ARMY, MARINE CORPS, NAVY, AIR FORCE

J-FIRE

MULTISERVICE PROCEDURES FOR THE JOINT APPLICATION OF FIREPOWER

FM 3-09.32 (FM 90-20)
MCRP 3-16.6A
NTTP 3-09.2
AFTTP(I) 3-2.6

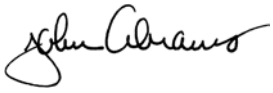
AIR LAND SEA APPLICATION CENTER

NOVEMBER 2002

MULTISERVICE TACTICS, TECHNIQUES, AND PROCEDURES

FOREWORD

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



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PREFACE

1. Scope

J-Fire applies to the tactical and special operating forces of the Army, Navy, USMC, and Air Force. It is a United States (U.S.) unilateral-only document, but it includes North Atlantic Treaty Organization (NATO) formats where appropriate. Information in J-Fire has been extracted from existing applicable service directives. It is primarily intended to be used by members of battalion- and squadron-level combat units.

2. Purpose

J-Fire is a pocket-sized, quick reference guide for requesting fire support and should be used in accordance with approved joint tactics, techniques, and procedures. J-Fire contains calls for fire, a format for joint air strike requests, close air support coordination and planning procedures, communications architecture, and weapons data.

3. 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 curricula as follows:

Army. The Army will incorporate the procedures in this publication in U.S. Army training and doctrinal publications as directed by the commander, U.S. Army Training and Doctrine Command (TRADOC). Distribution is in accordance with DA Form 12-99-R.

Marine Corps. The Marine Corps will incorporate the procedures in this publication in U.S. Marine Corps training and doctrinal publications as directed by the commanding general, U.S. Marine Corps Combat Development Command (MCCDC). Distribution is in accordance with the Marine Corps Publication Distribution System (MCPDS).

Navy. The Navy will incorporate these procedures in U.S. Navy training and doctrinal publications as directed by the commander, Navy Warfare Development Command (NWDC). Distribution is in accordance with MILSTRIP Desk Guide and NAVSOP Pub 409.

Air Force. Air Force units will validate and incorporate appropriate procedures in accordance with applicable governing directives. Distribution is in accordance with AFI 33-360.

4. User Information

a. The TRADOC-MCCDC-NWDC-Air Force Doctrine Center (AFDC)-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. NOTE: For the purposes of this document, the term Terminal Attack Controller (TAC) will be used instead of FAC, JTAC, ETAC, GTAC, TACP, TAC-A, TACCS, and SOTAC.

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—

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MCRP 3-16.6A	**Marine Corps Combat Development Center** **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**

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J-FIRE
Multiservice Procedures for the Joint Application of Firepower

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*This publication supersedes FM 90-20, MCRP 3-16.8B; NWP 3-09.2; and AFTTP(I) 3-2.6, 6 November 1997.

FORMATS

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ARTILLERY/MORTAR 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. There are six elements of the call for fire 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 and the FDC reads back data. Be ready for a challenge and response after the last readback.

1st 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)
2nd Transmission (Mandatory Call)
3. Target location (can be given in three ways: grid, polar plot, and shift from a known point).
3rd 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 the target location: grid coordinates, polar plot, and shift from a known point. The most common method is grid coordinates. The call for fire formats on the following pages are all set up for the grid coordinates method. If the other methods are desired, substitute these formats into the **2nd Transmission (Mandatory Call)** (3. Target location).

POLAR PLOT
"Direction _____" in mils/degrees grid (to nearest 10 mils/1 deg) *(observer to target [tgt] line)*
(***NOTE*:** Must specify degrees to FDC only if direction is given in degrees.)
"Distance _____" in meters (to nearest 100 m) **"Up/Down _____ "** in meters (to nearest 5 m)
(*NOTE:* Difference in target altitude is with respect to observer, not given if less than a 35-meter elevation difference between the observer and the target.)
SHIFT FROM A KNOWN POINT
"Direction _____" in mils/degrees grid (to nearest 10 mils/1 deg) *(observer to tgt line)*
(***NOTE:*** Must specify deg. to FDC only if direction is given in deg.)
"Left/Right (Lateral Shift)**_____"** in meters (to nearest 10m)
"Add/Drop (Range Shift)**_____"** in meters (to nearest 100m)
"Up/Down (Vertical Shift) **_____"** in meters (to nearest 5m)
(***NOTE:*** Difference in target altitude with respect to known point altitude.)
EXAMPLE - MIL RELATION FORMULA
The observer knows that the distance from his location to the known point (CHURCH) is 2,500 meters. With his binoculars, he measures an angular deviation of 62 mils from the church to the target. He calculates the lateral shift as follows: W = R x mils (Width of lateral shift = Range (km) x mils) W = 2500/1000 x 62 = 155 meters = approximately 160 meters (lateral shift expressed to nearest 10 meters.) **"LEFT 160**. **"** (NOTE: one degree = 17.8 mils)

MESSAGE TO OBSERVER

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

a. Call sign of the unit firing the mission (Mandatory Call). This is given as the last letter of the call sign of the unit firing the mission. If two letters are given, then 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 Call). Number of rounds per tube that will fire for effect.

d. Target Number (Mandatory Call). For tracking subsequent missions or to record as a target for future use.

e. Time of Flight. 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, Copperhead, or coordinated illumination missions.

ARTILLERY/MORTAR/NAVAL GUNFIRE DEFINITIONS

At My Command—The command used when the observer desires to control the exact time of delivery of fires.

Check Firing—A command from anyone in the fire support net to cause an immediate halt in firing.

Danger Close—The term included in the method of engagement segment of a call for fire, which indicates that friendly troops are within close proximity of the target. The close proximity distance is determined by the weapon and munition fired. Specific distances for artillery, mortar, and naval gunfire are: within 2,000 meters (m) of friendly troops for Multiple-Launch Rocket System (MLRS); 600m for mortars and artillery; 750m for 5-inch (in) naval guns. The creeping method of adjustment will be used exclusively during danger close missions.

Direction—Used by a spotter/observer to indicate the direction from the observer to the target and is commonly referred as the Observer Target Line (OTL). When the

observer anticipates that he will be required to adjust fire, he will send a direction to the FDC. Preferred units are mils. If using degrees, the observer must inform the FDC by stating *"__ degrees."* The observer will normally send the direction after the Message to Observer (MTO), but must send it before the 1st correction.

Mark—Spotting round (normally white phosphorous [WP]) or illumination on the deck to indicate targets to aircraft, ground troops, or fire support.

Repeat—During adjustment, a 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 for effect.

Surveillance—Battle damage assessment (BDA).

Shot—Announced by the FDC to alert the observer that rounds have been fired.

Splash—Announced by the FDC to alert the observer that rounds will impact in approximately 5 seconds.

Time on Target—The desired time the observer wants the round(s) to impact.

MISSION FORMATS

FORMAT 1: ADJUST FIRE MISSION (Grid Method)	
Observer: **"_____ this is _____,Adjust Fire, Over"** *(FDC's Call Sign)* *(Observer's Call Sign)*	
"Grid _____, Over" *(6-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--must specify if using degrees]*
Adjustments	
"Left/Right _____"	*(Meters, Distance from Impact to Observer Target Line)*
"Add/Drop _____"	*(Meters, Distance from Impact to Target)*
Once on target call: **"Fire for Effect, Over"**	
Mission Completion	
"End of Mission, _____, Over." *(BDA and Target Activity)*	

FORMAT 2. FIRE FOR EFFECT MISSION (Grid Method)	
Observer: **"_____ this is_____, Fire for Effect, Over"** *(FDC's Call Sign) (Observer's Call Sign)* **"Grid _____, Over"** *(6-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) **"Over"**	*(At My Command, Time on Target, Request Splash, Request Time of Flight, Request Ordinate Altitude Information)*
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	
Adjustments	
Prior to 1st Adjustment: **"Direction _____, Over"** *(Mils or Degrees*)* *[*Mils is the default--must specify if using degrees]* **"Left/Right _____"** **"Add/Drop _____"** **"Repeat, Over"**	*(Meters, Distance from Impact to Observer Target Line)* *(Meters, Distance from Impact to Target)*
Mission Completion	
"End of Mission, _____, Over." *(BDA and Target Activity)*	

FORMAT 3. MARKING MISSION (Grid Method)	
Observer: **"_____ this is_____ , Fire for Effect, Over"** *(FDC's Call Sign) (Observer's Call Sign)*	
"Grid _____, Over" *(6-Digit UTM)*	
"Mark, WP, At My Command, Request Time of Flight, Over"	
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	
Mission Completion	
"End of Mission, Over."	

