios are as follows: HF = 2.000 to 29.999 MHz in 1kHz increments VHF-FM = 29.950 to 75.950 MHz in 50 kHz increments VHF-AM = 116.000 to 149.975 MHz in 25 kHz increments UHF = 225.000 to 399.975 MHz in 25 kHz increments Note 3: No narrow band capability Note 4: JSTARS frequencies: HF = 2.000 to 29.999 in 1 kHz increments VHF-AM = 108.000 to 115.975 in 25 kHz increments, Receive only VHF-AM = 116.000 to 151.975 in 25 kHz increments, Transmit/Receive VHF-FM = 30.000 to 87.975 in 25 kHz increments UHF-AM = 225.000 to 399.975 in 25 kHz increments</p>			

Table 20: Rotary Wing Communications Equipment			
<i>Aircraft</i>	<i>Frequency Band</i> ¹	<i>Freq Hopping</i>	<i>Secure Capable</i>
AH-1W	Multiband ²	HQ II SINCGARS	KY-58
UH-1N	Multiband ²	HQ II SINCGARS	KY-58
UH-60	VHF-FM UHF VHF-FM	SINCGARS HQ II SINCGARS	KY-58 KY-58 KY-58
OH-58D	VHF-FM UHF VHF-FM	SINCGARS HQ II SINCGARS	KY-58 KY-58 KY-58
AH-64	UHF VHF-FMx2 VHF-AM	HQ I or HQ II SINCGARS	KY-58 KY-58
MH-53M	UHF UHF-AM VHF/AM HF SATCOM	YES NO YES NO	KY-58 NO KY-100 USC-43 (ANDVT)
AH-6	UHF VHF-FM	SINCGARS	KY58
CH-47	VHF-FM UHF	SINCGARS HQII	KY58
MH-60	VHF-FM UHF SATCOM	SINCGARS HQII	KY58
¹ Normal frequency bands are as follows: VHF-FM = 29.950 to 87.975 MHz in 25 kHz increments. VHF-AM = 108.000 to 151.975 MHz in 25 kHz increments. UHF = 225.000 to 399.975 MHz in 25 kHz increments. ² VHF-FM, VHF-AM, UHF, or 156.0-173.975 MHz			

Table 21: Fixed Wing Aircraft Communications Equipment			
<i>Aircraft</i>	<i>Frequency Band</i>	<i>Freq Hopping</i>	<i>Secure Capable</i>
AC-130	UHFx2 SATCOM, HF, VHF-AM/FMx3	HQ II No No SINCGARS	KY-58/-100 KY-58 /-100 KYV-5 KY-58
EA-6B	VHF/UHF HF, VHF-FM	HQ II SINCGARS	ICOM KY-58
AV-8B	Multiband ²	HQ II SINCGARS	KY-58
A/OA-10	UHF, VHF-AM/FM	HQ II	KY-58
B-1B	UHF or SATCOM VHF/UHF, HF	HQ II SINCGARS	KY-58 ³ KY-100
B-2	VHF/UHF HF, SATCOM	HQ II No	KY-58 KYV-5
B-52H	UHF/VHF HF, SATCOM	HQ II No	KY-58/-100 No
F-14	Multiband ² / HF	HQ II / No	KY-58 / No
F-15E	UHF	HQ II	KY-58
F-16	UHF VHF-AM, VHF-FM	HQ II No	KY-58 KY-58
F/A-18	Multiband ²	HQ II SINCGARS	KY-58
F-117	UHF	HQ II	KY-58
P-3	VHF/UHF, HF, SATCOM	HQ II	KY-58, Link 11
R/MQ-1B	Multiband ² , SATCOM ⁵ , C-Band Rover ⁴	No	KY-100
¹ Normal frequency bands follow: HF = 2.000 to 29.999 MHz in 1 kHz increments. VHF-FM = 29.950 to 87.975 MHz in 25 kHz increments. VHF-AM = 108.000 to 151.975 MHz in 25 kHz increments. UHF = 225.000 to 399.975 MHz in 25 kHz increments. ² Standard VHF-FM, VHF-AM, UHF, or 156.0-173.975 MHz VHF-FM. ³ FM = 30.0000 to 87.9925 MHz AM = 108.0000-135.9925 MHz using KY-100 secure voice, AM/FM = 136.0000-155.9925 MHz Voice SATCOM, FM =156.0000-173.9925 MHz Voice DAMA SATCOM, AM/FM = 225.0000-399.9925 MHz ⁴ Real-time video broadcast. ⁵ SATCOM may be available from some aircraft, query pilot.			

Table 22: USMC Fire Support Request Nets				
<i>NET</i>	<i>Purpose</i>	<i>NET Control</i>	<i>Stations on NET</i>	<i>Freq</i>
Artillery Conduct of Fire	FOs request/adjust artillery fire	DS arty BN	DS arty BN, firing battery, arty LNO at BN, FSOs at BDE/BN, FOs, REIN arty units	VHF
GCE air spot net	Naval aviation observers	Artillery regt	NAO, arty BN, firing battery, FOs, FSCCs, GCE HQ	VHF
Tactical air request	To request immediate air support	TACC-afloat DASC-ashore	TACC, DASC, FSCCs, FAC parties, airborne controllers, HDC, TADC	HF
Tactical air direction	Direct CAS aircraft in CAS missions by a JTAC	TACC-afloat DASC-ashore	TACC, DASC, FSCCs, FAC parties, airborne controllers, OAS aircraft and JTAC as req'd	UHF/VHF aircraft dependent
NGF ground spot	Spot teams request and adjust NGF	NGLO at BN FSCC	BN NGLO, NGF spot TMs, DS ship, GS ship as req'd	HF PRI VHF ALT
NGF air spot	NAOs request and adjust NGF	SACC-afloat TACC-afloat as req'd. GCE FSCC ashore	SACC, TACC, FSCCs, DS & GS ships, NAOs	UHF/VHF aircraft dependent
BN mortar	Mortar FOs request and adjust fires	Mortar PLT cmdr	Mortar PLT cmdr, mortar FOs, BN FSCC	VHF

