AVIATION URBAN OPERATIONS

MULTI-SERVICE TACTICS, TECHNIQUES, AND PROCEDURES FOR AVIATION URBAN OPERATIONS

ATP 3-06.1[FM 3-06.1]
MCRP 3-35.3A
NTTP 3-01.04
AFTTP 3-2.29

APRIL 2013

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*Supersedes FM 3-06.1 / MCRP 3-35.3A / NTTP 3-01.04 / AFTTP 3-2.29, dated 9 July 2005.
FOREWORD

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

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

KIRBY R. BROWN
Deputy to the Commanding General
US Army Combined Arms Center

ERIC M. SMITH
Brigadier General, US Marine Corps
Director
Capabilities Development Directorate

TERRY B. KRAFT
Rear Admiral, US Navy
Commander
Navy Warfare Development Command

WALTER D. GIVHAN
Major General, US Air Force
Commander
Curtis E. LeMay Center for Doctrine Development and Education

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PREFACE

1. Purpose
This publication provides multi-Service tactics, techniques, and procedures (MTTP) for planning and executing aviation operations in the urban environment.

Note: For the Army, the term "command and control" was replaced with "mission command". "Mission command" now encompasses the Army’s philosophy of command (still known as mission command) as well as the exercise of authority and direction to accomplish missions (formerly known as command and control).

2. Scope
This manual is a tactical level document for planning and conducting operations in an urban environment. This publication complements established doctrine and provides a single-source reference to assist aviation and ground personnel in planning and coordinating tactical aviation support to urban operations. It promotes an understanding of the complexities of urban terrain and incorporates lessons learned and tactics, techniques, and procedures (TTP) from recent aviation urban operations. This publication does not address all functions of airpower employment that may be used in urban operations, (e.g., counterair, strategic attack, air interdiction, etc.) as these topics are addressed in other appropriate joint and Service publications.

3. Applicability
This publication applies to all personnel involved in planning and conducting operations in an urban environment, including commanders, staffs, and operators. It can serve as a source document for developing Service and joint manuals, publications, and curricula; supplementary documentation; or a stand-alone document. In accordance with Department of Defense Instruction 5230.24 (August 23, 2012), Distribution Statements on Technical Documents, table 3, this document is distribution statement D for “Administrative or Operational Use”.

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

   Army. Upon approval and authentication, this publication incorporates the TTP contained herein into the United States (US) Army Training and Doctrine Command (TRADOC) Doctrine Program as directed by the Commander, TRADOC.

   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 Publications Distribution System.

   Navy. The Navy will incorporate these procedures in US Navy training and doctrine publications as directed by the Commander, Navy Warfare Development Command (NWDC)[N5]. Distribution is in accordance with Military Standard Requisitioning and Issue Procedures Desk Guide, Naval Supply Systems Command Publication 409.

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1 Marine Corps PCN: 144 000088 00
**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 33-360.

5. **User Information**

a. US Army Combined Arms Center (CAC), MCCDC, NWDC, Curtis E. LeMay Center for Doctrine Development and Education (LeMay Center), 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:

<table>
<thead>
<tr>
<th>Army</th>
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<tbody>
<tr>
<td>Commander, US Army Combined Arms Center</td>
</tr>
<tr>
<td>ATTN: ATZL-MCK-D</td>
</tr>
<tr>
<td>Fort Leavenworth KS 66027-6900</td>
</tr>
<tr>
<td>DSN 552-4885 COMM (913) 684-4885</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:usarmy.leavenworth.mccoe.mbx.cadd-org-mailbox@mail.mil">usarmy.leavenworth.mccoe.mbx.cadd-org-mailbox@mail.mil</a></td>
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<tr>
<th>Marine Corps</th>
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</thead>
<tbody>
<tr>
<td>Deputy Commandant for Combat Development and Integration</td>
</tr>
<tr>
<td>ATTN: C116</td>
</tr>
<tr>
<td>3300 Russell Road, Suite 204</td>
</tr>
<tr>
<td>Quantico VA 22134-5021</td>
</tr>
<tr>
<td>DSN 278-2871/6227 COMM (703) 784-2871/6227</td>
</tr>
<tr>
<td>E-mail: Publication POC at <a href="https://www.doctrine.usmc.mil">https://www.doctrine.usmc.mil</a></td>
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<th>Navy</th>
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<tbody>
<tr>
<td>Commander, Navy Warfare Development Command</td>
</tr>
<tr>
<td>ATTN: N52</td>
</tr>
<tr>
<td>1528 Piersey St, Building O-27</td>
</tr>
<tr>
<td>Norfolk VA 23511-2723</td>
</tr>
<tr>
<td>DSN 341-4185 COMM (757) 341-4185</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:alsapubs@nwdc.navy.mil">alsapubs@nwdc.navy.mil</a></td>
</tr>
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<table>
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<tr>
<th>Air Force</th>
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<tbody>
<tr>
<td>Commander, Curtis E. LeMay Center for Doctrine Development and Education</td>
</tr>
<tr>
<td>ATTN: DDJ</td>
</tr>
<tr>
<td>401 Chennault Circle</td>
</tr>
<tr>
<td>Maxwell AFB AL 36112-6004</td>
</tr>
<tr>
<td>DSN 493-2640/2256 COMM (334) 953-2640/2256</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:lemayctr.ddj.workflow@maxwell.af.mil">lemayctr.ddj.workflow@maxwell.af.mil</a></td>
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<table>
<thead>
<tr>
<th>ALSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director, ALSA Center</td>
</tr>
<tr>
<td>114 Andrews Street</td>
</tr>
<tr>
<td>Joint Base Langley-Eustis VA 23665-2785</td>
</tr>
<tr>
<td>DSN 575-0902 COMM (757) 225-0902</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:alsa.director@langley.af.mil">alsa.director@langley.af.mil</a></td>
</tr>
</tbody>
</table>
SUMMARY OF CHANGES

ATP 3-06.1/MCRP 3-35.3A/NTTP 3-01.04/AFTTP 3-2.29, Multi-Service Tactics, Techniques, and Procedures for Aviation Urban Operations.

This revision presents new and updated material to the reader. The publication’s organization was changed to provide an overview of aviation operations in the urban environment, aviation planning considerations, aviation missions, and weapon employment. New appendices discuss AC-130 gunship operations, rotary wing tactics, techniques, and procedures (TTP), urban suppressive fires, and urban camouflage.