FORMAT 4. SEAD MISSION (USMC) (Grid Method)
Observer: **"_____ this is _____, SEAD, Over"** *(FDC's Call Sign)* *(Observer's Call Sign)* **"Grid to Suppress _____, "Grid to Mark"_____, Over"** *(6-Digit UTM)* *(6-Digit UTM)* **"_____, _____ Over"** *(Target description)* *(Timing)*

FORMAT 5. ARTILLERY/MORTAR QUICK SMOKE REQUEST
Observer: **"_____ this is _____, Adjust Fire, Over"** *(FDC's Call Sign)* *(Observer's Call Sign)* **"Grid _____, Over"** *(6-Digit UTM)* Target Description**: "_____ Smoke/WP in Effect, Over"** **a. L:** Length of smoke screen desired _____ **b. M:** Maneuver-Target Line _____ **c. Dir:** Wind Direction _____ *(Head, Tail, Right/Left Cross, Head/Tailwind)* **d. T:** Time or Duration the smoke screen is to be effective _____
Adjust Fire Up/Down
For Ground Burst: **"Up 100"** ***NOTE:*** High explosive (HE) will be used to adjust rounds onto the desired target area. Once properly adjusted, the observer will request shell smoke; adjustments will be made if necessary. Then Fire for Effect is requested.

FORMAT 6. 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 and those using night-vision devices.**

Observer: **"**_____**this is** _____**"**
(FDC's 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 target 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 Targets and Suggested Ammunition	
TARGETS	***SHELL/FUZE***
Personnel or Light Vehicles	DPICM
Covered Positions or Heavy Vehicles	DPICM
Vehicles or Personnel	HE/VT/MT
Bunkers	HE/CP
Armor, Bunkers	Copperhead
LEGEND	
CP–concrete piercing DPICM–dual-purpose improved convention munition	HE–high explosive MT–mechanical time VT–variable time

Table 2. Field Artillery MLRS Assets					
Weapon	***Ammunition***		***Range (Meters)***		***Rates of Fire***
	Model	***Type***	***Minimum***	***Maximum***	
MLRS	M26	644-M77 DPICM	10,000	32,000	12 Rockets in 40 sec
	ER MLRS	518 XM85	13,000	45,000	"
ATACMS	Block I M39	950 APAM	25,000	165,000	2 ATACMS in 20 sec
	Block IA M39A1	300 APAM	70,000	300,000	"
	Block II M39E3	13 BAT	35,000	145,000	"
APAM–antipersonnel antimateriel BAT–brilliant antiarmor technology submunition					

Table 3. Field Artillery Cannon Assets

Arty	Ammunition		Range (Meters)			Rates of Fire/Notes
	Projectile	Fuzes	Maximum	DPICM	RAP	
105-mm M102	HE, HC, WP ILLUM, APICM, DPICM	PD, VT, MT, MTSQ, CP, Delay	11,400	10,500	15,300	Sustained rate of fire: 3 rds/min. Max rate of fire: 10 rds/min.
105-mm M119A1	HE, HC, WP ILLUM, APICM, DPICM	PD, VT, MT, MTSQ, CP, Delay	11,500	14,100	19,500	Sustained rate of fire: 3 rds/min. Max rate of fire: 10 rds/min.
155-mm M198	HE, HC, WP ILLUM, CPHD, APICM, DPICM, M825 Smoke SCAT-MINE	PD, VT, MT, MTSQ, Delay	18,300 or 22,000 with M795 HE, M825 Smoke	18,000 or 28,200 with M864	30,100	Sustained rate of fire: 2 rds/min. Max rate of fire: 4 rds/min.
155-mm M109A5/ A6	HE, HC, WP ILLUM, CPHD, APICM, DPICM, M825 Smoke SCAT-MINE	PD, VT, MT, MTSQ, Delay	18,200 or 21,700 with M795 HE, M825 Smoke	17,900 or 28,100 with M864	30,000	Sustained rate of fire: 1 rd/min. Max rate of fire: 4 rds/min.

LEGEND

APICM–anti-personnel improved conventional munition
CP–concrete piercing
CPHD–Copperhead
DPICM–dual-purpose improved convention munition
HC–hexachloroethane
HE–high explosive
ILLUM–illumination
MT–mechanical time
MTSQ–mechanical time superquick
PD–point detonating
SADARM–sense and destroy armor
VT–variable time
WP (white phosphorous)

Table 4. Mortar Assets

Weapon	Ammunition		Range (Meters)		Rates of Fire/ Notes
	Model	Type	Minimum Range	Maximum Range	
60-mm M224	M720/	HE	70	3,500[1]	30 rds/min for 4 min[2], then 20 rds/min sustained. Diameter of Illumination: M721–500m M83A3–300m
	M889	WP	70	3,500	
	M722	ILLUM	200	3,500	
	M721	WP	35	1,830	
	M302A1	ILLUM	725	950	
	M83A3	HE	45	1.830	
	M49A4				
81-mm M29A1	M374A2	HE	70	4,600	25 rds/min for 2 min, then 8 rds/min sustained. Diameter of Illumination: 360m
	M374A3	HE	73	4,790	
	M375A2	WP	73	4,595	
	M301A3	ILLUM	100	3,950	
81-mm M252	M821/	HE	80	5,800	30 rds/min for 2 min, then 15 rds/min sustained. Diameter of Illumination: 650m
	M889	HE	73	4,790	
	M374A3	RP	300	4,800	
	M819	WP	73	4,595	
	M375A2	ILLUM	300	5,060	
	M853A1	ILLUM	100	3,950	
	M301A3				
107-mm M30	M329A2	HE	770	6,840	18 rds/min for 1 min, then 9 rds/min for 5 min, then 3 rds/min sustained. Diameter of Illumination: 800m
	M329A1	HE	920	5,650	
	M328A1	WP	770	5,650	
	M335A2	ILLUM	440	5,490	
120-mm M120	M57	HE	200	7,200	15 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	200	7,200	
	M929	(MDF)	200	7,200	
	M930	WP	200	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

Table 5. Artillery/Mortar Illumination Factors				
WEAPON	***SHELL TYPE***	***HOB (m)***	***BURN TIME (sec)***	***RATE OF FALL (m/sec)***
60 mm	M83A1	160	25	6
60 mm	M83A2/3	160	32	6
81 mm	M301A3	600	60	6
105 mm	M314A2	750	60	10
105 mm	M314A3	750	70–75	10
107 mm	M335	700	60	10
107 mm	M335A1	700	70	10
107 mm	M335A2	400	90	5
155 mm	M118	750	60	10
155 mm	M485A	600	120	5

Table 6. 5"/54 and 5"/62 Gun Data	
Maximum Range:	23,100m (Full Charge) 12,200m (Reduced Charge)
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:	Mk 88: Height of burst (HOB) = 500m Burn Time (sec) = 45/72 Rate of Fall (m/sec) = 5m/sec Mk 91: (new round), HOB 325 Meters (65-70 second burn time) Rate of Fall = 5m/sec
NOTE: Data applies to 5"/62 firing conventional munitions.	

DANGER CLOSE MISSIONS (<750m for NSFS)

Give cardinal direction and distance to friendlies. Use first salvo offset and "creeping" method for adjustments at 50 meter(m) increments.

DIRECTIONS

Directions are normally given in mils in relation to grid north. Any other combination may be used but must be specified (i.e., "direction 180 degrees magnetic").

FORMAT 7. NSFS POLAR PLOT	
"Direction _____"	in mils/degrees (to nearest 10 mils/1 degree)
"Distance _____"	in meters (to nearest 100m)
"Up/Down _____" *(vertical shift)*	in meters (to nearest 5m) if greater than 30 meters
SHIFT FROM A KNOWN POINT:	
"Shift _____" *(target number/reference point)*	
"Direction _____" *(from observer to target)*	in mils/degrees (to nearest 10 mils/1 degree)
"Right/Left _____" *(lateral shift)*	in meters (to nearest 10 m)
"Add/Drop _____" *(range shift)*	in meters (to nearest 100 m)
"Up/Down _____" *(vertical shift)*	in meters (to nearest 5 m)

FORMAT 8. NSFS CALL FOR FIRE
(given in two transmissions)
(Grid Method)

"_____this is _____Fire Mission,
(Ship Call Sign) *(Observer's Call Sign)*

Target # _____, Over"
(Assigned by Observer)

"Grid _____, Altitude _____, Direction
(6-digit UTM) *(Meters MSL)*

_____, 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	

CLOSE AIR SUPPORT (CAS)

CAS PLANNING CONSIDERATIONS (DAY/NIGHT)

1. Ground Commander's Intent/Mission Objectives
2. Prepare Maps (coordinate with S-2, Intel, S-3)
    a. Contact Points, Initial Points, Observation Points, Battle Positions
    b. Friendly Order of Battle
        i. Scheme of Maneuver
        ii. Scheme of Fires
        iii. Unit Locations
        iv. Observation/Terminal Attack Control Positions
    c. Enemy Order of Battle
        i. Unit Location
        ii. Target Locations
        iii. Threats
3. Review of ACO, ATO, SPINS, ROE, Communications Plan; verify appropriate forms, worksheets, and formats in use to request and control CAS.
4. Weather
    a. Ceiling/Visibility
    b. Winds (ground and at altitude)
    c. Sunrise/Begin Morning Nautical Twilight (BMNT)
    d. Sunset/End Evening Nautical Twilight (EENT)
    e. Solar elevation/azimuth
    f. Moon Data (rise/set, elevation, azimuth, percent illumination)
5. Agency Coordination
    a. ASOC
    b. DASC
    c. AWACS
    d. JSTARS
6. Prepare AO Update (see Format 10, pg. 23)
7. Fire Support Coordination
    a. ACM/FSCM Plan
    b. Artillery/Mortar Position Areas (PA)
    c. Gun-Target Line (GTL)

d. Minimum/Maximum Ordinate
e. Attack plan
f. Support by fire and maneuver
g. High Payoff Target List (HPTL)
h. Attack Guidance Matrix (AGM)
i. Target Marking (Smoke/LASER/ILLUM)
j. SEAD
k. Schedule of Fires Worksheet