Table 23: Army Fire Support Request Nets				
<i>NET</i>	<i>Purpose</i>	<i>NET Control</i>	<i>Stations on NET</i>	<i>Freq</i>
BDE Fire Support	CFF, Clear Fires	BDE FSE	FSCoord MVR BN FSO, FSE BDE FSO & FSE COLTS	FM
MVR BN fire support	Calls for fire from non-FA observers	MVR BN FSE	MVR BN FSE, MVR BN FSO, FOS, MVR BN mortar FDC, FIST HQ, any FDC, FSO, or COLTs as req'd, MVR BDE FSO	FM
MVR BN mortar FD	Tactical and technical fire direction and calls FO fire to the mortar FDC	MVR BN mortar FDC	MVR BN FSE/FSO, MVR CO FOS MVR BN MORTAR FDC, FIST HQ, COLT(s), any FSO or observer as req'd	FM
DS BN fire direction	Tactical and technical fire direction and calls for fire to FA BN, btry, or platoon FDCs	DS BN FDC	DS BN FDC, PLT FDCs, FIST HQ, FOS, AN/TPQ-36 radar, COLT(s), BN FSE/FSO, MVR BDE FSE/FSO, FA btry FDCs, FA PLT FDCs	FM
Air Force air request net	JTAC request immediate air support	ASOC, ABCCC	TACP, ASOC, ALO	HF/ SATCOM
NGF ground spot	Fire control teams request and adjust NGF	BN FSE	CO, BN FSE, BDE FSE, DIV FSE, DS ship, GS ship as req'd	HF(pri) VHF(alt)

APPENDIX D: MUNITIONS DESCRIPTIONS

GENERAL PURPOSE (GP) MUNITIONS

All GP munitions are similar in construction and vary only in size and weight with a streamlined cylindrical body. Conical fins are designed for low drag (LD) releases. Retarding fins / air inflatable retarder (AIR) are designed for high drag (HD) releases.

500 lb. (LD/HD)

-Mk-82 Selectable high/low drag when fit with AIR or retarding fins.

--Effects: blast, frag, and limited cratering.

-BLU-111-500-lb improved, thermally protected GP bomb.

--Effects: blast, frag, and limited cratering.

1000 lb. (LD/HD)

-Mk-83. Selectable high/low drag when fit with AIR/retarding fins.

--Effects: blast, frag, and cratering.

-BLU-110/B—1,000-lb improved, thermally protected GP bomb.

--Effects: cratering and hard target penetration.

2000 lb. (LD/HD)

-Mk-84. Selectable high/low drag when fit with AIR/retarding fins.

--Effects: blast, frag, and cratering.

-BLU-109/B Penetrator - 2,000-lb improved protected GP bomb.

--Effects: cratering and hard target penetration.

-BLU-117-2000-lb improved, thermally protected GP bomb.

--Effects: blast, frag, and cratering.

Other weights:

-BLU-113 Penetrator Bomb - 4,400-lb improved GP bomb.

--Effects: cratering and hard target penetration.

-M-117, 750-lb GP Bomb - The M-117 has a very thin bomb casing.

--Effects: more blast and less fragmentation than other GP bombs.

-M-117R - Selectable HD/LD by means of a retarding tail assembly.

GUIDED MUNITIONS

JDAM - The joint direct attack munition (JDAM) is an accurate (near precision), all weather, INS/GPS-guided bomb for use against stationary targets. Multiple JDAMs can be dropped on different targets in a single pass ("fire & forget" weapon). Effects: blast/frag or cratering with a delayed fuze (Mk-83/84 bomb body) or hard target penetrator with (BLU-109/110 bomb body).

GBU-38 w/ Mk-82 bomb body

GBU-32 (v)2/B w/ Mk-83 bomb body (USN)

GBU-32 (v)4/B w/ BLU-110 bomb body (USN)

GBU-31 (v)1/B (USAF) or (v)2/B (USN) w/ Mk-84 bomb body

GBU-31 (v)3/B (USAF) or (v)4/B (USN) w/ BLU-109 bomb body

AGM-154 JSOW - The joint stand-off weapon (JSOW) is a low-observable, all weather 1,000-lb class family of stand off air-to-ground glide weapons. Modular payload assembly to attack armored and light-armored vehicle columns, surface-to-air targets, and personnel.

Guidance: AGM-154A & B-INS/GPS

AGM-154C (Navy only)-INS/GPS w/IIR Seeker.

Warheads: AGM-154A = 145 BLU-97 bomblets

AGM-154B = 6 BLU-108s (24 skeets)

AGM-154C = BLU-111 or BROACH

Range: 15nm at low altitude, >40nm at high altitude.

GBU-10/GBU-12/GBU-16 (Paveway II) - Laser-guided, free-fall weapon. Laser codes are pre-flight selectable (code 1511-1788). These weapons can be fuzed for instantaneous (frag) or delayed (cratering) detonation.

GBU-12 uses an Mk-82 bomb body.

GBU-16 uses an Mk-83 or BLU-110 bomb body.

GBU-10 uses an Mk-84 or BLU-109 bomb body.

GBU-15/EGBU-15 - TV- or IR-guided, automatically or manually by the weapon system operator (WSO). Mk-84 or BLU-109 body. Effects: same as Mk-84/BLU-109. The EGBU-15 incorporates GPS/INS guidance providing precision adverse weather capability for autonomous or man-in-the-loop deliveries.

GBU-24 Low Level LGB (Paveway III) - Low-level, Laser-guided, maneuverable free-fall weapon. Mk-84 (GBU-24), BLU-109 (GBU-24A) or BLU-116 advanced unitary penetrator (AUP) is a 2,000-lb class penetrator bomb with twice the penetration capability of the BLU-109. Used only in

GBU-24C/B (USAF) and GBU-24 D/B (Navy). Effects: cratering and hard target penetration) bomb bodies may be used. GBU-24E/B adds GPS/INS guidance to allow adverse weather capability with BLU-109 bomb body. Can be released from very low or very high altitudes. Can be released below a low overcast (3,000–4,500' AGL) if the correct mode switches have been set prior to takeoff. Can be launched without laser signal acquisition. Effects: same as Mk-84.