- Restructured and updated Chapter I Overview; removed urban operations historical data.
- Added a new section in Chapter II for Air to Ground Integration.
- Consolidated the Intelligence Preparation of the Battlefield considerations in Chapter II.
- Updated the Route Planning and Navigation section, in Chapter II, with new techniques.
- Chapter III is a new chapter that provides information on types of aircraft occupying urban airspace, their missions, capabilities, and specific urban considerations.
- Updated the Urban Grids and Reference Techniques section in Chapter IV with new techniques to produce the ground reference graphic.
- Updated the Lasing section, in Chapter IV, to include buddy lasing techniques among various platforms.
- Deleted redundant munitions information from appendix A now contained in ALSA's Multi-Service Procedures for the Joint Application of Firepower. Appendix A now provides a comparison of the advantages/disadvantages of various weapon types in the urban environment.
- Added appendix B which describes AC-130/KC-130J employment in the urban environment.
- Added appendix C which consolidates rotary wing TTP in the urban environment in a single appendix.
- Added appendix D which provides TTP for the suppression of enemy air defenses in an urban environment.
- Added appendix E which provides examples and insights into contemporary camouflage techniques in urban terrain.
AVIATION URBAN OPERATIONS
MULTI-SERVICE TACTICS, TECHNIQUES, AND PROCEDURES FOR AVIATION URBAN OPERATIONS

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EXECUTIVE SUMMARY
AVIATION URBAN OPERATIONS

Multi-Service Tactics, Techniques, and Procedures (MTTP) for Aviation Urban Operations:

- Provides MTTP for tactical level planning and execution of aviation urban operations.
- Provides reference material to assist aircrew and ground personnel in planning and coordinating tactical urban operations.
- Applies to all elements of force planning and conducting aviation urban operations, including commanders, planners, aircrew, and ground personnel requiring aviation support.

Chapter I
Overview

Chapter I provides an overview of aviation urban operations including lessons learned, tactical challenges, and training considerations to assist in preparing urban aviation operations.

Chapter II
General Planning Considerations

Chapter II includes discussions concerning urban environmental characteristics, threat considerations, weather effects, operational graphics, route planning, and fratricide prevention. It further includes discussion of political and civilian considerations, rules of engagement, and collateral damage considerations.

Chapter III
Urban Aviation Missions

Chapter III highlights the most common aviation mission areas from all four Services and associated platforms. It also includes information on aviation capabilities and employment limitations for fixed- and rotary-wing as well as unmanned aircraft systems.

Chapter IV
Weapon Employment

Chapter IV highlights employing munitions in the urban environment. It discusses target selection, urban grids, and target reference and marking techniques. Additionally, this chapter includes information on munitions’ effectiveness and target lasing techniques/considerations.
Appendix A
MUNITIONS CONSIDERATIONS

Appendix A provides additional information on the advantages and disadvantages of various munitions in the urban environment.

Appendix B
C-130 GUNSHIP OPERATIONS

Appendix B provides a detailed discussion of the unique capabilities and employment techniques of the AC-130/KC-130J.

Appendix C
ROTARY WING URBAN TACTICS, TECHNIQUES, AND PROCEDURES (TTP)

Appendix C provides TTP on rotary wing flight techniques, navigation, survivability and multi-ship operations. It also includes TTP for selecting attack positions, helicopter landing zones and forward arming and refueling point locations.

Appendix D
URBAN SUPPRESSIVE FIRES

Appendix D provides TTP on suppression of enemy air defenses in the urban environment.

Appendix E
URBAN CAMOUFLAGE CONCEALMENT AND DECEPTION

Appendix E provides an overview of common urban camouflage techniques.
PROGRAM PARTICIPANTS
The following commanders and agencies participated in this publication:

Army
United States (US) Army Combined Arms Center, Fort Leavenworth, KS
US Army Training and Doctrine Command, Fort Eustis, VA
US Army Aviation Center of Excellence, Fort Rucker, AL
Headquarters I Corps, Joint Base Lewis McChord, WA
US Army Training and Doctrine Command Capability Manger, Fort Leavenworth, KS

Marine Corps
US Marine Corps Combat Development Command, Quantico, VA
Marine Corp Capabilities Development Directorate, Quantico, VA
Marine Aviation Weapons and Tactics Squadron (One), MCAS, Yuma, AZ

Navy
Navy Warfare Development Command, Norfolk, VA
Naval Special Operations Command, Naval Base Coronado, San Diego, CA

Air Force
Curtis E. Lemay Center for Doctrine Development and Education,
Maxwell Air Force Base, AL
561st Joint Tactics Squadron, Nellis Air Force Base, NV
14th Weapons Squadron, Hurlburt Air Force Base, FL
6th Reconnaissance Squadron, Holloman Air Force Base, NM
Headquarters, Air Force Special Operations Command, Hurlburt Air Force Base, FL
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Chapter I
OVERVIEW

1. Background: The Nature of the Urban Environment

a. Conflicts over the last 30 years involving militaries of world powers show ill equipped belligerents successfully utilized the complex nature of urban combat to offset advantages in technology, numbers, and firepower.

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<td>“The world is in the midst of a massive urban transition unlike that of any other time in history. Within the next decade, more than half of the world’s population, an estimated 3.3 billion, will be living in urban areas ... In 1975, just over one third of the world’s people lived in urban areas. By 2025, the proportion will have risen to almost two thirds (United Nations’ data).”</td>
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<td>Source: World Resources, 1996-97: [The Urban Environment] by World Resources Institute Staff (et al Copyright 1996 reproduced with permission of World Resources Institute in the format ‘other book’ via Copyright Clearance Center)</td>
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b. Manmade structures and density of noncombatants in urban terrain affect tactical options available to commanders and aircrews. Whether engaged in offensive, defensive, or stability operations, aviation units may conduct missions in urbanized terrain. This is due not only to growing populations, but also a potential adversary’s tendency to create a nonlinear operational environment rather than face United States (US) forces directly. Expect potential adversaries to use urban terrain for cover and concealment, and to reduce US combat superiority by taking advantage of weapons restrictions and reduced options available to commanders under the rules of engagement (ROE).

c. This publication focuses on and addresses the tactical level operator’s unique considerations owed to the dense, three-dimensional terrain when conducting aviation urban operations.