8. Fighter Holding Plan
   a. Location
   b. Altitude
9. Rotary Aviation Coordination
   a. JAAT Opportunities
   b. Battle/Firing Positions
   c. Altitudes
   d. Minimum Risk Routes (MRR)
   e. Deconfliction Plan
   f. Frequencies
   g. Spider routes (CSAR assets)
10. Target Area Operations
    a. Authentication Procedures
    b. Friendly location marking procedures
    c. Prepare CAS Briefing 9-Line (see Format 11, pg. 24, or NATO briefing, Format 15, pg. 30)
    d. 9-Line Remarks Considerations
       i. Target Description
       ii. Threats
       iii. Artillery
       iv. Clearance (Final Control/Abort Code)
       v. Desired Ordnance Effects
       vi. Restrictions
       vii. Timing/Deconfliction Plan
       viii. Airspace Coordination Areas (ACAs)
       ix. Weather
       x. SEAD and location
       xi. Laser, illumination, night vision capability
       xii. Danger Close

e. Prepare Target Mark Devices
    i. Artillery
    ii. Laser/IR Pointers
    iii. FAC-A

11. Pass BDA
    a. Fighters
    b. ASOC
    c. DASC

URBAN CAS PLANNING CONSIDERATIONS

1. Effective Targeting
    a. Large Scale (1:25,000) maps with street names
    b. Gridded overhead photos
    c. RPV/UAV Support
    d. Other NIMA/standardized maps with geo-ref overlay
2. Responsive C2
3. SEAD
4. Target marking capabilities
5. Effective weapons
    a. Penetration capability
    b. Proportional response
6. Capable Platforms/Sensors
7. Proficient and trained participants
8. Rules of engagement considerations

Additional references are found in JP 3-09.3, FM 3-06.1, MCRP 3-35.3A, NTTP 3-01.04, AFTTP 3-2.29, and Multiservice Procedures for Aviation Urban Operations.

CAS Integration: ALOs and FSE personnel "integrate CAS with other fire support assets and maneuver forces to support the ground commander. Whether conducting offensive or defensive operations, commanders focus CAS at key points throughout the depth of the battlefield. Priority for the assignment of CAS is to support the commander's intent and concept of operation. Commensurate with other Joint Force Command mission requirements, supporting air commanders posture their assets to optimize support to requesting units." - *Joint Publication 3-09.3.*

JOINT TACTICAL AIR STRIKE REQUEST

See Joint Pub 3-09.3 for preparation instructions.

SECTION I - MISSION REQUEST

DATE

1. UNIT CALLED | THIS IS | REQUEST NUMBER | SENT: TIME / BY

2. PREPLANNED: [A] PRECEDENCE ____ [B] PRIORITY ____
IMMEDIATE: [C] PRIORITY ____ | RECEIVED: 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 ____
[Q] REMARKS ____

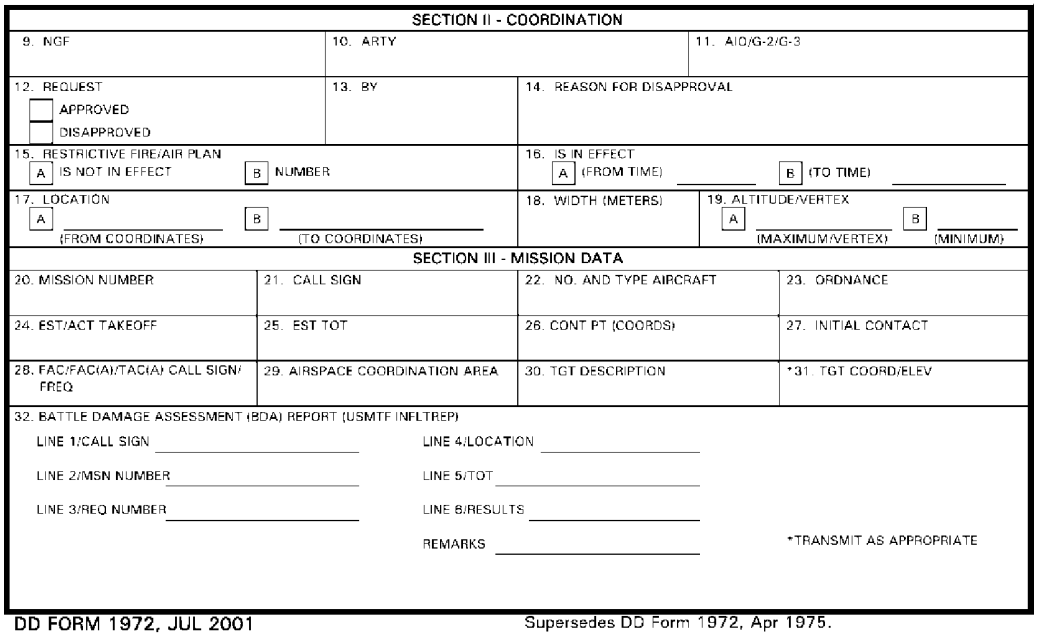
4. TARGET LOCATION IS | CHECKED BY
[A] ____ (COORDINATES) [B] ____ (COORDINATES) [C] ____ (COORDINATES) [D] ____ (COORDINATES)
[E] TGT ELEV ____ [F] SHEET NO. ____ [G] SERIES ____ [H] CHART NO. ____

5. TARGET TIME/DATE
[A] ASAP ____ [B] NLT ____ [C] AT ____ [D] TO ____

6. DESIRED ORD/RESULTS [A] ORDNANCE ____
[B] DESTROY ____ [C] NEUTRALIZE ____ [D] HARASS/INTERDICT ____

7. FINAL CONTROL
[A] FAC/RABFAC ____ [B] CALL SIGN ____ [C] FREQ ____
[D] CONT PT ____

8. REMARKS
1. IP ____
2. HDNG ____ MAG OFFSET: L/R
3. DISTANCE ____
4. TGT ELEVATION ____ FEET MSL
5. TGT DESCRIPTION ____
6. TGT LOCATION ____
7. MARK TYPE ____ CODE ____
8. FRIENDLIES ____
9. EGRESS ____
10. BCN-TGT ____ MAG BCN GRID ____/____
11. BCN-TGT ____ METERS TGT GRID ____/____
11. BCN ELEVATION ____ FEET MSL



SECTION II - COORDINATION

9. NGF	10. ARTY	11. AIO/G-2/G-3
12. REQUEST ☐ APPROVED ☐ DISAPPROVED	13. BY	14. REASON FOR DISAPPROVAL
15. RESTRICTIVE FIRE/AIR PLAN A IS NOT IN EFFECT B NUMBER		16. IS IN EFFECT A (FROM TIME) B (TO TIME)
17. LOCATION A (FROM COORDINATES) B (TO COORDINATES)	18. WIDTH (METERS)	19. ALTITUDE/VERTEX A (MAXIMUM/VERTEX) B (MINIMUM)

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/FAC(A)/TAC(A) CALL SIGN/ FREQ	29. AIRSPACE COORDINATION AREA	30. TGT DESCRIPTION	*31. TGT COORD/ELEV

32. BATTLE DAMAGE ASSESSMENT (BDA) REPORT (USMTF INFLTREP)

LINE 1/CALL SIGN _____ LINE 4/LOCATION _____

LINE 2/MSN NUMBER _____ LINE 5/TOT _____

LINE 3/REQ NUMBER _____ LINE 6/RESULTS _____

REMARKS _____

*TRANSMIT AS APPROPRIATE

DD FORM 1972, JUL 2001 Supersedes DD Form 1972, Apr 1975.

Figure 1. Joint Tactical Air Strike Request Form

CAS BRIEFING FORMATS

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

FORMAT 9. CAS CHECK-IN BRIEFING **Aircraft Transmits to Controller**
Aircraft: **"**_____, **this is** _____**"** *(Controller Call Sign)* *(Aircraft Call Sign)* Identification/Mission Number: "_____" ***NOTE:*** Authentication and appropriate response suggested here. The brief may be abbreviated for brevity or security ("as fragged" or "with exception"). Number and Type of Aircraft: "_____" Position and Altitude: "_____" Ordnance: "_____" Play Time: "_____" Abort Code: "_____" (if applicable) *****Remarks: "_____ (NVG, LST, Special Mission Items) _____"
*****Optional Entry

FORMAT 10. AREA OPERATION (AO) UPDATE
AO Update # _____ (TAC to Fighter) (see note below) 1. General Enemy Situation 2. Threat Activity 3. General Friendly Situation 4. Friendly Artillery Activity 5. Remarks a. Localized SEAD efforts (suppression/EW) b. Hazards (WX/Terrain/Obstructions)
NOTE: Area Operation update is normally only given once when a fighter first checks in. Higher echelons (i.e., Division/Brigade) may assign an alphanumeric tracking number to facilitate subsequent check-ins at lower echelons. For example, ***"Icebox 21, Hog Flight checking in as fragged with AO update hotel."*** AO update could be passed to supporting airborne platforms (ABCCC, JSTARS) to speed information flow.