GBU-28 (GBU-37) - Laser-guided (GPS) BLU-113.

4,700-lb weapon used for hard target penetration.

MISSILES

AGM-65 (MAVERICK) - Tactical, air-to-surface guided missile designed for high probability of strike against tanks and a variety of tactical targets, including moving vehicles. Maverick seeker is locked on to the target prior to release and guides autonomously (except AGM-65E), providing standoff ranges of up to 10nm. Guidance: TV (A,B,H,K); IR (D,F,G2); Laser (E).

Warheads: 125 lbs. shaped charge jet and blast (A,B,D,H);

300 lbs. Penetrator/Blast-Frag (E, F, G2, K).

AGM-84E (SLAM)-AGM-84H (SLAM-ER) - An intermediate range (over 150nm for SLAM-ER) missile designed to provide day, night, and adverse weather precision strike capability against land targets and ships in port. The SLAM uses an inertial navigation system with GPS, infrared terminal guidance, and is fitted with a titanium warhead for better penetration.

AGM-88 (HARM) - High-speed antiradiation missile (HARM) is a supersonic air-to-surface tactical missile designed to seek and destroy radar-equipped air defense systems. The AGM-88 can detect, attack, and destroy a target with minimum aircrew input. (Range > 40 nm).

AGM-114 (HELLFIRE) - Solid propellant laser or radar frequency (RF) guided anti-armor missile. Can also be used against buildings and field fortifications. Hellfire variants include shaped charge, blast fragmentation, and metal augmented charge (MAC) warheads. Max effective range: 8,000 meters. Min range is based on employment technique, but 500 meters should be used as a guide. RF Hellfire (Longbow) is all weather capable.

AGM-130 - Rocket-powered version of GBU-15. Standoff range between 15 and 40 nm. Midcourse guidance (MCG) version uses GPS for guidance (WSO is still able to steer the weapon during terminal guidance for pinpoint accuracy).

AGM-158A JASSM - Joint air-to-surface stand-off missile (JASSM) is a precision cruise missile designed for launch from outside area defenses to kill hard, medium-hardened, soft, and area type targets. Guidance: Imaging, Infrared Radar. 2,000-lb Unitary Warhead.

BGM-71 TOW Missile - Solid propellant, wire-guided, antiarmor missile. Range: min. 500m; max 3750m; max time of flight: 21.5 sec.

GUNS

7.62 Mini-Gun - Up to 6,000 rounds/min. TP, AP, tracer.

50 Cal - 1,150 to 1,250 rounds/min. TP, AP, API, and tracer.

20mm - 750 to 850 rounds/min. AP, HE, and incendiary.

20mm Gatling - 2,500-6,000 rounds/min. TP, HEI, API, TPI, HEIT.

25mm Gatling (GAU-12) - 3,600-4,200 rounds/min (AV-8B) or 1,800 rounds/min (AC-130) TP, HEI, API, TPI, or HEIT.

30mm (M230 cannon AH-64) - TP, HEDP (Shaped charge and fragmentation) Target types: personnel, material, and light armor.

30mm Gatling (GAU-8) - 3,900 rounds/min. 1.5-lb projectile TP, HEI, API on A/OA-10 (can fire 1,174 rounds in 10, 2-second bursts).

40mm (AC-130) - 100 rounds/min. HEI, API, HEI-P. Target types: personnel undercover and all light vehicles. Fired from 4,500 ft AGL min altitude to 18,000 ft AGL max altitude.

105mm (AC-130) - 10 rounds/min. HE and HE/High Fragmentation, Proximity (HE/HF, Prox). Target types: personnel, light vehicles, buildings. Fired from 4,500 ft AGL min altitude to 18,000 ft AGL max altitude.

INERT AND PRACTICE MUNITIONS

BDU-33—25-lb practice bomb with spotting charges.

BDU-48/B—Practice bomb that simulates Mk-82 HD ballistics. (Similar to Mk-106.)

BDU-45—Mk-82 inert 500-lb practice bomb (USN).

BDU-50—Mk-82 inert 500-lb practice bomb (USAF).

BDU-56—Mk-84 inert 2,000-lb practice bomb.

Mk-106—Practice bomb simulating HD ballistics with spotting charge.

Mk-76—Navy version of BDU-33.

LGTR-Laser guided training round with 12 preflight selectable laser guidance codes. Ballistics are similar to GBU-12

ILLUMINATION FLARES

LUU-1/B, 5B, 6D (target marking flares [LOGS])—Designated for a 30-minute burn time on the ground, providing a colored flame. LUU-1 burns red, LUU-5 burns green, and LUU-6 burns maroon.

LUU-2A/B Flare—Parachute flare with a 4.5-minute burn time at an average of 2 million candle power.

LUU-19B Covert Flare—Parachute flare with a burn time of approximately 5 minutes in the IR spectrum.

M257—2.75-inch rocket delivers overt (visible) illumination that provides 1 million candlepower for an average 120-sec. burn time.

M278—2.75-inch rocket delivers IR (.7 – 1.1 microns) illumination that provides 180 seconds of coverage.

ROCKET WARHEADS

2.75" Rocket Warheads

Mk-67 mod 0—Smoke White Phosphorous.

Mk-67 mod 1—Smoke Red Phosphorous.

M-151—(10-lb. HE). Fuses: point detonating (PD), proximity (P), time delay (TD); primary fragmentation against personnel, material, and light armor.

M-156—WP. Used for target marking.

M-229—(17-lb HE). Same as M151.

M-257— Overt illumination.

M-261—Multi-purpose submunition (MPSM), Fuse TD; 9 shape charge/fragmentation submunitions used against personnel, material, and light armor.

M278 – Covert (IR) illumination.

M-255E1—Flechette for antipersonnel.

WDU-4A/A—Flechette for antipersonnel (USMC).

WTU-1/B—TP. A practice M-151.

5.00" Rocket Warheads

Mk-63 mod 0—Fuzes: PD,P,TD; HE-frag anti-personnel/anti-material

Mk-24 GP—Fuses: PD, P, TD; frag, anti-personnel, anti-material, and light armor

Mk 32 AT/APERS—Fuses PD, P, TD; for use against personnel.