2. Aviation Operations in Urban Terrain

a. Employment of aviation assets in urban operations presents important and unique tactical challenges across the full range of military operations. Aviation enhances urban operations by providing:

   (1) Reconnaissance and security.
   (2) Responsive and flexible re-supply.
   (3) Rapid troop movement.
   (4) Evacuation of personnel and equipment.
   (5) Cooperative maneuver.
   (6) Precision fires in support of ground forces.
   (7) The ability to quickly transition to new missions.
b. The two dominant characteristics affecting aviation urban operations are the existence of manmade construction and the difficulty in distinguishing combatants from noncombatants.

c. Commanders may conduct operations on or against objectives located on a complex urban topology and its adjacent natural terrain.

3. Tactical Challenges of Aviation Urban Operations

a. Physical Limitations.
   (1) The availability of obstacles, cover, concealment, and potential strong points offers a defending force advantages.
   (2) City layouts limit traditional methods of military operations.
   (3) Operating within the vertical construction or subterranean infrastructure limits line of sight (LOS) communications.

b. Logistics and Medical.
   (1) Urban operations require a responsive logistical support system due to unit dispersion in the urban environment.
   (2) A responsive/robust treatment and evacuation plan for casualties is critical.
   (3) To meet casualty and evacuation needs, plan to establish aid stations and landing zones (LZs) as far forward as the situation allows.

4. Aviation Urban Operations Planning Overview

Planning and conducting urban operations requires effective aviation integration including:

a. Unified planning from concept through execution.

b. A single, common set of standards usable by all ground and aviation forces.

c. Early and integrated attention to spectrum management, airspace management, integration with fires, and command and control.

5. Training Considerations

a. Aviation missions span the full spectrum of military operations. Even a benign environment, such as disaster relief or civilian assistance, requires focused training to minimize mission risks.

b. Baseline training requirements include:
   (1) Day/night urban terrain navigation (to include navigation without Global Positioning Systems (GPS).
   (2) Urban environment drop zone (DZ) selection.
   (3) Urban environment LZ selections.
   (4) Confined area operations.
   (5) Waypoint and route selection.
   (6) Approach and departure considerations.
   (7) Noise considerations.
c. Training Programs.

(1) Frequent, realistic training is required to overcome the difficulties associated with aviation urban operations and requires achieving and maintaining a high degree of aircrew proficiency.

(2) Include the following in unit urban aviation operations training programs:
   (a) Centralized control from the operational headquarters; decentralized aircrew execution.
   (b) Application of ROE, special instructions, and law of armed conflict.
   (c) Developing checklists/procedures/considerations for targeting.
   (d) Low-level flight techniques.
   (e) Urban terrain navigation.
   (f) Night operations.
   (g) Weaponeering.
   (h) Joint live fire training exercises focused on target identification, terminal attack control, fratricide prevention and integrated fires in close combat conditions.
   (i) Integrated urban scenarios into notional training exercises.
   (j) Joint exercises using established joint military training areas.
   (k) Battle-tracking.
   (l) Exercising all levels of joint command structure (whenever possible).
   (m) Urban grid training.
   (n) Video and simulation (live, virtual, and constructive aids can enhance planning and execution of aviation urban operations).
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Chapter II
GENERAL PLANNING CONSIDERATIONS

1. Introduction
   a. Urban combat planning requires integrated and coherent planning involving all ground and air elements from the most senior echelon to the lowest level ground maneuver element.
   b. Operations in urban terrain generally follow the same planning and execution concepts as in other terrain; however, special planning and consideration of characteristics unique to urban terrain are required. Low altitude aircraft should stand off to engage targets in urban areas. Overflight and engagement of targets within urban areas may require night operations and special preparation due to possible enemy direct fire at very close range.

2. Air to Ground Integration
   a. Synchronizing a commander's assets on the modern battlefield poses a serious challenge; urban terrain amplifies it. The commander should include aviation in all aspects of the plan, not simply add aviation support at the end.
   b. Commanders should integrate (and deconflict) close air support (CAS), intelligence, surveillance and reconnaissance (ISR), unmanned aircraft system (UAS), rotary wing attack, security, assault, and general support missions with the ground scheme of maneuver. Integration essentially means applying aviation assets at the ground commander's critical point on the battlefield.
   c. Using liaison officers (LNOs) at all levels is critical, both in the planning process and to the development of situational awareness. LNOs can help expedite asset deconfliction, which is an ongoing process through completion of the mission.

3. Characteristics Unique To The Urban Environment
   a. Unique Considerations. The compressed operational environment of urban areas creates unique considerations for planning and conducting aviation operations to include:
      (1) Operations in urban canyons.
      (2) Aircraft deconfliction in confined airspace.
      (3) The vertical operational environment.
      (4) Increased presence of towers, wires, and antenna hazards.
      (5) Political considerations that restrict rules of engagement (ROE).
      (6) Difficulty in threat analysis.
      (7) An overload of visual cues and differing ground and air perspectives.
      (8) High concentration of noncombatants.
      (9) The potential for collateral damage (CD).
   b. Urban operations require planners to have thorough knowledge and understanding of key terrain (i.e., intersections, roads, hospitals, schools, cultural,
religious, and municipal buildings), flight routes in and out of the area of operations, and flight hazards (e.g., towers, wires, canals, and power lines).

4. Intelligence Preparation of the Battlefield (IPB)

a. The presence of a major threat to air operations, such as enemy aircraft or effective integrated air defenses, completely changes the character of aviation urban operations. Even an enemy without an “effective” or “integrated” air defense system can pose a significant threat to friendly aircraft, and planners should address the threat during their IPB.

   (1) Planners and intelligence analysts should pool their information and jointly analyze all available intelligence to enable all elements of the force to form a common operating picture and shared understanding of the tactical situation.
   (2) Planners should anticipate rapid changes in the threat, and incomplete information.
   (3) Every structure in an urban area is a potential enemy position. Expect enemy forces to establish command posts in urban areas (basements etc.) to take advantage of concealment, reduced signatures, and increased civilian security concerns for friendly forces.
   (4) Sniper presence, vulnerability to ambush, and difficulty in distinguishing combatants from noncombatants are all urban threat considerations mitigated through the IPB process.
   (5) The most prominent characteristics of urban operations are the number of avenues of assault and areas of concealment the enemy can use to attack friendly forces.

   (a) Friendly forces will have difficulty detecting an entrenched or static enemy with an understanding of air observation techniques, prior to an enemy attack.
   (b) Planners should expect surprise attacks in urban areas from a dedicated enemy.