FORMAT 11. CAS BRIEFING (9-LINE)

(Omit data not required. Do not transmit line numbers. Units of measure are standard unless otherwise specified. *****Denotes minimum essential in limited communications environment. **BOLD** denotes readback items when requested.)

Terminal controller: **"_____, this is _____"**
(Aircraft Call Sign) (Terminal Controller)

1. ***IP/BP: "_____"**
2. *****Heading: "_____" *(Deg Magnetic)*
   (IP/BP to Target)
   Offset: "_____" *(Left/Right)*
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 [i.e., WGS-84], offsets or visual description)
7. *Type Mark: "_____" Code: "_____"
   (WP, Laser, IR, Beacon) (Actual Code)
   Laser to Target Line: "_____ Degrees"
8. ***Location of Friendlies: "_____"**
   (from target, cardinal directions and distance in meters)
   Position marked by: "_____"
9. Egress: "_____"

Remarks (as appropriate): "_____"
(Ordnance Delivery, Threats, FAH, Hazards, ACAs, Weather, Restrictions, Addtnl Tgt Info, SEAD, Laser, Illumination, Night Vision Capability, Danger Close [with commander's initials])

Time on Target (TOT): "_____"

OR

Time to Target (TTT):

"Stand by_____ plus _____, Hack."
(minutes) (seconds)

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

CAS Briefing Worksheet		
Call Sign		
Mission #		
# / Type A/C		
Position and Altitude		
Ordnance		
Playtime		
Abort Code		
	LST / Datum / NVG	**LST / Datum / NVG**
IP/BP		
Heading Offset **Left/Right**		
Distance (Fixed Wing-NM, Helo-M)		
Tgt Elev (MSL)		
Tgt Description		
Tgt Location		
Mark Laser Code ____ LTL		
Friendlies		
Egress		
Remarks (as appropriate)**:** (Ordnance Delivery, Threats, Final Attack Hdg/Cone, Hazards, ACAs, Weather, Restrictions, Additional Tgt Info, SEAD & Location, Laser, Illumination, Night Vision Capability, Danger Close [with commander's initials], Follow-on [Re-attack])		
TTT/TOT		

CALLS FOR FIRE

FORMAT 12. AC-130 GUNSHIP CALL FOR FIRE
1. Observer/Warning Order: **"**_____**, THIS IS** _____**,** *(AC-130 C/S)* *(Observer C/S)* **FIRE MISSION, OVER."** 2. Friendly Location/Mark: **"MY POSITION** _____ *(TRP, Grid, etc.)* **MARKED BY** _____**."** *(Strobe, Beacon, IR Strobe, etc.)* 3. Target Location: **"**_____**."** *(Bearing [magnetic] & Range [meters], TRP, Grid, etc.)* 4. Target Description/Mark: **"**_____**, MARKED BY**_____**, OVER."** *(Target Description)* *(IR Pointer, Tracer, etc.)* 5. Remarks: **"**_____**."** *(**Threats**, Danger Close Clearance, Restrictions, At My Command, etc.)* ***AS REQUIRED*** 1. Clearance: Transmission of the Fire Mission is clearance to fire (unless Danger Close). 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. 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.
ADJUSTING AC-130 GUNSHIP FIRE
• Only adjust for marking rounds or incorrect target. Adjust from impact by giving range (meters) and cardinal (North, South, East, West) direction.
• To move burn, say, **"MOVE BURN"** or **"ROLL BURN"**
• Once burn is over target, say **"FREEZE BURN"** (If you say **"STOP BURN,"** they will turn it off)
DON'TS: 1. Do **not** ask the gunship to identify colors (A/C can only distinguish "light" versus "dark" coloration). 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

TERMINAL ATTACK CONTROLLER'S CALLS

ABORT—(include code). ABORT (abort code). Abort the pass. Do not release ordnance. Directive call to cease action/attack/event/mission.
CLEARED HOT—You are cleared to release ordnance on this pass.
CONTINUE—Cleared to proceed with the pass, but you are not yet cleared to release any ordnance. Used to acknowledge aircraft without providing clearance to release ordnance.

WARNING

The word "cleared" will only be used when ordnance is actually to be delivered. This will minimize the chances of dropping ordnance on dry passes, further reducing the risk of fratricide.

Non-standard calls must be avoided at all times.

Table 7. Abort Call Illustration

(The TAC is "NAIL 11," the CAS attack flight is "SPIKE 41." SPIKE 41 flight has chosen "ABR" (authenticated "D") as the abort code.)

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 TAC 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

NATO BRIEFING FORMATS. (Be prepared to use this format with NATO forces.)

FORMAT 13. 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: 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: a. Target area threats b. Navigation hazards c. Hazards d. Other items

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

FORMAT 14. NATO CAS CHECK-IN BRIEFING	
1. Permissive Environment	
Aircraft transmits to controller:	
Item	***Transmission***
Aircraft Call Sign	**"Hog 01"**
Mission Number	**"3M106"**
Authentication	**"Authenticate Alpha Bravo"** (TAC 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 Romeo"**
Playtime	**"15 minutes"**
Rear Briefing Identifier	**"Got briefing Echo"**
Abort Code	**"Charlie Sierra"**
2. Non-permissive Environment	
Aircraft transmits to controller	
Item	***Transmission***
Aircraft Call Sign	**"Hog 01"**
Mission Number	**"3M106"**
Authentication	**"Authenticate Alpha Bravo"** (TAC should authenticate before continuing with the brief)
Briefing Termination	**"As fragged with briefing Echo"**

FORMAT 15. NATO TAC-TO-ATTACK AIRCRAFT BRIEFING

MISSION C/S _____ ABORT CODE _____

Note:

1. A through J are Mandatory Brief items, K through O are optional.
2. Items A, D, G, H underlined are mandatory readback (even if "NONE").
3. Heading and bearings Magnetic unless True is requested

A.	**IP**	"_____"
B.	BEARING	"_____ degrees"
C.	DISTANCE	"_____nautical miles"
D.	**TARGET LOCATION**	
	1. (UTM)	"_____"
	2. (LAT/LONG)	"_____"
E.	TARGET ELEVATION	"_____FT"
F.	TARGET DESCRIPTION	"_____"
G.	**MANDATORY ATTACK HEADING**	"_____"
H.	**FRIENDLY FORCES**	"_____"
I.	ATTACK TIME TOT/TTT	"_____"
J.	ATTACK CLEARANCE TAC C/S	"_____TAD_____"

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 "_____"

NATO CAS Worksheet (TAC 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			

Note:
1. A through J are Mandatory Brief items, K through O are optional.
2. Items A, D, G, H underlined are mandatory readback (even if "NONE")
3. Heading and bearings Magnetic unless True is requested.

Table 8. Fixed Wing Aircraft Weapons and Capabilities						
		Laser Capability		*Marking Capability*	*Beacon Option*	*Other Systems*
Aircraft	*Ordnance*	*LST*	*LTD*			
AV-8B Harrier II	Laser-guided bombs (LGB) MAVERICK GP bombs CBUs Aerial mines	YES	NO	Rockets 25mmHEI IR marker LUU-2 flares	None	CCD TV NVG GPS (N) FLIR
Litening II[1]	2.75" rockets 25mm cannon	YES[1]	YES[1]	Laser[1] IR Pointer[1]		(T) FLIR[1]
"II Plus" [2]	SIDEARM	NO[2]	NO[2]			SAR Rdr[2,3]
A/OA-10A	LGB AGM-65 JDAM GP bombs CBUs Aerial mines 2.75" rockets 30mm cannon	YES	NO	WP rockets 30mm HEI IR Pointer LUU-1/-2/-5/-6/-19 flares M-257/-258 illum flares	None	NVG GPS SADL (EPLRS)
AC-130H	105mm howitzer (176 rds) 40mm cannon (512 rds)	NO	YES (1688 only)	105mm 40mm ILZD ATI	PPN-19 SST-181 SSB PLS	FLIR LLLTV Radar GPS
AC-130U	105mm howitzer (100 rds) 40mm cannon (256 rds) 25mm cannon (3000 rds)	NO	YES	105mm 40mm 25mm LIA	PPN-19 SST-181 SSB	FLIR ALLTV SAR Rdr[3] GPS

[1] *If equipped with LITENING II pod*
[2] *AV-8B Harrier "II Plus" (with Radar)*
[3] *Synthetic Aperture Radar with ground mapping modes*