Mk 34 Mod2 RP—Fuses: PD, P, TD; smoke.

MK 84—Chaff rocket for use against radar threats

Mk 6/24/32 and WTU-11/B practice rounds - Inert practice variants.

CLUSTER MUNITIONS

Mk-20 and CBU-99/100 cluster munitions (USN) - Excellent weapon against armor, personnel, artillery, etc. Dispenses 247 Mk 118 mod 0/1 bomblets in an oval pattern. Bomblet density and pattern size vary with release parameters.

CBU-87/B Combined Effects Munitions (CEM) - Excellent weapon

against armor, personnel, artillery, etc. Dispenses 202 BLU-97 bomblets with a shaped charge for armor, steel-scored liner for fragmentation, and incendiary ring. **NOTE:** Dispersion is an oval with density and size of the area covered dependent upon release parameters and spin rates.

CBU-89/B GATOR - SUU-64 loaded with a mix of 72 BLU-91/B anti-armor and 22 BLU-92/B anti-personnel mines with preset self-destruct time. (**NOTE:** Dispersion varies from circular at high altitudes to linear at low angles).

CBU-97/B Sensor-fuzed-weapon (SFW) - SUU-64 with an airbag dispensing system and 10 BLU-108/B submunitions. Provides multiple kill per pass capability against tanks, armored vehicles, artillery, armored personnel carriers (APCs), and support vehicles. This cluster weapon is dropped over an area with armor. The fuze sensors detect heat and fires down at the engine of the armored vehicle.

CBU-103 to 105 Wind Corrected Munitions Dispenser (WCMD) - All weather, INS-guidance tail kit for CBU. The tail kit inertially steers the munition from a known release point to precise target coordinates while compensating for launch transients, winds aloft, surface winds, and adverse weather.

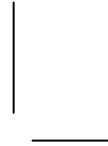
CBU-103 = CBU-87/B + WCMD tail kit.

CBU-104 = CBU-89/B + WCMD tail kit.

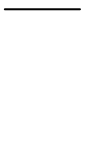
CBU-105 = CBU-97/B + WCMD tail kit.

CBU-107 Passive Attack Weapon (PAW) – 1000-lb CBU-87 canister loaded with a mix of inert kinetic energy penetrators (364 large, 1004 medium, 2406 small rods) fuzed with an FZU-39/B proximity sensor and equipped with a WCMD tail kit.

BL-755 - European munitions loaded with 147 antiarmor submunitions. Designed for low-altitude, low-angle deliveries against armor. (**NOTE:** Dispersion is a rectangular pattern).



WEAPONS NOTES:



APPENDIX E: RISK-ESTIMATE DISTANCES

Risk-estimate distances allow the supported commander to estimate the risk to friendly troops from friendly attack. When ordnance may be a factor to the safety of friendly troops, aircraft attack heading should be parallel to the friendly forces. This mitigates the risk from long or short deliveries. Risk-estimate distances allow the supported commander to estimate the risk in terms of the percent of friendly casualties that may result from fires against an enemy threat along the forward line of own troops (FLOT). Friendly forces outside the 0.1% PI distance are still subject to weapons fragments, but at a lower risk. Commanders must carefully weigh the choice of ordnance, accuracy, and proficiency of the aircraft / firing unit in relation to the risk of fratricide. Taking steps to protect friendly soldiers (e.g. prone behind cover), can reduce the risk. Risk-estimate distances are based on fragmentation and blast patterns.

WARNING: 0.1% Probability of Incapacitation numbers are for combat use only during "Danger Close" situations and are not minimum safe distances for peacetime training.

DANGER CLOSE

Ordnance delivery inside 0.1% PI distances will be considered "*Danger Close*." The supported commander must accept responsibility for the risk to friendly forces when targets are inside 0.1% PI distance. The supported commander will pass his/her initials to terminal controllers to pass to attacking aircraft, indicating acceptance of the risk inherent in ordnance delivery inside the 0.1% PI distance.

CANNON RISK ESTIMATE DISTANCES

The term "Danger Close" is used when there are friendly troops or positions within a prescribed distance of the target, namely **600 meters** for cannon. This is simply a warning and not a restriction to the maneuver commander and the fire direction center to take proper precautions. Risk-estimate distances are defined as the distance in meters from the intended center of impact at which a specific degree of risk and vulnerability will not be exceeded. The risk is usually expressed as the probability of incapacitation (PI), which is the probability that a soldier will suffer an incapacitating injury. Percent PI value is less than or equal to 1 chance in 1,000.

CANNON RISK ESTIMATE ASSUMPTIONS

Cannon risk estimates were calculated using the following assumptions:

- Gun Target Line is perpendicular to the FLOT.
- An observer has adjusted the fires onto the target. Unadjusted fire for effect (FFE) fires may entail greater risk.
- The friendly troops are standing unprotected in the open, in winter clothing and helmet, and on a line perpendicular to the line of fire.
- Note that friendly forces outside the PI distance may still be subject to weapons fragments, but at a lower risk. Commanders and fire supporters must carefully weigh the choice of ordnance and the accuracy and proficiency of the firing unit in relation to the risk of fratricide. Taking steps to protect friendly soldiers (e.g. prone behind cover) can reduce the risk. The risk estimate distances for a 10% PI and a 0.1% PI are also shown in the following table.

Table 24: Cannon Risk-Estimate Distances							
Item/ System	Description	10% PI (meters)			0.1% PI (meters)		
		1/3 range	2/3 range	Max range	1/3 range	2/3 range	Max range
M102/M119	105mm Howitzer HE	85	85	90	175	200	275
M109/M198	155mm Howitzer HE	100	100	125	200	280	450
M109/M198	155mm Howitzer DPICM	150	180	200	280	300	475

WARNING: 0.1% Probability of Incapacitation numbers are for combat use only during "Danger Close" situations and are not minimum safe distances for peacetime training.