   - Focus not only on the preplanned CAS, but on a real-time response to enemy engagements of friendly forces.
   - US forces should look at the best way to shorten the CAS timeline.
   - Plan to employ the Army’s close combat attack tactics, techniques, and procedures (TTP) in response to surprise attacks.
   - Expect close-in, “danger close” engagements as the rule.
   (c) Focus on methods of determining and tracking friendly positions in fluid operations as the situation progresses.
   (d) Simplify position reporting between ground and air forces. Place all players, air and ground, on the same page with respect to any coded reference systems.
   (e) Establish TTP that allow combined air and ground forces to quickly locate, identify, and correlate new enemy locations as they arise.
(6) Surface-to-air Threat. Urban operations provide the enemy with unique options for surface-to-air attack on friendly aircraft, and a very complex threat picture for friendly forces.

(a) The enemy may employ light-to-medium, antiaircraft artillery (AAA) from:
- Ground sites.
- Tops of buildings.
- In or near otherwise protected structures (attack prohibited by ROE).
- Mounted on civilian vehicles.

(b) Antiarmor rockets, such as rocket-propelled grenades, are readily available, inexpensive, and normally standard equipment at the small unit level, even in irregular forces. They are unguided, have effective ranges of less than 500 meters (m), and are a significant threat to rotary-wing aircraft.

(c) Small arms and machine guns can also become significant threats in an urban environment. Generally, 5.56- and 7.62-milimeter rifles are effective up to 500 m. The 7.62-milimeter machine guns, and sniper rifles of similar caliber, are effective up to 1,000 m; and .50-caliber/12.7-milimeter machine guns and sniper rifles are effective up to 2,000 m. The enemy may place these weapons on the upper floors of buildings to fire down on rotary-wing aircraft. During night operations, the enemy may not have night vision devices (NVDs) to visually acquire low flying aircraft resulting, in audible targeting. If tracer fire is present, aircrews should evaluate the effectiveness of the small arms fire and adjust their flight route accordingly.

(d) A man-portable air defense system (MANPADS), with its small size, light weight, rapid engagement capability, and ease of concealment, is an excellent weapon for operating in proximity to, or on top of, buildings and other structures.

(e) Heavy AAA and surface-to-air missiles (SAMs) require open terrain due to radar or aiming requirements, but this does not prevent their employment within urban boundaries.

(f) Obstructions and airspace restrictions over urban areas may limit low-altitude aircraft defensive maneuvering options while providing the enemy excellent opportunities for establishing ambush sites. The reduced maneuverability of low flying aircraft also increases the aircraft’s vulnerability to tanks, armored personnel carriers and antitank guided missiles (ATGMs). Modern fire control systems permit effective aircraft engagement by tanks and armored personnel carriers with their main gun or cannon. Most ATGMs have an effective range of between 3,000 and 5,000 m and can engage helicopters in the same way they engage ground targets.

(g) Planners should account for these variables and consider all available intelligence when constructing mission profiles.
(7) Other Threats.
   (a) The cluttered environment (e.g., lights, fires, smoke, dust, marking lasers, etc.) may make identification of missile launches or ground fire difficult.
   (b) Aircrews and planners also should consider the effects of fixation, task saturation, and visual confusion.
   (c) Missions employing rotary-wing aircraft also should consider ground threats such as artillery, and mortars.

(8) Planners should expand their view of what constitutes a threat to aviation operations in the urban environment. Detailed analysis of flight hazards during mission planning is critical to safe flight operations and mission accomplishment in urban terrain. Bright urban lighting may make many unlit hazards difficult to discern. Several types of flight hazards exist:
   (a) Physical Hazards. The majority of physical hazards within an urban area are manmade. These include antennas, wires, power lines, tube-launched, optically tracked, wire guided (TOW) missile wires, and other obstructions (e.g., trash/debris).
   (b) Environmental Hazards. These include meteorological effects, extremes in artificial illumination, and unpredictable wind effects.
   (c) Natural Hazards. These include mountains, hills, tall trees, and areas of high bird concentration.
   (d) Air Traffic Hazards. A high volume of air traffic over and within urban areas is another significant hazard (including rotary-wing, fixed-wing, and UAS aircraft).
   (e) Electromagnetic Hazards. High-intensity radio transmission areas (HIRTA) may adversely affect aircraft communication, navigation, and electrical systems. Planners should review the location and effects of known and suspected HIRTA sites. Electromagnetic hazards also include the enemy’s use of GPS jammers and spectrum fratricide from friendly jammers.

b. Urban terrain is categorized into four basic dimensions; airspace, super-surface, surface, and subsurface as illustrated in figure 1. All aspects of urban terrain require careful analysis during mission planning.
Figure 1. Urban Terrain

(1) Airspace. Expect increased airspace usage in urban environments to include civilian air traffic operating under the host nation’s air traffic control system. Planners should identify the potential for commercial traffic and deconflict their air operations accordingly.

(2) Super-surface. Areas above ground level that consist of manmade structures such as buildings, towers, power lines, etc., as well as natural features (hills, mountains, etc.). The enemy can also use these areas for cover and concealment, movement, and fighting positions. They also provide excellent field of view for antiaircraft defenses and can restrict friendly observation, communication, and weapons employment.
   (a) Super-surface structures can block radio transmission and video downlink. Ground personnel, including joint terminal attack controllers (JTACs), must understand how super-surface structures will affect communications based on assigned aircraft holding positions.
   (b) Super-surface structures can create urban canyons, and cause weapons delivery restrictions and podium effect for lasers designators.
   (c) Depending on the super-surfaces’ heights, they also can limit aircraft maneuverability and air-to-ground approach vectors.

(3) Surface. The surface area is everything at ground level, including streets, alleys, open lots, and parks. These areas provide ground forces mobility through the urban area.

(4) Subsurface Areas. These are areas below ground level that consist of sewer and drainage systems, subway tunnels, utility corridors, basements, bunkers or
other subterranean spaces. The enemy can use these areas for cover and concealment and movement, but use requires intimate knowledge of the area.

(a) Underground targets require careful weapon consideration.
(b) Planners should consider penetration weapons, where appropriate.
(c) Ground forces identifying entrances and exits to underground sites will allow air assets to destroy these and effectively remove them as potential threats to ground forces or useable sanctuaries for enemy forces.

c. Population.

(1) The primary differences between urban areas and other environments are the large numbers and density of noncombatants.
(2) Noncombatants are further characterized by:
   (a) Neighborhoods and their make-up.
   (b) Demographics (i.e., ethnicity, race, age, etc.).
   (c) Daily movement in and around the city (i.e., patterns of life).
(3) Understanding the population of an urban area requires knowledge of its size, location, density, and composition. Analysts may examine these elements in terms of the city as a whole; but complete understanding will only come by examining those same elements for each geographical area and each demographic group within the urban area.

d. Infrastructure.