Table 8. Fixed Wing Aircraft Weapons and Capabilities						
Aircraft	*Ordnance*	*Laser Capability*		*Marking Capability*	*Beacon Option*	*Other Systems*
		LST	*LTD*			
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	NO	None	PPN-19 PPN-20 SMP-1000	(T)FLIR LLLTV Radar NVG GPS
F-14 LANTIRN	JDAM, LGBs GP Bombs CBUs 20mm cannon	NO	YES	Laser Rockets LUU-2 Flares	None	NVG (T)FLIR GPS LINK16[4]
F-15E LANTIRN	JDAM[5], LGBs Maverick GP bombs CBUs+WCMD JSOW[5] 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*
[4] *F-14D only*
[5] *After Fall 2002*

Table 8. Fixed Wing Aircraft Weapons and Capabilities						
		Laser Capability		Marking Capability	Beacon Option	Other Systems
Aircraft	*Ordnance*	*LST*	*LTD*			
F-16 (Block 25/30/32) LANTIRN[6]	LGBs, CBUs Maverick	NO	YES[1,6,7]	Laser[1, 6,7]	None	SAR Rdr[3] NVG
	GP bombs Aerial Mines			IR Pointer[1,6]		GPS[8] SADL
LITENING[1] SniperXR[7]	HARM- (*no HTS)* 20mm cannon	YES [1,7]				FLIR[1, 6,7] CCD TV[1,7]
F-16**CG** (Block 40/42) LANTIRN	JDAM, LGBs Maverick GP bombs CBU +WCMD Aerial Mines JSOW 2.75" Rockets Illum Rockets 20mm cannon	NO	YES	Laser WP Rockets	None	FLIR GPS NVG SAR Rdr[3] IDM
F-16**CJ** (Block 50/52) **HTS**	HARM Maverick JDAM, JSOW GP Bombs CBU +WCMD	NO	NO	None	None	SAR Rdr[3] GPS NVG IDM
Sniper-XR[7]	LGB[7] Aerial Mines 20mm cannon	YES[7]	YES[7]	Laser[7]		(T)FLIR[7] CCDTV[7]

[1] *If equipped w/ LITENING II pod*
[3] *Synthetic Aperture Radar with ground mapping modes*
[6] *If equipped w/ LANTIRN pod*
[7] *If equipped with SNIPER-XR advanced targeting pod*
[8] *F-16 Block 25/30/32 being upgraded to GPS*

Table 8. Fixed Wing Aircraft Weapons and Capabilities						
		Laser Capability		Marking Capability	Beacon Option	Other Systems
Aircraft	Ordnance	LST	LTD			
F/A-18 A/C/D/E/F	JDAM[9] JSOW[9] Maverick SLAM (+ER) LGBs, HARM GP bombs CBUs, 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	LGBs, HARM GP bombs CBUs, Aerial Mines 2.75"rocket 20mm cannon	NO	YES	None	None	FLIR GPS NVG
S-3B	GP bombs CBUs 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[10]	NO	YES	Laser/IR Illuminator	None	GPS FLIR, EO[11]
Pioneer						FLIR EO

[3] *Synthetic Aperture Radar with ground mapping modes*
[9] *F-18 Lot 10 and above*
[10] *Predator equipped with Hellfire has no SAR radar capability*
[11] *Real-time C-band video broadcast*

Table 9. Rotary Wing Aircraft						
Aircraft	*Using Service*	*Ordnance*	*LST*	*LTD*	*Marking Capability*	*Other Systems*
UH-1N	USMC	7.62 MG .50 cal MG 2.75" rockets	NO	NO	Rockets WP	NVG FLIR GPS
AH-1F[2]	USA	BGM-71 TOW 2.75" rockets 20mm cannon	YES (Some)	NO	Rockets WP	NVG
AH-1W[1]	USMC	BGM-71 TOW Hellfire 5", 2.75" rockets 20mm cannon LUU-2 flares Sidearm	YES	YES	Rockets Laser WP	FLIR NVG GPS CCDTV DVO
AH-64 A[3]	USA	Hellfire 2.75" rockets 30mm cannon	YES	YES[1]	Laser Rockets	FLIR NVG GPS DTV/ DVO
AH-64D (including Longbow)	USA	Hellfire (Laser or RF) 2.75" rockets 30mm cannon	YES	YES[1]	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 still in wide use in other nations.

Table 10. Attack Helicopter Weapons Capabilities	
Weapon	***Effective Max Range (m)***
2.75" Rocket, 10-lb (Mk66/M151)	7,600
2.75" Rocket, 17-lb (Mk66/M229	7,600
2.75" Mk 66/M151, 22.95-lb (USMC only)	6,900
2.75” Rocket, MPSM (Mk66/M261)[1]	7,600
2.75” Illumination M257(overt)	3500
2.75” Illumination M278 (covert)	3000
7.62 mm minigun	1,000
.50 cal. machine gun	1,830
20-mm cannon	1,500
30-mm cannon (AH-64A/D)	3,000
TOW	3,750
Hellfire	8,000
5" Rocket (USMC)	7,200
[1] Recommended min range 2,500 meters due to submunition arming and dispersion pattern	

LASER OPERATIONS

Terminal Attack Controller (TAC) 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 2. 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. (See Figure 2.)
- Prebrief pilot if possible.
- Plan early and 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 being used. (See Table 15. Risk-Estimate Distances for Aircraft Delivered Ordnance.)

❒ Immediately prior to execution, confirm actual LTL is no more than 5 degrees of 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.

WARNING

Use extreme caution when using an IR pointer or laser sources as the sole source for target mark/designation/ verification. Attack Aircraft may confuse IR pointer or laser energy source with the intended target. IR pointers or laser sources should not be used as the sole source for target mark/verification. When using IR pointers or lasers to mark, include "IR POINTER" or "LASER" in the marks portion of the CAS briefing. TACs 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. TACs 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.

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

CAPTURED—Aircrew has acquired and is able to track a specified air-to-ground (A/G) target with an onboard sensor.

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

TALLY—Sighting of a target or enemy position. Opposite of NO JOY.

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

LASER BREVITY CODES

DEADEYE—Informative call by an airborne laser designator indicating the laser/IR system is inoperative.

LASER ON—Directive call to start Laser designation.

LASING—Informative call indicating that the speaker is firing the Laser.

NEGATIVE LASER—Aircraft has not acquired Laser energy.

SHIFT (direction)—Directive call to shift Laser illumination.

SPOT—Acquisition of Laser designation.

TEN SECONDS—Directive to terminal controller to stand by for LASER ON call in approximately 10 seconds.

TERMINATE—Stop Laser illumination of a target.

NIGHT IR CAS BREVITY CODES

BURN—Informative call that Gated Laser Illuminator (GLINT) is being used to provide illumination. Typically employed by AC-130 to illuminate surface points of interest.

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

SPARKLE—1. Target marking by IR pointer. 2. Target marking by gunship/TAC-A using incendiary rounds.

SNAKE—Directive call to oscillate an IR pointer about a target.

STEADY—Directive call to stop oscillation of IR pointer.
STOP—Stop IR illumination of a target.

OTHER BREVITY CODES

ARIZONA—No ARM ordnance remaining.
BINGO—Fuel state needed for recovery.
CHATTERMARK—Directive call to begin using briefed radio procedures to counter jamming.
HOLD FIRE—An emergency fire control order to stop firing on a designated target, to include destruction of missiles in flight.
HOSTILE—A contact identified as enemy upon which clearance to fire is authorized in accordance with theater rules of engagement.
JOKER—Fuel state above BINGO at which separation/event termination should begin.
MAGNUM (system/location)—Launch of friendly antiradiation missile.
OFFSET (direction)—Directive/informative call indicating maneuver in a specified direction with reference to a target.
PIG(S)—Friendly glide weapon(s) (i.e., JSOW).
PLAYTIME—Amount of time aircraft can remain on station.
RIFLE—Friendly air-to-surface missile launch.
SPLASH—1. (A/S) Weapons impact. 2. (S/S) Informative call to observer or spotter five seconds prior to estimated time of impact.
SUNSHINE—Directive or informative call indicating illumination of target is being conducted with artificial illumination.
THUNDER—Informative call one minute prior to A/S weapons impact.
WINCHESTER—No ordnance remaining.

LASER DESIGNATION ZONES

Acquisition Areas and Safety Zones

Figure 2 depicts the acquisition areas and safety zones as defined by JP 3-09.1 (JLaser). Reference to Laser Guided Weapons in general.

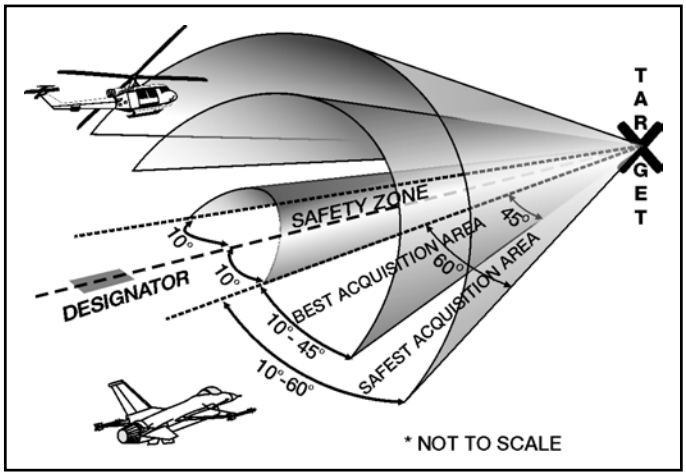


Figure 2. Laser Designation Zones (3-Dimensional)

Hellfire Designator Exclusion Zone. Figure 3 depicts the Hellfire designator exclusion zone.