AIRCRAFT MUNITION RISK ESTIMATE ASSUMPTIONS

Users must fully understand the assumptions used to develop these risk estimate distances. All values were calculated using the General Fullspray Personnel Program from the Joint Technical Coordinating Group for Munitions Effectiveness at Eglin AFB, FL. The classified assumptions and conditions used to develop the aircraft ordnance risk estimate table are available on the ALSA classified website, <https://wwwacc.langley.af.smil.mil/alsa/ifire>. Combining the online assumptions and/or conditions with the risk estimate numbers makes both sets of numbers classified. The following risk estimate table depicts a "worst-probable" scenario.

Table 25: Risk-Estimate Distances for Aircraft-Delivered Ordnance			
<i>Weapon</i>	<i>Description</i>	<i>10% PI meters</i>	<i>0.1% PI meters</i>
Mk-82 LD ¹ contact	500-lb bomb	145	325
Mk-82 LD ^{1,2} airburst	500-lb bomb	175	390
Mk-82 HD ³ contact	500-lb bomb/retarded	110	290
Mk-82 HD ^{2,3} airburst	500-lb bomb	135	350
Mk-83 LD ¹ contact	1,000-lb bomb	175	385
Mk-83 LD ^{1,2} airburst	1,000-lb bomb	195	405
Mk-83 HD ³ contact	1,000-lb bomb/retarded	130	330
Mk-83 HD ^{2,3} airburst	1,000-lb bomb/retarded	160	375
Mk-84 LD ¹ contact	2,000-lb bomb	175	430
Mk-84 LD ^{1,2} airburst	2,000-lb bomb	190	510
Mk-84 HD ³ contact	2,000-lb bomb/retarded	115	350
Mk-84 HD ^{2,3} airburst	2,000-lb bomb/retarded	140	460
CBU-87 ⁴ , CBU-89 ⁴	CEM or GATOR	165	220
CBU-99 ⁴ , 100 ⁴	CBU-87/89 w/kit	100	145
Mk20 ⁴	Rockeye	100	145
M151, M229, M261 ⁵	2.75" Rockets med alt ⁷	255	440
	2.75" Rockets low alt ⁷	145	240
Zuni - all warheads ⁵	5" Rockets	220	340
M61A1, M197	20 mm gatling	80	125
GAU-12	25 mm gatling	40	50
GPU-5A, M230A1	30 mm gatling/chain	25	40
GAU-8 (A-10)	30 mm gatling	40	65
AC-130	25mm / 40mm	50 / 45	70 / 85
	105mm Cannon	95	230

Table 25: Risk-Estimate Distances for Aircraft-Delivered Ordnance			
<i>Weapon</i>	<i>Description</i>	<i>10% PI meters</i>	<i>0.1% PI meters</i>
GBU-12	500-lb LGB	95	300
GBU-16	1,000-lb LGB	105	350
GBU-10/24	2,000 lb LGB	90	340
GBU-38	500-lb JDAM ^{6,7}	95	300
GBU-32	1,000-lb JDAM ^{6,7}	105	350
GBU-31	2,000-lb JDAM ^{6,7}	90	340
AGM-130 ⁷	2,000 lb TV guided	90	335
BLU-97	JSOW ^{6,7}	Not available	Not available
AGM-158A	JASSM ^{6,7}	55	235
AGM-65 ⁷	Maverick (All)	25	95
AGM-114	Hellfire	40	105
BGM 71	TOW Anti-tank	Not available	Not available
¹ LD=low drag ² Airburst fuzing (DSU-33) ³ HD=high drag/air inflatable retarder (AIR) ⁴ Not recommended for use with troops in contact ⁵ Fixed-wing only. Helicopter numbers not available ⁶ Refer to JFIRE Appendix D for use with troops in contact ⁷ See classified ALSA website (facing page) for munitions profiles			

WARNING: 0.1%/10% Probability of Incapacitation numbers are for combat use only during "Danger Close" situations and are not minimum safe distances for peacetime training.

WARNING: The risk estimate distances listed in Table 25 are highly generalized and are valid only for the conditions specified in the assumptions spreadsheet on the ALSA classified website <https://www.wacc.langley.af.smil.mil/alsa/jfire>. Any change to these assumptions may significantly increase the risk estimate distances.

APPENDIX F: GENERAL INFORMATION

CONVERSION TABLES

Use the following table to calculate the number of min/secs that it will take an aircraft to go from the IP to the target at various ground speeds. Ground speed (GS) is airspeed (A/S) adjusted for winds at altitude. Table 27, provided on the facing page, converts meters to feet for use on 9-line briefings.

Table 26: Speed and Time Conversions									
<i>GS (Knots)</i>	<i>nm/ min</i>	<i>8 nm</i>	<i>9 nm</i>	<i>10 nm</i>	<i>11 nm</i>	<i>12 nm</i>	<i>13 nm</i>	<i>14 nm</i>	<i>15 nm</i>
270	4.5	1:47	2:00	2:13	2:27	2:40	2:53	3:07	3:20
300	5	1:36	1:48	2:00	2:12	2:24	2:36	2:48	3:00
330	5.5	1:28	1:39	1:50	2:00	2:11	2:23	2:33	2:44
360	6	1:20	1:30	1:40	1:50	2:00	2:10	2:20	2:30
420	7	1:09	1:17	1:26	1:34	1:43	1:51	2:00	2:09
450	7.5	1:04	1:12	1:20	1:28	1:36	1:44	1:52	2:00
480	8	1:00	1:08	1:15	1:23	1:30	1:38	1:45	1:53
510	8.5	0:57	1:04	1:11	1:18	1:25	1:32	1:39	1:46
540	9	0:53	1:00	1:07	1:13	1:20	1:27	1:33	1:40
Aircraft Run-in Speeds									
<u>Aircraft</u>	<u>A/S (knots)</u>			<u>Aircraft</u>			<u>A/S (knots)</u>		
A-10	270-350			B-1			480-540		
AV-8B	420-480			B-2			400-460		
F-15E, F-16	480-540			B-52			380-440		
F-14, F/A-18	480-520								