(1) Urban infrastructures are those systems that support the urban inhabitants and their economy. They link the physical terrain to the urban society.
(2) Destroying, controlling, or protecting vital parts of the infrastructure can isolate a threat from potential sources of support. However, commanders should understand damaging or disrupting any portion of the urban infrastructure can have cascading effects and unintended consequences, particularly toward the urban inhabitants.
(3) To understand the complexity of the urban area’s infrastructure will require the expertise of engineer and civil affairs units, local urban engineers and planners, and others with infrastructure-specific expertise.
(4) Only after understanding the technical aspects of the area’s systems can commanders and planners develop the best course of action that considers potential second- and third-order effects.

e. Pre-mission briefing. Prior to each mission, planners should brief and update the aircrews with the most current intelligence estimates discussed in this section. The brief should also include friendly force updates.

5. Command, Control, and Communications Considerations

a. Commander’s Intent.

(1) In the complex urban environment, structures may restrict LOS communication systems causing increased reliance on decentralized execution.
(2) A clear understanding of the commander’s intent is imperative for all operations.
(3) The ground or special operations commander is normally the supported commander for urban operations.

b. Command and Control (C2) Planning.
   (1) A detailed, flexible, and redundant C2 plan is essential.
   (2) Vertical structures blocking LOS can severely affect radio communications.
   (3) Airborne C2 support systems, rooftop retransmission systems, radios utilizing high-power transmissions, and remote antennas may overcome some of the transmissions problems.
   (4) Airborne C2 platforms have unique capabilities that make them desirable for operations in urban environments.

c. Air Asset Deconfliction.
   (1) Airborne C2 platforms are the primary resources for air asset deconfliction above the established coordinating altitude. Lower altitude aircraft primarily rely on procedural controls.
   (2) Asset deconfliction en route to and from the objective area is critical in all situations, but especially where C2 assets are unavailable or unable to communicate. In those cases, procedural control measures are required for deconfliction of air operations (i.e., fixed-wing, rotary-wing, UAS, etc.).
   (3) Aircrews should establish communications with ground maneuver elements as soon as possible en route to the objective.

d. Frequency Management.
   (1) Determine net information for all participating and supporting elements prior to execution.
   (2) For situations in which multiple terminal attack controllers could control multiple flights of aircraft in a confined area, planners should consider utilizing separate tactical air direction nets for each target area. A separate common frequency for threat warning/aircraft deconfliction is recommended in this case.
   (3) Urban areas may reduce radio frequency availability for airborne platforms due to preexisting public safety and commercial aviation spectrum usage.
   (4) Subordinate commands should deconflict all radio frequency assignments and requirements with the higher level regional or area frequency managers.

e. Congested Airspace.
   (1) A dense three-dimensional urban environment can lead to challenges in planning and airspace coordination. Planners should integrate, deconflict, and coordinate fixed-wing, rotary-wing, UAS, and ground fires into the ground scheme of maneuver; complementing the overall objectives and commander’s intent. Planning and execution become difficult given the enemy’s proximity to friendly forces, protected sites, and noncombatants. For example, a ground unit may request an air medical evacuation (MEDEVAC) and CAS simultaneously resulting in multiple aircraft working the same airspace.
(2) Synchronize airspace priorities that account for day to day changes in scheme of maneuver to enable the right effect at the right time.
(3) Only allocate the minimum airspace for the mission to maximize the number of missions possible.

Note: Planners should understand allocating the minimum airspace may hinder tactical execution and threat reaction options. This is an important planning consideration in a congested, urban area airspace.

f. Control Measures.

(1) Planners should develop control measures to eliminate airspace conflicts.
(2) These measures must consider ongoing host nation civil/military and foreign military airspace requirements, as well as UAS, special operations forces (SOF), and other government agency/nongovernmental organization operations.
(3) Establish boundaries for participating and non-participating aircraft operating in the area of operations.
(4) The joint air tasking order (ATO)/airspace control order (ACO) aids deconfliction and synchronization of aviation assets which may include multinational air assets.
(5) Due to the potential for high volumes of air traffic over urban areas, the use of a forward air controller (airborne) (FAC(A)) or tactical air coordinator (airborne) (TAC(A)) will facilitate the JTAC’s employment of aircraft in the objective area.
(6) Operation centers and aircrews should maintain a heightened awareness of other missions operating in and throughout the general area.
(7) Avoid using “See and Avoid” as a deconfliction measure. Visual detection is difficult in the urban environment due to city lights, mixing of aircrews using NVDs and forward-looking infrared (FLIR), and the presence of UASs.
(8) Planners, ground personnel, and JTACs need to understand the visual limits of sensors as aircraft orbit or hold (blocked by terrain or manmade structures). JTACs should choose holding points accordingly.
(9) Planners should develop procedures for aircraft to alert friendly ground forces of impending danger (as they provide armed overwatch) in possible communications-out situations. This may include the use of visible aircraft flares to mark the danger source.

6. Environmental/Night Considerations

Environmental Concerns. Environmental concerns can include weather, lighting conditions, infrared (IR) scene, visibility, thermal reflection, and smoke/fog. For a detailed discussion of these conditions refer to Joint Publication (JP) 3-09.3, Close Air Support (CAS).

a. Weather. Weather conditions affect different aircraft and weapons systems differently. Adverse weather may hinder employing utility and strike aircraft, UASs, radar, FLIR, laser, IR/optical systems, and NVDs. Although inertial navigation system/GPS-aided munitions are not affected by weather conditions, weather
conditions can complicate precise targeting for CD and other considerations. See JP 3-09.3, *Close Air Support*, for weather effects on CAS.

1. Ceilings.
   a. Low ceilings can obscure high-rise rooftops and other obstructions, such as power lines, towers, and smokestacks.
   b. Low ceilings can deny aircraft the required time and altitude to obtain satisfactory ordnance delivery and fragmentation avoidance.
   c. Artificial lighting with a low, overcast cloud condition may highlight aircraft to ground observers and adversely affect NVD performance.

2. Visibility. Reduction in visibility due to smog, smoke, rain, fog, or dust can significantly degrade aircraft and weapons sensors and laser or optically guided munitions performance.

3. Winds.
   a. In urban areas, the city structure affects wind patterns.
   b. High winds in an urban area may adversely affect low-altitude, unguided weapons delivery accuracy because wind patterns are “broken up” and funneled down streets and alleys.