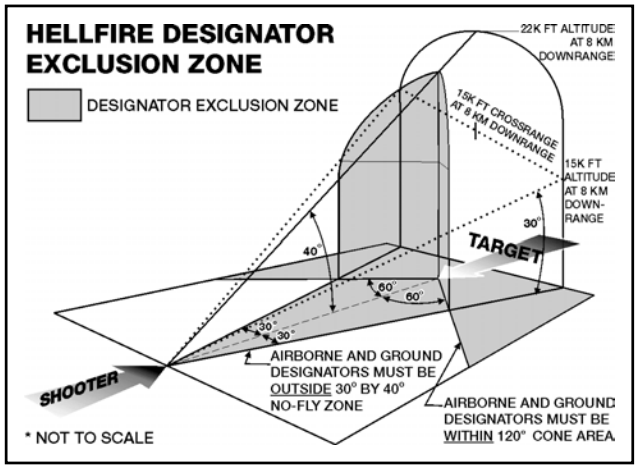


Figure 3. Hellfire Designator Exclusion Zone

- 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. Special care must be taken 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 lase 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.

GENERAL INFORMATION

The following tables can be used to calculate the number of min/secs that it will take a fighter to go from the IP to the target at various ground speeds. Ground speed (GS) is airspeed (A/S) adjusted for winds at altitude. Also, a chart is provided to convert meters to feet that will be used on 9-line briefings.

Table 11. Speed and Time Conversions

GS (knots)	nm/ min	8 nm	9 nm	10 nm	11 nm	12 nm	13 nm	14 nm	15 nm
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

Aircraft	A/S (knots)	Aircraft	A/S (knots)
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 12. Distance Conversion Table (1 meter = 3.28 feet)					
METERS	***FEET***	***METERS***	***FEET***	***METERS***	***FEET***
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

Note: 1 statute mile (5280') = 1610 m
1 nautical mile (6000') = 1829 m

TARGET WEATHER INTELLIGENCE (TARWI)

The TARWI code is a technique for transmitting detailed information about en route or target area weather observations.

Table 13. TARWI DATA

#	Cloud	#	Ht (AGL)	#	Vis (NM)	#	Wx
0	none	0	None	0	0+	0	not obs
1	1/8	1	500’	1	1+	1	none
2	1/4	2	1000’	2	2+	2	sleet
3	3/8	3	1500’	3	3+	3	dist/smoke
4	1/2	4	2000’	4	4+	4	fog/haze
5	5/8	5	2500’	5	5+	5	drizzle
6	3/4	6	3000’	6	6+	6	rain
7	7/8	7	3500’	7	7+	7	snow
8	8/8	8	4000’	8	8+	8	showers
9	not obs	9	not obs	9	not obs	9	T-storms

A	WX SIM FOR EXERCISE	N	T-STORMS ENROUTE
B	CLOUD HT X 10	O	ICE/FREEZING RAIN
C	NO MED CLOUD	P	SFC WIND NEGLIGIBLE
D	SCATTERED CLOUD	Q	SFC WINDS SE
E	BROKEN OVERCAST	R	SFC WINDS SW
F	CONTRAILS AT FL	S	SFC WINDS NW
G	MAINLY IFR	T	WX BETTER TO NORTH
H	MAINLY VFR	U	WX BETTER TO EAST
I	GUSTY SFC WINDS	V	WX BETTER TO SOUTH
J	FOG IN VALLEY	W	WX BETTER TO WEST
K	HILLTOPS OBSCURED	X	WX SUITABLE
L	VIS VARIES IN SHOWERS	Y	WX MARGINAL
M	T-STORMS	Z	WX UNSUITABLE

Example: **“3, 6, 8, 9, X-ray, Kilo, November”**
This code indicates weather at the target was 3/8 cloud at 3,000 AGL, visibility at least 8 km (5NM), thunderstorms, WX suitable for mission, higher terrain obscured, thunderstorms en route.

Table 14. Recommended Target-Weapons Pairings	
Targets	***Recommended Aircraft Ordnance***
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) 2.75" Rockets (w/M261 MPSM, M229, or HE M151 HE)
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	
In open	GP bomb, JDAM, 20 mm, 25 mm, 30 mm, 40mm, CBU-87 CEM, CBU-103, 2.75" Rockets (w/ M229, M151, M261, M255E1/WDU-4A/A Flechette,)
In fighting holes	GP bomb, JDAM, 2.75" Rockets (w/ M261, M229, M151)
Under light cover	GP bomb, JDAM, 20 mm, 25 mm, 30 mm, 40mm, 2.75" Rockets (w/ M229, M151) CBU-87 CEM, CBU-103
Under heavy cover (concrete bunker)	GP bomb or JDAM (w/BLU-109/-110) GP bomb with steel nose plug LGB (GBU-10, -24, -28), Maverick, GBU-15/EGBU-15, AGM-130

Table 14. Recommended Target-Weapons Pairings	
***** *JSOW and JDAM for use against stationary targets only*	
Field fortification	GP bomb or JDAM, LGB (GBU-10, -24, -28), Maverick, GBU-15/EGBU-15, AGM-130, 2.75” Rockets (w/ M229, M151)
Building	GP bomb or JDAM, LGB (GBU-10, -24, -28), Maverick, GBU-15/EGBU-15, AGM-130, Hellfire, 2.75” Rockets (w/ M229, M151)
Field Artillery, AAA, Rocket Launcher	
In open	CBU-87/-97/-103/-105, JSOW, GP bomb, JDAM, LGB (GBU-10/-12/-16/-24), EO/IR guided munition (Maverick, Hellfire, TOW, GBU-15/EGBU-15 or AGM-130), 2.75" Rockets (w/ M255E1/WDU-4A/A Flechette, M261, M229, M151), 30 mm, 40mm gun
In revetment	CBU-97, GP bomb, JDAM, LGB (GBU-10/-12/-16/-24), Maverick, Hellfire, 30mm, GBU-15/EGBU-15, AGM-130, 2.75" Rockets (w/ M261, M229, M151)
In covered position	GP bomb, JDAM, LGB (GBU-10/-12/-16/-24), Maverick, GBU-15/EGBU-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/EGBU-15, AGM-130, 2.75” Rockets (w/ M261, M229, M151)
Surface-to-Surface Missile site	Same as SAM, above (except delete AGM-88 HARM)

MUNITIONS DESCRIPTIONS

GENERAL PURPOSE (GP) MUNITIONS

Mk-82, 500-lb; Mk-83, 1,000-lb; Mk-84, 2,000-lb—All are similar in construction and vary only in size and weight. Streamlined cylindrical body with conical fins designed for low drag (LD). Effects: blast, frag (airburst fuze), and cratering (with a delayed fuze). NOTE: A GP bomb planned for low altitude release will be fitted with a high drag (HD) device.

Mk-82 HDGP (SNAKE-EYE)—Mk-82 with four BSU-49B retarding fins. Selectable high or low drag. Effects: blast, frag, and cratering (with a delayed fuze).

Mk-82 Air Inflatable Retarder (AIR) HDGP; Mk-84 (AIR) HDGP—GP bombs with BSU-49/50 AIR tail assembly. Selectable HD/LD. Effects: blast, frag.

Mk-36 (DESTRUCTOR)—Mk-82 with an Mk-75 arming kit which converts the bomb into a land or water mine. Deployed HD only. Timed self-destruct or magnetic fuzing.

BLU-109/B Penetrator Bomb—2,000-lb improved GP bomb. Effects: cratering and hard target penetration. See GBU-24 A/B.

BLU-110/B Penetrator Bomb—1,000-lb improved GP bomb. Effects: cratering and hard target penetration.

BLU-113 Penetrator Bomb—4,400-lb improved GP bomb. Effects: cratering and hard target penetration.

BLU-116 AMP—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.

M-117, 750-lb GP Bomb—The M-117 has a very thin bomb casing compared to other GP bombs. It is designed to provide more blast and less fragmentation than other GP bombs.

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

M-117D (DESTRUCTOR)—Equipped with an Mk-75 arming kit for ground implant and shallow water mining. High drag releasable only!

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 at different targets in a single pass ("fire & forget" weapon). Effects: blast/frag or cratering with a delayed fuze (Mk-83/84) or hard target penetrator (BLU-109/110).
GBU-29, 250lb; GBU-30, 500lb; GBU-31, 2000lb; GBU-32/35, 1000lb.
GBU-31 (Mk-84): USAF (v)1/B, Navy (v)2/B.
BLU-109: USAF (v)3/B, Navy (v)4/B.
GBU-32 (Mk-83): USAF (v)1/B. Navy (v)2/B.
BLU-110: USAF N/A, Navy (v)2/B.