Table 27: Distance Conversion Table (1 meter = 3.28 feet)					
<i>METERS</i>	<i>FEET</i>	<i>METERS</i>	<i>FEET</i>	<i>METERS</i>	<i>FEET</i>
25	82	525	1722	1025	3362
50	164	550	1804	1050	3444
75	246	575	1886	1075	3526
100	328	600	1968	1100	3608
125	410	625	2050	1125	3690
150	492	650	2132	1150	3772
175	574	675	2214	1175	3852
200	656	700	2296	1200	3936
225	738	725	2378	1225	4018
250	820	750	2460	1275	4100
275	902	775	2542	1275	4182
300	984	800	2624	1300	4264
325	1066	825	2706	1325	4346
350	1148	850	2788	1350	4428
375	1230	875	2870	1375	4510
400	1312	900	2952	1400	4592
425	1394	925	3034	1425	4674
450	1476	950	3116	1450	4756
475	1558	975	3198	1475	4838
500	1640	1000	3280	1500	4920
<i>Notes:</i> 1 statute mile (5280') = 1610 m 1 nautical mile (6076') = 1852 m					

FIRES INTEGRATION DIAGRAMS

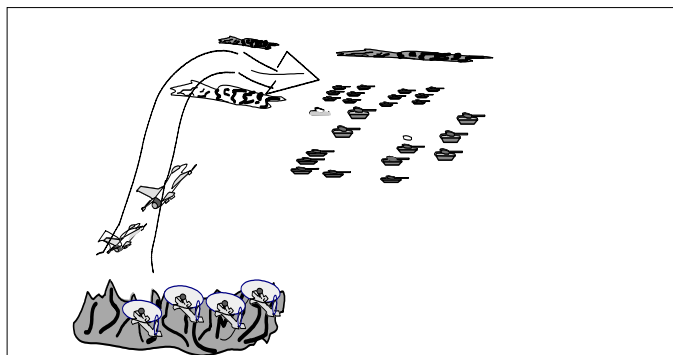


Figure 9: Example of a Combined Attack

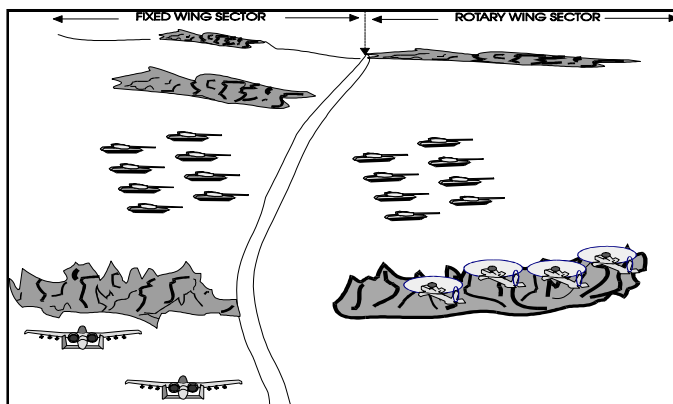


Figure 10: Example of a Sectored Attack

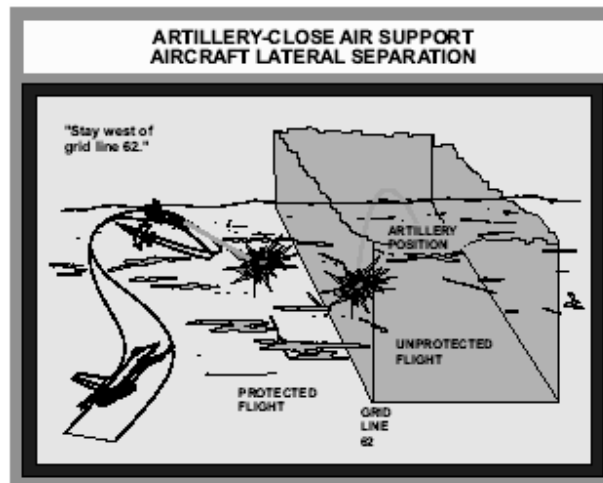


Figure 11: Fires Lateral Separation

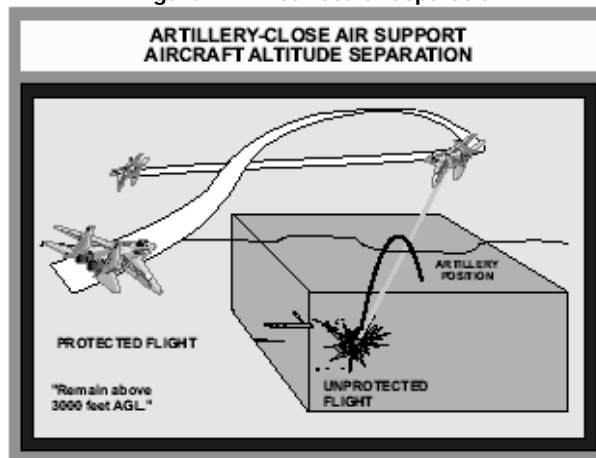


Figure 12: Fires Altitude Separation



Figure 13: Fires Altitude and Lateral Separation

Table 28: Recommended Target-Weapons Pairings for Aircraft Ordnance	
<i>Targets</i>	<i>Recommended Aircraft Ordnance</i>
Armored Vehicles (tanks, APCs, and mobile assault guns)	Maverick, Hellfire, TOW, LGB (GBU-10/-12/-16/-24) JDAM* or GP bomb (with inst. fuze) CBU-87 CEM, CBU-89 Gator (mine), CBU-97 SFW CBU-103/-104/-105 (WCMD)* JSOW*, GBU-15, AGM-130 30 mm (API/HEI)
Area denial and channelization	CBU-89 Gator (mine), CBU-104
Soft target (trucks, radar, aircraft parked, etc.)	Maverick, GP bomb, JDAM*, JSOW*, Hellfire, TOW, 20 mm or 30 mm gun (API/HEI) 25 mm, 40 mm or 105 mm gun (AC-130) CBU-87/CBU-103, 2.75" Rockets (w/ M261, M229, M151)
Personnel	
<i>In the open</i>	GP bomb, JDAM, 20 mm, 25 mm, 30 mm, 40mm, 105mm CBU-87 CEM, CBU-103, 2.75" Rockets (w/ M229, M151, M261, M255E1/WDU-4A/A Flechette)
<i>In fighting positions /prepared positions</i>	GP bomb, JDAM*, 2.75" Rockets (w/ M261, M229, M151)
<i>Under light cover</i>	GP bomb, JDAM*, 20 mm, 25 mm, 30 mm, 40mm, 2.75" Rockets (w/ M229, M151) CBU-87 CEM, CBU-103
<i>Under heavy cover (concrete bunker)</i>	GP bomb or JDAM (w/BLU-109/-110) GP bomb with steel nose plug LGB (GBU-10, -24, -28), Maverick, GBU-15/EBU-15, AGM-130
Buildings	GP bomb or JDAM, LGB (GBU-10, -24, -28), Maverick, GBU-15/EBU-15, AGM-130, Hellfire, 2.75" Rockets (w/ M229, M151)
*WCMD, JSOW and JDAM recommended against stationary targets only	