4. Temperatures.
   a. Urban temperatures are generally higher than those in rural areas and can reach 5 to 8 degrees Celsius higher than the surrounding environment.
   b. IR signatures are affected by the proximity of other structures due to shadowing and winds.
   c. Planners may have difficulty determining thermal crossover in urban areas due to shadowing effects of structures, differing wind patterns, and the types of materials (e.g., asphalt, concrete, etc.) making up the background.

b. NVD.

1. When planning for, and employing NVDs, aircrews and JTACs should pay careful attention to the location and intensity of urban lights, the moon’s angle and illumination along the flight route and in the objective area.

2. Night imagery of the area is an important tool for effective analysis and mission planning. Prepare a detailed analysis of the area to determine when and where to use NVDs.

3. Aircrews should prepare to make frequent and rapid transitions from aided to unaided flight at night over urban terrain.

   a. Night vision goggles (NVGs) and FLIR/integrated display system (IDS) are adversely affected by the composition and surface conditions of urban terrain.
   b. Unlike rural areas, the urban environment consists primarily of manmade objects with little consistency in the thermal/visual scene.
   c. The volume and irregular patterns of ground lights may washout NVGs, decreasing their effectiveness.
(d) The FLIR/IDS is an identification aid for terrain features and hazards in brightly lit, night urban environments since it is not susceptible to blooming effects from overt lighting.
(e) Both air and ground forces can navigate cities without NVDs, but discerning detail in darkened areas or shadows may require image intensifiers or IR sensors.
(f) Relatively dark areas, such as city parks, are readily identified and make good navigation references at night.

7. Law of Armed Conflict (LOAC)/Collateral Damage (CD)

a. Law of Armed Conflict.

(1) The LOAC, also known as the law of war, constitutes a portion of international law regulating conduct of armed hostilities. The primary purpose of LOAC is to protect civilian populations and limit civilian casualties. Additional information on the LOAC is available in Chapter II, JP 1-04, Legal Support to Military Operations.

(2) As policy, US forces will abide by the LOAC in all military operations; including the unique challenges presented during aviation urban operations.

(3) Leaders are responsible for ensuring their subordinates abide by the LOAC. Commanders may hold subordinate commanders criminally responsible for war crimes committed by personnel within their unit. Commanders and planners should seek the advice of judge advocates at all stages of planning to ensure compliance with LOAC.

(4) The four basic principles of LOAC are:

(a) Distinction. This principle requires combatants to distinguish between combatants and noncombatants, and military objectives and protected property and places. The central idea is to engage military targets; a complicated task in the urban environment.
   • In urban areas, it is difficult to distinguish between military targets and civilian objects. Urban operations require accurate targeting and realistic training to distinguish between military and civilian targets. LOAC attempts to solve this dilemma by requiring defending forces to remove the civilian population from the vicinity of military objectives and not to locate military objectives within or near densely populated areas. Although strictly prohibited by LOAC, defenders may attempt to render military forces and objectives immune from attack by mixing their soldiers among noncombatants and using civilian structures for overt military purposes.
   • A failure by an adversary to adequately safeguard the civilian population does not relieve the commander of the obligation to consider civilian CD and injury. Commanders should use the principle of proportionality (paragraph (b.)) during urban targeting.
• When an enemy uses members of the civilian population as “human shields,” US forces are under no legal obligation to assume responsibility for their safety, or to place US lives at undue risk.

• While US forces may attack lawful targets consistent with the principle of proportionality, the enemy may conduct retaliatory information operations to highlight civilian casualties resulting from their use as human shields. Commanders should pre-plan their information operations prior to commencing urban operations to either deny or counter the enemy’s propaganda efforts.

(b) Proportionality. This principle prohibits attacks expected to cause excessive incidental civilian CD relative to the expected concrete and direct military advantage to be gained. This principle encourages combat forces to minimize CD. In the urban environment, excessive weapons effects can result in disproportionate civilian CD.

(c) Military Necessity. This principle is applied with the other LOAC principles. It justifies those measures not forbidden by international law or otherwise prohibited by the LOAC, that are indispensable for securing rapid victory. In applying military necessity to targeting, the US military may target facilities, equipment, and forces which, if destroyed, would lead as quickly as possible to the enemy’s partial or complete submission.

(d) Unnecessary Suffering. This principle forbids the employment of means and methods of warfare calculated to cause unnecessary suffering. This principle largely applies to the legality of weapons and ammunition.

b. Collateral Damage. CD describes incidental injury or damage to non-combatant personnel or property as a byproduct of an attack on a lawful target. CD is unintentional damage created beyond the primary target/desired mean point of impact. For example, an attack on an enemy fuel truck resulting in the destruction of a nearby civilian structure is considered CD. While this damage is unintended, the resulting images of destroyed homes, damaged religious or cultural buildings, or civilian casualties may have adverse strategic-level consequences. This damage is exacerbated by worldwide media reports and enemy attempts to characterize such damage as unlawful. These media reports and claims may affect strategic decision making and lead to the loss of international and public support.

(1) Commanders and planning staffs should keep these considerations in mind when planning or conducting aviation urban operations.

(2) Commanders can manage these issues through the careful crafting and management of ROE. However, US forces always retain the right and obligation of self-defense and force protection.

(3) All aircrews employing ordnance should record basic information about their actions to assist in CD reporting.

(4) Additional information on collateral damage estimation (CDE) is available in chapter 1 of Army techniques publication (ATP) 3-09.32, Marine Corps reference publication (MCRP) 3-16.6A, Navy tactics, techniques, and procedures (NTTP) 3-09.2, Air Force tactics, techniques, and procedures (instruction) (AFTTP(I)) 3-
2.6, *Multi-Service Tactics, Techniques, and Procedures for the Joint Application of Firepower.*

c. Fratricide Potential/Avoidance.

(1) Close quarters, identification problems, and unintentional secondary weapons effects increase the potential for fratricide during urban operations. Preventing fratricide without overly restricting the friendly force’s ability to accomplish the mission is challenging. Fratricide prevention requires accurate information pertaining to the location of friendly, neutral, and hostile personnel facilitated through training, doctrine, TTP, C2, and sensor employment before engaging targets.

(2) Aircrews should ensure identification friend or foe (IFF) and aircraft survivability equipment (ASE) are working, and know the purpose and demarcation lines for IFF and ASE employment.

(3) Commanders, aircrews, and ground personnel should select the proper weapon system to produce the desired effect while minimizing CD.