AGM-154 JSOW—The joint stand-off weapon (JSOW) is a low-observable, all weather, 1,000-lb class, family of standoff 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, maneuverable, free-falling weapons. GBU-10 uses an Mk-84 or BLU-109 bomb body. GBU-12 uses an Mk-82 bomb body. GBU-16 uses an Mk-83 bomb body. Effects: same as Mk-82/83/84 bomb series.

GBU-15/EGBU-15—TV- or IR-guided, automatically or manually by the 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 AMP (GBU24C/B [USAF]; D/B [Navy]) bomb body. GBU-24E/B adds GPS/INS guidance to allow adverse weather capability with BLU-109 bomb body. Can be released from very low or from 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 (except AGM-65E) and guides autonomously, 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 high-value 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)—The AGM-88 high-speed antiradiation missile (HARM) is a supersonic air-to-surface tactical missile designed to seek and destroy enemy 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 antiarmor missile. Can also be used against buildings and field fortifications. Warhead configuration is shaped charge with blast fragmentation. 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. Warhead: 18 lbs.

AGM-122A (SIDEARM)—A small antiradiation missile, carried on the USMC AH-1W Supercobra attack helicopters and the AV-8B for self-defense against antiaircraft gun and SAM radars. Although vulnerable to countermeasures and limited compared to AGM-88 HARM, it does provide a useful self-defense capability against low-level antihelicopter threats such as the ZSU-23 or SA-8.

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-71A TOW Missile—Solid propellant, wire-guided, antiarmor missile. Min range: 500m; max range: 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 to 6,000 rounds/min. TP, HEI, API, TPI, HEIT.

GAU-12, 25mm Gatling—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 (Shape charge and fragmentation) Target types: personnel, material, and light armor.

GAU-8, 30mm Gatling—3,900 rounds/min. 1.5-lb projectile TP, HEI, API on A/OA-10 (typically fires all 1,174 rounds in five 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 & 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-50—Mk-82 inert 500-lb practice bomb.

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.

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 90 seconds in the IR spectrum.

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

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

2.75" ROCKET WARHEADS

Mk-67 mod 0—Smoke WP.

Mk-67 mod 1—Smoke RP.

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.

M257/M278—Illumination.

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

M-255E1—Flechette for antipersonnel.

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

WTU-1/B—TP. A practice M-151.

CRV-7—Canadian hypervelocity rocket with various combinations of warheads and fuzes.

5.00" ROCKET WARHEADS

Mk-63 mod 0—Fuses: PD, P, TD; HE-Frag for personnel and material targets

Mk-24 GP—Fuses: PD, P, TD; primary fragmentation against personnel, 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 or non-fuzed practice variants.

CLUSTER MUNITIONS

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 oval pattern with density and sizes 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 antiarmor and 22 BLU-92/B antipersonnel 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, APCs, and support vehicles. This cluster weapon is propped 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, 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.

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

RISK-ESTIMATE DISTANCES

Risk-estimate distances are based on the following assumptions. Any changes to the assumptions may increase the risk-estimate distances from those given in Table 15. Risk-estimate distances allow the ground forces commander or combat air commander to estimate the risk in terms of the percent of friendly casualties that may result from an air strike against an enemy threat along the forward line of own troops (FLOT). Risk-estimate distances are based on fragmentation patterns.

COMPUTATIONS

All attacks are parallel to the FLOT. Distances are computed from the intended impact point of the center of a stick of bombs or a pod of rockets. Deflection distance (from the aiming point toward the friendly troops) is built into the risk-estimate distance. The deflection distance equals the distance from the aircraft centerline to the farthest outboard station, plus the lateral distance that a weapon travels because of rack-ejection velocity. **Risk-estimate distances are for combat use and are not minimum safe distances for peacetime training use.**

RELATIONSHIPS BETWEEN WEAPON IMPACT AND POINT OF INTERSECTION

For all determinations in Table 15, the position of a prone man was assumed to be on a line perpendicular to the line of flight (or line of weapon impacts) at the midpoint of the line (stick) of weapons. For all sticks of weapons, a weapon was assumed to impact at the point of intersection of these two lines. Thus, for the weapons evaluated, the following relationships between weapon impact and the point of intersection were assumed:

- GP munitions—center bomb of stick impacts at point of intersection.
- Rockets—center rocket.
- Cluster weapons—pattern center of the center dispenser.
- Guns—center of pattern.

- Maverick—single-weapon delivery impacting at point of intersection.

WEAPON RELIABILITY AND DELIVERY PARAMETERS

A weapon reliability of 1.0 was used for all weapons evaluated. Delivery parameters and considerations for specific weapons are located in (S) FM 101-50-31/TH 61A1-3-9-AVAIR OO-130ASR-9.

DANGER CLOSE

Ordnance delivery inside 0.1% PI distances will be considered as "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 passes initials to terminal controllers indicating acceptance of the risk inherent in ordnance delivery inside the 0.1% PI distance.

Risk-estimate distances allow the supported commander to estimate the risk to friendly troops from the CAS attack. Risk-estimate distances are listed in Table 15. **When ordnance is a factor to the safety of friendly troops, the aircraft's attack heading should be parallel to the friendly forces.** This precludes long and/or short deliveries from being a factor to friendlies.

Table 15. Risk-Estimate Distances For Aircraft Delivered Ordnance			
Item	*Description*	*Risk-Estimate Distance (m)*	
		10% PI	*0.1% PI*
Mk-82 LD/HD	500-lb Bomb/AIR	275	475
Mk-82 LGB[1]	GBU-12	75	200
Mk-83 LD/HD	1,000-lb /AIR	300	500
Mk-83 LGB[1]	GBU-16	75	200
Mk-83 JDAM[1]	GBU-32	100	250
Mk-84 LD/HD	2,000-lb /AIR	325	500
Mk-84 LGB[1]	GBU-10/24	75	225
Mk-84 JDAM[1]	GBU-31	100	225
Mk-20	Rockeye	275	650
CBU-87[2] CBU-89[2,3]	CEM or GATOR	275	425
WCMD[3]	CBU-87/89 w/kit	125	200
JSOW	BLU-97	125	225
2.75" Rockets	Rocket with various warheads (M151, M229, M261)	100	175
5" Rockets	Zuni with various warheads	150	200
Hellfire	AGM-114	50	75
M4, M12, SUU-23, M61, GAU-12, GPU-5A, GAU-8	20mm, 25mm & 30mm Gatling Guns	100	150
AGM-65	Maverick (TV, IIR, Laser Guided)	25	75
AC-130[4]	25mm, 40mm	100	125
	105mm Cannon	80	200

WARNING

Risk-estimate distances are for combat use and are not minimum safe distances for peacetime training use.

RISK ESTIMATE DISTANCE NOTES (Table 15)

1. JDAM is a viable CAS munition, however, detailed procedures for employment have yet to be developed. These procedures need to be in place prior to full implementation.

2. Not recommended for use near troops in contact.

3. CBU-89 bombs are antitank and antipersonnel mines and are not recommended for use near troops in contact.

4. This distance is used for all AC-130 engagements as it has the largest fragmentation pattern for the largest weapon system on board.

NOTE: To request CAS, use the tactical air request net/Air Force Air Request Net (AFARN). Control of CAS aircraft should be conducted on a tactical air direction net.

Table 16. Terminal Controller Communication Equipment

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

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.

Table 17. Command and Control Communications Equipment

Component	*Freq Band (Note 1)*	*Frequency Hopping*	*Secure Capable*
ASOC USAF	Multi-Band, SATCOM Microwave	SINCGARS/HQ II	KY-57, KY-99
ABCCC USAF	UHF-AM	HQ I/II	KY-58
	VHF-AM/FM	SINCGARS	KY-58
	HF		KYV-5 (ANDVT)
	UHF SATCOM	(Note 3)	KY-58
	Teletype		KG-84
JSTARS (Note 4) USAF	VHF-AM/FM		KY-58
	UHF-AM, UHF SATCOM	HQ II	KY-58
	HF		KYV-5 (ANDVT)
E-2C	VHF-UHF AM/FM HF SATCOM JTIDS/LINK 16	HQ II, JTIDS	KY-57/ 58, JTIDS
DASC-USMC	UHF/VHF-AM, HF	HQ II	KY-58, KY-99

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 and Receive;
VHF-FM = 30.000 to 87.975 in 25 kHz increments;
UHF-AM = 225.000 to 399.975 in 25 kHz increments.

Table 18. Rotary Wing Communications Equipment Summary			
A/C TYPE	***FREQUENCY BAND (Note 1)***	***FREQUENCY HOPPING***	***SECURE CAPABLE***
AH-1W	Multiband (Note 2)	NO	KY-58
UH-1N	Multiband (Note 2)	NO	KY-58
UH-60	VHF-FM	SINCGARS	KY-58
	UHF	HQ II	KY-58
	VHF-FM	SINCGARS	KY-58
OH-58C	VHF-AM	NO	NO
	UHF		NO
OH-58D	VHF-FM	SINCGARS	KY-58
	UHF	HQ II	KY-58
	VHF-FM	SINCGARS	KY-58
AH-64	UHF	HQ I or HQ II	KY-58
	VHF-FM	SINCGARS	KY-58
MH-53M	UHF VHF/AM HF SATCOM	YES YES NO	KY-58 KY-100 USC-43 (ANDVT)
Note 1: 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. **Note 2:** VHF-FM, VHF-AM, UHF, or 156.0-173.975 MHz VHF-FM.			