Table 28: Recommended Target-Weapons Pairings for Aircraft Ordnance	
Artillery, AAA, Rocket Launcher	<i>Recommended Aircraft Ordnance</i>
<i>In Open</i>	CBU-87/-97/-103/-105, JSOW, GP bomb, JDAM, LGB (GBU-10/-12/-16/-24), EO/IR guided munition (Maverick, Hellfire, TOW, GBU-15/EBU-15 or AGM-130), 2.75" Rockets (w/ M255E1/WDU-4A/A Flechette, M261, M229, M151), 30 mm, 40mm gun
<i>In revetment</i>	CBU-97, GP bomb, JDAM, LGB (GBU-10/-12/-16/-24), Maverick, Hellfire, 30mm, GBU-15/EBU-15, AGM-130, 2.75" Rockets (w/ M261, M229, M151)
<i>In covered position</i>	GP bomb, JDAM, LGB (GBU-10/-12/-16/-24), Maverick, GBU-15/EBU-15, AGM-130, Hellfire, 2.75" Rockets (w/ M229, M151)
Surface-to-Air Missile (SAM) site	HARM followed by CBU-87/-97/-103/-105, JSOW, JDAM, GP bomb, LGB (GBU-10/-12/-16/-24), Maverick, Hellfire, TOW, GBU-15/EBU-15, AGM-130, 2.75" Rockets (w/ M261, M229, M151)
Surface-to-Surface Missile site	Same as SAM, above (except delete AGM-88 HARM)

REFERENCES

Joint Publications

JP 1-02, DOD Dictionary of Military and Associated Terms. 12 April 2001, as amended through 23 March 2004.
JP 3-0, Doctrine for Joint Operations. 10 September 2001.
JP 3-01, Joint Doctrine for Countering Air and Missile Threats. 19 October 1999.
JP 3-09, Doctrine for Joint Fire Support. 12 May 1998.
JP 3-09.1, Joint Tactics, Techniques, and Procedures for Laser Designation Operations. 28 May 1999.
JP 3-09.3, Joint Tactics, Techniques, and Procedures for Close Air Support (CAS). 3 September 2003.
JP 3-33, Joint Force Capabilities. 13 October 1999.
JP 3-52, Doctrine for Joint Airspace Control in the Combat Zone. 22 July 1995.
JP 3-60, Joint Doctrine for Targeting. 17 January 2002.
JP 6-0, Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations. 30 May 1995.

Multi-Service

FM 3-52.2/MCRP 3-25F/NTTP 3-56.2/AFTTP(I) 3-2.17, TAGS Multi-Service Tactics, Techniques, and Procedures for the Theater Air-Ground System. 8 December 2003.
FM 3-60.1/MCRP 3-16D/NTTP 3-60.1/AFTTP(I) 3-2.3, TST Multi-Service Tactics, Techniques, and Procedures for Targeting Time Sensitive Targets. 20 April 2004.
FM 6-60/FMFRP 6-6-60, Tactics, Techniques, and Procedures for the Multiple Launch Rocket System (MLRS) Operations (S) FM 101-50-36-CD/61A1-3-11-CD/FMFM 10-2-CD/NA 00-130AA-1-3-11-CD, Joint Munitions Effectiveness Manual/Air-to-Surface (JMEM/AS) 23 April 1996.
FM 3-54.10/ MCRP 3-25B/NTTP 6-02.1/AFTTP(I) 3-2.5, Brevity Multi-Service Brevity Codes. 5 June 2003.
(S) FM 101-59-36-CD (EM0008)61A1-3-11-CD/FMFM 10-2-cd/NA 00-130AA-1-3-11-CD, Joint Munitions Effectiveness Manual (JMEM)/Air-to-Surface (AS) Weapons Systems (JAWS) version 2.3. 19 December 2003.

Army

FM 1-112, Attack Helicopter Operations (will be revised as FM 3-04.112). April 2, 1997.
FM 1-114, Tactics, Techniques, and Procedures for the Regimental Aviation Squadron (will be revised as FM 3-04.114). 1 February 2000.
FM 6-30, Tactics, Techniques, and Procedures for Observed Fire 16 July 1991.
FM 6-60, Tactics, Techniques, and Procedures for Multiple Launch Rocket System (MLRS) Operations, 2 Apr 96.
FM 34-81, Weather Support for Army Tactical Operations (will be revised as FM 2-33.2). 31 August 1989.

Navy

NWP 3-20.32, Surface Ship Gunnery.
NWP 1-10.1, Tactical Action Officer Handbook.

Marine Corps

MCWP 3-23.1, Close Air Support. 30 July 1998.
MCWP 3-23.2, Deep Air Support. 4 January 2001.
MCWP 3-16, Fire Support Coordination in the Ground Combat Element. 28 November 2001.
MCWP 3-16.1, Marine Artillery Operations. 29 May 2002
MCWP 3-16.6, Observer, Spotter and Controller Handbook. 28 November 1998.