(4) Forces involved in urban operations should understand the limitations of Blue Force Tracking devices; specifically the reliability of friendly and target position marks. Further, not all marking devices are compatible with all friendly aviation assets and other weapons systems due to equipment compatibility, onboard system interference, training, familiarity, and limitations on time, frequency, and slant range corresponding to contrast and apparent size (angular subtense). The introduction of any new element into urban combat operations (e.g., inexperienced ground or air elements, untried markings or acquisition systems, conversion of coordinates) adds risks. When more than one new feature is introduced, risks grow exponentially. The most critical element in preventing fratricide is organized, clear, and effective communication among elements working in a common operational environment.

(5) Aircrews employing aerial weapons should always obtain positive identification (PID) of the target before engagement. When possible, utilize a secondary means of PID to prevent fratricide.

d. Rules of Engagement.

(1) Because aviation urban operations normally pose a high risk of civilian CD and fratricide, commanders should carefully craft operation-specific ROE to allow flexibility fulfilling the mission while limiting the danger to noncombatants and friendly forces. Commanders should consult their servicing staff judge advocate when writing their ROE.

(2) Commanders may further mitigate risks to noncombatants by:

(a) Ensuring appropriate weapon selection.

(b) Moving noncombatants to a safer location, if possible.

(c) Providing thorough training in urban tactics.
8. Operational Planning Products

a. General Considerations. Consider all types of geospatial products ranging from paper tourist maps and charts to digital mapping databases including commercial and government products.

(1) Maps with a large scale (1:50,000, 1:24,000 or 1:12,500) provide greater detail for urban mission planning and execution.

(2) Numerous large-scale maps exist to assist aircrews. Gridded image products are excellent substitutes and, in many cases, preferable to maps for planning and conducting urban operations.

(3) Due to the dynamics of urban growth, current maps and photographs are not always available. In the absence of these materials, detailed reconnaissance is required to minimize risk.

WARNING

Check the reference system used to prepare a map or chart (i.e., World Geodetic System 1984 (WGS-84) – the current joint standard, Tokyo Special, etc.) Different datum can cause significant confusion, errors, and fratricide.

Note: Planners should ensure operational planning products are useful to all members of the operation and reference points are discernible from both the ground and air perspectives. Once developed, the publishing headquarters should disseminate the products to all units; including their higher headquarters.

b. Geospatial Products.

(1) Units should maintain accurate and current geospatial products for their operational area and continuously update them as new features (i.e., manmade, control measures, and hazards) are identified. This is a shared responsibility for aircrews, intelligence personnel, and operations sections. For example, the intelligence staff may have the only source of hazard information, but they require aircrews’ input to produce relevant aviation maps and charts before mission execution.

(2) Other hazard sources include the National Geospatial-Information Agency and the airspace authority that publishes known flight hazards, such as the notices to airmen (NOTAM).

c. Air-to-Ground Coordination Products.

It is critical for commanders to establish a common standard for geographic and other essential references.

(1) Common graphics should be easy to reference and use (overlays, pictures, urban grid, and target reference points (TRPs)).
(2) The controlling headquarters should distribute common graphics to all units prior to the operation.

(3) Attack control personnel should reduce the possibility of attack aircraft target location translation errors by:
   (a) Converting x, y, and z axis coordinates of preselected targets and reference points to the formats used by each attack platform.
   (b) Confirming the accuracy of the coordinates with targeting personnel.

(4) Figure 2 depicts an example of ground unit control measures. Establishing objectives and phase lines assists in understanding the ground scheme of maneuver and is one method to integrate air and ground operations to reduce the risk of fratricide. See chapter IV for details on urban grids and reference techniques.
Figure 2. Ground Unit Control Measures

Note: Urban grids are not necessarily the same as the traditional grid system. Grid lines may follow significant and/or unique references such as roadways, rivers, and significant terrain features to facilitate identification from the ground and air.
9. Route Planning and Navigation

a. Planning Factors. Appropriate flight profile and route selection are perhaps the most difficult planning factors.

   (1) Use a dynamic flight profile; it offers the best survivability in an urban environment.
   (2) Fly at medium to high airspeeds to decrease exposure.
   (3) Plan routes and altitudes to consider known threats, and exploit environmental factors (such as wind direction, moon/sun angle and azimuth, and urban noise).

b. Low-Level Route Planning.

   (1) Planners should create a network of standard flight routes to facilitate route planning, navigation, and C2 similar to the example in figure 3.

![Figure 3. Network Route Structure](image-url)
(2) Air control points (ACPs) are especially useful for aircraft navigation systems that require visual updates. Use vertical and linear references to distinguish ACPs. Easily recognizable features include cemeteries, stadiums, cathedrals, radio towers, tall buildings, major roads, and prominent rail and highway interchanges. Highways, rivers, railways, canals, and coastlines provide easily recognizable boundaries to maintain orientation.

(3) Consider small arms, AAA, MANPADS, rocket-propelled grenades (RPG), SAM weapon ranges and communication limitations when creating routes and flight profiles.

(4) Create routes utilizing sequences of ACPs and assign code words to facilitate operational security, control, and route changes in flight. For example, ACP sequence 1, 2, and 3 is route “BROADWAY”; ACPs 7, 8, and 9 are route “WALLSTREET,” and ACPs 10 and 11 are route “BOURBON.”

(a) Low-level aircraft utilizing routes are generally not under positive control and require procedural airspace deconfliction measures. Common methods include one-way routes and ACP calls on a common traffic advisory frequency (CTAF).

(b) There are two methods to create routes and name ACPs. Each has advantages and disadvantages depending on the operational environment.

- Random numbering. Number ACPs on each route randomly. This is advantageous for operational security if the ATO special instructions require CTAF calls on unsecured frequencies. The disadvantage to this method includes increased pilot workload to maintain situational awareness.

- Sequential numbering. Number ACPs on each route sequentially and in a consistent direction (e.g., ACPs count up from west to east.) This is advantageous to reduce pilot workload in congested urban airspace because it allows the pilot to determine the location and direction of travel of other aircraft on the route structure without referencing a map. For example, a pilot at ACP 2 traveling east on route BROADWAY hears a CTAF call “YANKEE 24 at BROADWAY 1 for BROADWAY 2.” The pilot automatically knows YANKEE 24 is on the same route traveling in the same direction behind his aircraft. This is disadvantageous for operational security as it may reveal the location of ACPs and established routes.

(5) Clearly define and verify (with aircrews if possible) the initial point (IP) prior to commencing operations to ensure the IP data and aircraft systems are correct and reliable.

(6) Create TRPs to facilitate target identification (ID).