Table 19. Fixed Wing Aircraft Communication Summary			
A/C TYPE	***FREQUENCY BAND***[1]	***FREQUENCY HOPPING***	***SECURE CAPABLE***
AC-130	UHF SATCOM, VHF[3] HF VHF-FM	HQ II No No SINCGARS	KY-58/ -100 KY-58 /-100 KYV-5 KY-58
EA-6B	VHF/UHF HF	HQ II No	 KY-58
AV-8B	Multiband[2]	No	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 No	KY-58 KYV-5 No
B-52H	UHF HF, SATCOM	HQ II No	KY-58 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
F/A-18	Multiband[2]	HQ II	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[6]

[1] Frequency bands are as follows:
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 with HQ II, 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.
[6] After Jan 03.

Table 20. USMC Fire Support Request Nets				
NET	***PURPOSE***	***NET CONTROL***	***STATIONS ON NET***	***FREQ***
Artillery Conduct of Fire	FOs request and adjust arty fire	DS arty BN	DS arty BN, firing battery, arty LNO at 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	Direction of aircraft in CAS missions by a terminal controller	TACC-afloat DASC-ashore	TACC, DASC, FSCCs, FAC parties, airborne controllers, OAS aircraft and TAC 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 21. Army Fire Support Request Nets				
NET	***PURPOSE***	***NET CONTROL***	***STATIONS ON NET***	***FREQ***
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	TAC request immediate air support	ASOC, ABCCC	TACS, ASOC, ALO, ABCCC	HF/ SAT-COM
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

FIRE SUPPORT/AIRSPACE COORDINATING MEASURES

This section briefly describes fire support coordinating measures (FSCMs) and airspace control measures (ACMs) used as FSCMs. For detailed descriptions see JP 3-09, *Joint Fire Support*, and JP 3-52, *Joint Airspace Control*.

The establishment or change of an FSCM by the ground commander is typically initiated thought the J-3, G-3, and/or S-3 operations cell and ultimately approved by the appropriate commander. The fire support coordinator (FSCOORD) recommends the establishment of FSCMs in coordination with the air liaison officer (ALO) at the appropriate level of command to the S-3 or commander. Formal measures are usually published in the fire support plan and the airspace control order (ACO).

ACMs are nominated from subordinate headquarters through component command headquarters and forwarded to the airspace control authority in accordance with the air control plan (ACP). Most ACMs impact on indirect fire trajectories and unmanned reconnaissance aircraft because of their airspace use. Some ACMs may be established to permit surface fires or UAV operations. The component commanders ensure that ACM nominations support and do not conflict with ground operations prior to forwarding to the joint air operations center (JAOC). The airspace control authority approves formal ACM nominations and includes them in the ACO.

Within their operational areas, land and naval force 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. To enable effective fires during all operations, commanders should limit the use (and size) of restrictive control measures to the minimum required to safeguard

friendly forces (air and surface) and accomplish the mission.

Permissive FSCMs include:

Fire Support Coordination Line (FSCL) FSCLs facilitate the expeditious attack of surface targets of opportunity beyond the coordinating measure. The FSCL is established and adjusted by appropriate land or amphibious force commanders within their boundaries in consultation with superior, subordinate, supporting, and affected commanders. A FSCL does not divide an area of operations by defining a boundary between close and deep operations or a zone for close air support. The FSCL applies to all fires of air, land, and sea-based weapons systems using any type of ammunition and should follow well-defined terrain features. Short of the FSCL, all air-to-ground and surface-to-surface attack operations are controlled by the appropriate land or amphibious force commander.

Supporting elements attacking targets beyond the FSCL must ensure that the attack will not produce adverse effects on, or to the rear of, the line. Forces attacking targets beyond an FSCL must inform all affected commanders in sufficient time to allow necessary reaction to avoid fratricide. Coordination of attacks beyond the FSCL is especially critical to commanders of air, land, and special operations forces. In exceptional circumstances, the inability to conduct this coordination will not preclude the attack of targets beyond the FSCL. However, failure to do so may increase the risk of fratricide and could waste limited resources.

Coordinated Fire Line (CFL) The CFL is a line beyond which conventional, direct, and indirect surface fire support means may fire at any time within the boundaries of the establishing headquarters without additional coordination. The purpose of the CFL is to expedite the surface-to-surface attack of targets beyond the CFL without coordination with the ground commander in whose area of

operation the targets are located. Referred to in NATO as the Fire Support Safety Line (FSSL).

Free-Fire Area (FFA) A specific area into which any weapon system may fire without additional coordination with the establishing headquarters.

Restrictive FSCMs include:

Restrictive Fire Line (RFL) The RFL is a line established between converging friendly forces—one or both may be moving—that prohibits fires or the effects of fires across the line without coordination with the affected force. The purpose of the line is to prevent fratricide and duplication of attacks by converging friendly forces. The commander common to the converging forces establishes the RFL. It is located on identifiable terrain when possible. In link-up operations, it is usually closer to the stationary force to allow maximum freedom of action for the maneuver and fire support of the link-up force.

No-Fire Area (NFA) The NFA prohibits fires or their effects into an area. There are two exceptions: (1) When the establishing headquarters approves fires within the NFA on a mission-by-mission basis. (2) When an enemy force within the NFA engages a friendly force and the engaged commander determines there is a requirement for immediate protection and responds with the minimal force needed to defend his force. Usually, a division or corps equivalent establishes an NFA. If possible, the NFA is established on identifiable terrain.

Restrictive Fire Area (RFA) The RFA is an area where specific restrictions are imposed and into which fires (or the effects of fires) that exceed those restrictions will not be delivered without coordination with the establishing headquarters. The purpose of the RFA is to regulate fires into an area according to the stated restrictions. Restrictions may include weapon size (e.g., < 155mm), shell/fuse combinations (e.g., Only HE/VT or No DPICM) or

even which units may provide support (e.g., fires only from LRSU Team 4). A maneuver battalion or higher echelon normally establishes a RFA. Usually, the RFA is located on identifiable terrain, by grid, or by a radius from a center point.

Airspace Coordination Area (ACA) An ACA is an ACM used as a restrictive FSCM. It is the primary FSCM that reflects the coordination of airspace for use by air support and indirect fires. An ACA is a three-dimensional block of airspace in a target area, established by the appropriate ground commander, in which friendly aircraft are reasonably safe from friendly surface fires. There are two basic types of ACAs: formal and informal. Both types of ACAs are constructed with the assistance of the ALO to ensure they meet the technical requirements of the aircraft and weapon systems.

Formal ACAs The airspace control authority establishes a formal ACA (a three-dimensional box of airspace) at the request of the appropriate ground commander. A formal ACA includes minimum and maximum altitudes, a baseline designated by grid coordinates at each end, the width on either side of the baseline, and the effective times.

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.

Table 22. Example of Airspace Coordination Area Terminology	
Terminology	***Meaning***
ACA established but not activated	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.**
ACA activated	ACA is activated at this time. 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 TACs in the field. There is no one favorite technique used, but always plan on the one that allows for the most firepower on the target. If at all possible, never shut off your artillery when flying CAS.

Table 23. Separation Techniques			
Technique	***CAS target same as/near surface target***	***CAS target distant from surface target***	***CAS target along gun-target line (GTL)***
High/Medium Altitude Attack	Time/Altitude Separation	Time/Altitude/ Lateral Separation	Time/Altitude Separation
Low/Very Low Altitude Attack	Time Separation	Time/Altitude or Lateral Separation	Time/Altitude Separation

GLOSSARY

A

AAA	anti-aircraft artillery
ABCCC	airborne battlefield command and control center
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
AGL	above ground level
AGM	attack guidance matrix, air-to-ground missile
ALLTV	all-light level television
ALSA	Air Land Sea Application
ALO	air liaison officer
AMC	air mission commander
ANDVT	advanced narrow band digital voice terminal
AOC	aerospace operations center (USAF), air operations center, Army operations center
AP	attack position/antipersonnel; average point
APICM	antipersonnel improved conventional munition
arty	artillery
A/S	airspeed
ASOC	air support operations center
ATACMS	Army Tactical Missile System
ATI	ambient temperature illuminator
AWACS	airborne warning and control system

B

BCN	beacon
BDA	battle damage assessment
BDE	Brigade

BP battle position

C

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

D

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

E

EPLRS enhanced position location reporting system
ER extended range
ETAC enlisted terminal attack controller

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 (also snakeye and air-inflatable retarded [AIR])
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

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
LLLTV	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
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
P	
PI	probability of incapacitation
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

TAC	terminal attack controller
TAC(A)	tactical air coordinator (airborne)
TACC	tactical air control center (USN); tactical air command center (USMC)
TACP	tactical air control party
TAI	target area of interest
TAOC	tactical air operations center (USMC)
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
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

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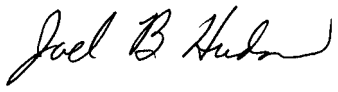

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