Air Force

AFDD 2-1.3, Counterland. 27 August 1999.
AFDD 2-7, Special Operations. 17 July 2001.
AFTTP 3-1 series publications
AGOS TACP TTP, 1 Nov 2001

Other

ATP-63 (AJP-3.3.2.1), Tactics, Techniques and Procedures for Close Air Support Operations. Ratification Draft 1, September 1998
Federal Aviation Administration Handbook 7340.1 General Use.

GLOSSARY

A

AAA	anti-aircraft artillery
A/C	aircraft
ACA	airspace coordination area
ACM	airspace control measure
ACO	airspace control order
ACP	airspace control plan
ADA	air defense artillery
ADAM	area-denial artillery munition
ADO	air defense officer
AGL	above ground level
AGM	air-to-ground missile, attack guidance matrix
ALLTV	all-light level television
ALSA	Air Land Sea Application center
ALO	air liaison officer
AMC	air mission commander
ANDVT	advanced narrow band digital voice terminal
AP	attack position, antipersonnel; average point
APICM	antipersonnel improved conventional munition
ARTY	artillery
ASOC	air support operations center
ATACMS	Army Tactical Missile System
ATI	ambient temperature illuminator
AWACS	Airborne Warning and Control System

B

BCL	battlefield coordination line (USMC)
BCN	beacon
BDA	battle damage assessment
BDE	Brigade
BP	battle position
BN	battalion

C

CAS	close air support
CBU	cluster bomb unit
CC	commander
CCDTV	charged coupled device television
CEM	combined effects munition
CFL	coordinated fire line
CGRS	common geographic reference system
CRC	control and reporting center
CS	call sign

D

DASC	direct air support center (USMC)
DASC(A)	direct air support center (airborne) USMC
DTV	day television
DVO	Direct View Optics

E

EPLRS	enhanced position location reporting system
ER	extended range

F

FAC(A)	forward air controller (airborne)
FAH	final attack heading

FDC	fire direction center
FFA	free-fire area
FIST	fire support team
FLIR	forward-looking infrared
FLOT	forward line of own troops
FM	frequency modulation; field manual
FO	forward observer
FRAG	fragmentation
FREQ	frequency
FSC	fire support coordinator (USMC)
FSCoord	fire support coordinator
FScc	fire support coordination center
FSCL	fire support coordination line
FSCM	fire support coordinating measure
FSE	fire support element
FSO	fire support officer
G	
GLINT	gated laser intensifier for night television
GP	general purpose
GPS	global positioning system
GS	ground speed
GTL	gun-target line
H	
HARM	high-speed antiradiation missile
HD	high drag
HE	high explosive
HEAT	high explosive antitank
HEI	high explosive incendiary
HF	high frequency
HOB	height of burst
HQ	HAVE QUICK, headquarters
HTS	HARM targeting system
I	
IDM	improved data modem
IIR	imaging infrared
IP	initial point
IR	infrared
IZLID	Infrared Zoom Laser Illuminator Designator
J	
JAAT	joint air attack team
JAOC	joint air operations center
JDAM	Joint Direct Attack Munition
JOC	joint operations center
JSOW	joint stand-off weapon
JSTARS	joint surveillance target attack radar system
JTAC	joint terminal attack controller
K	
kHz	kilohertz
km	kilometer
L	
LANTIRN	low-altitude navigation and targeting infrared for night
LAT	latitude
LD	low drag

LGB	laser-guided bomb
LIA	laser illuminator assembly
LLTV	low-light level television
LOAL	lock-on after launch
LOBL	lock-on before launch
LONG	longitude
LST	laser spot tracker
LTD	laser target designator
LTL	laser target line
M	
MAG	magnetic
MAX	maximum
MG	machine gun
MHz	megahertz
MIN	minimum
MLRS	Multiple Launch Rocket System
m	meter(s)
mm	millimeter
MSL	mean sea level
N	
NATO	North Atlantic Treaty Organization
NFA	no-fire area
NGF	naval gunfire
nm	nautical mile
NSFS	naval surface fire support
NVG	night vision goggle
O	
OP	observation post, orbit point
P	
Pi	probability of incapacitation
PIREP	pilot's report
PRF	pulse repetition frequency
R	
rds	rounds
REF	reference(s)
RFA	restrictive fire area
RFL	restrictive fire line
S	
SACC	supporting arms coordination center
SADL	situation awareness datalink
SALT	supporting arms liaison team
SAR	synthetic aperture radar
SATCOM	satellite communications
SDZ	surface danger zone
SEAD	suppression of enemy air defenses
sec	second
SFC	surface
SIM	simulation
SINCGARS	single-channel ground and airborne radio system
SLAM	stand-off land attack missile
SOF	special operations forces

T

TACC	tactical air control center (USN); tactical air command center (USMC)
TAI	target area of interest
TAOC	tactical air operations center (USMC)
TACP	tactical air control party
TARWI	target weather intelligence
TGL	target to gun line
TGT	target
TIS	thermal imaging system
TOC	tactical operations center
TOT	time on target
TOW	tube-launched, optically tracked, wire-guided
TRAP	tactical recovery, aircraft and personnel
TTT	time to target
TV	television
TVS	television sensor

U

UAV	unmanned aerial vehicle
UHF	ultrahigh frequency
USA	United States Army
USAF	United States Air Force
USMC	United States Marine Corps
USN	United States Navy
UTM	universal transverse mercator

V

VFR	visual flight rules
VHF	very high frequency
VIS	visibility
VT	variable time

W

WCMD	wind corrected munitions dispenser
WP	white phosphorous
WX	weather

FM 3-09.32
MCRP 3-16.6A
NTTP 3-09.2
AFTTP(I) 3-2.6
OCTOBER 2004

By Order of the Secretary of the Army:

Official:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff



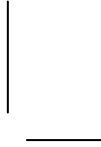
SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0434204

DISTRIBUTION: *Active Army, Army National Guard, and US Army Reserve:* Distribute in accordance with the initial distribution number 114378 requirements for FM 3-09.32.

By Order of the Secretary of the Air Force:

BENTLEY B. RAYBURN
Major General, USAF
Commander
Headquarters Air Force
Doctrine Center

Air Force Distribution: F



MARINE CORPS: PCN 144 000033 00

PIN: 080496-000