(7) Publish all IPs, ACPs, routes and TRPs in applicable plans and orders.

(8) Coordinate/deconflict routes with friendly ground forces.
(9) Avoid route predictability, although congested airspace may force repeated use of ACPs and flight profiles. Habitually flying routes from one obvious feature to the next, or along lines of communication (LOCs), is strongly discouraged in the presence of enemy forces or potentially hostile civilians.

(10) Plan and vary routes, times, battle positions, airspace coordination areas, holding areas, rally procedures, and orbits over terrain that do not expose aircraft to threats.

(11) Track ACP use frequency to better control route overuse. Historical Blue Force Tracker data can facilitate tracking.

(12) Periodically change route and ACP names.
Chapter III
URBAN AVIATION MISSIONS

1. Introduction

Aircraft perform the same missions in urban environments as in other, less restrictive areas. The primary difference is the aircraft’s effectiveness in the urban environment. It is important for ground commanders, planners and aircrews to understand the capabilities and limitations of various aircraft in their mission roles to optimize performance and effectiveness.

2. Fixed Wing Missions

a. Close Air Support (CAS). CAS is air action by fixed- and rotary-wing aircraft against hostile targets that are in proximity to friendly forces, and requires detailed integration of each air mission with the fire and movement of those forces.

   (1) Capabilities. CAS provides fires in offensive and defensive operations to destroy, disrupt, suppress, fix, harass, neutralize, or delay enemy forces. Platforms used include AV-8B, A-10, B-1, B-52, F-15, F-16, F/A-18, and AC-130. (See appendix B for specific C-130 employment techniques in the urban environment.) Centralized control, decentralized execution is critical; however, personnel at all levels should prepare to assist in mission execution. If close or detailed integration with the fire and maneuver of ground forces in proximity to the target is required, aircrews should conduct the mission as a CAS mission.

   (2) Specific Urban Considerations.

      (a) The authority and responsibility for the expenditure of any ordnance on the battlefield rests with the supported commander.

      (b) The supported commander should delegate weapons release clearance authority to the JTACs to facilitate CAS attacks.

      (c) Once in the target area, terminal procedures are governed by airspace limitations, target area threats, location of friendly forces/civilians, onboard sensors, weapon activity, CDE, and target geometry.

      (d) The concentration of ground units is greater in urban areas; increasing demand for air support in limited airspace. This may limit CAS availability and CAS aircraft maneuver space.

   (3) Mitigation and Employment Techniques.

      (a) Targeting. Many aircraft are capable of transmitting full motion video via targeting pods to remotely operated video enhanced receiver (ROVER), remote receiver station, and movement report systems.

      (b) Controllers. Controllers should provide the largest available airspace block for CAS aircraft to maneuver and maintain aircraft deconfliction while balancing the need to support multiple CAS engagements in the urban environment.

      (c) Risk-Estimate Distances. See ATP 3-09.32, MCRP 3-16.6A, NTTP 3-09.2, AFTTP(I) 3-2.6, Multi-Service Tactics, Techniques, and Procedures for the Joint Application of Firepower for a detailed discussion.
b. Air-Land Operations. Air-land delivery occurs when a transport or tanker aircraft lands and unloads its cargo. Air-land delivery, as opposed to airdrop, is the preferred method of aerial delivery when conditions permit, because it is the most efficient, safest, and least expensive way to deliver personnel and cargo.

(1) Capabilities. Air-land operations are conducted to reposition units, personnel, supplies, equipment, and other critical combat elements in support of current and/or future operations. These operations are usually accomplished by C-5, C-17, C-130, C-23, and C-27 aircraft.

(2) Specific Urban Considerations.
   (a) Air-land off-loading minimizes the risk of injury to personnel and damage to equipment.
   (b) Airlift and rotary-wing operations at common-use airfields require careful coordination to ensure lighting and traffic patterns do not compromise safety or tactical viability.
   (c) Extended air-land operations require secure, suitable, and conveniently located airfields with appropriate air mobility support assets to facilitate offload.
   (d) Depending on the nature of the urban conflict, common-use airfields may also support commercial air traffic operating outside the control of friendly forces.
   (e) Aircraft are most vulnerable during approach and departure due to low altitude/airspeed, predictability and lack of maneuverability.
   (f) Structures on approach and departure are good attack positions.
   (g) Air-land operations are relatively inefficient means to transport heavy supplies and equipment. Planners should reserve air-land operations for supporting major operations in which air movement is essential for success or in situations where emergency resupply is vital for mission accomplishment.

(3) Mitigation and Employment Techniques.
   (a) Planners should consider identified or suspected threats when planning approaches and departures at airfields.
   (b) Secure key terrain surrounding airfield approach corridors with ground forces or attack rotary-wing assets.

c. Air Drop Operations. This is unloading personnel or materiel from aircraft in flight. Air drop operations are usually accomplished by C-17, C-130, and C-27 aircraft.

(1) Capabilities. Airdrop allows commanders to project and sustain combat power into areas where a suitable helicopter landing zone (HLZ) or a ground transportation network may not be available. This delivery method allows rapid insertion of combat forces to numerous target areas. Most airdrop procedures use parachutes to deliver loads to the ground (i.e., heavy equipment, container delivery systems, and personnel). The alternative procedure is free fall delivery which involves dropping relatively small, unbreakable items without using a parachute.
(2) Specific Urban Considerations.
   (a) Formation airdrop operations increase mass on target and shorten the
time required to secure DZs.
   (b) Urban areas may not allow the use of large formations due to confined
airspace, obstacle altitudes, and the requirement for verbally initiated release
system drops.
   (c) Commanders may conduct airdrop missions in conjunction with
humanitarian and disaster-relief efforts in or near urban environments.
   (d) Direct airdrop support of ground forces operating in urban areas will
require precise navigation and considerable pre-mission planning or
coordination.

(3) Mitigation and Employment Techniques.
   (a) Urban limitations drive planners to use multiple small formations or
single-ship operations.
   (b) Close coordination concerning DZ lighting, markings, and drop criteria
are critical to safe employment.
   (c) Using multi-sensor, GPS-integrated navigation permits airdrop without
visual or verbal cues if joint planning is sufficient to meet a safe threshold.
   (d) Survivable aircraft using night-vision equipment and reliable threat
intelligence can operate in urban areas in relatively large formations without
undue tactical risk.
   (e) Operational aircraft defensive system technologies will further reduce the
risk.
   (f) ATP 3-09.32, MCRP 3-16.6A, NTTP 3-09.2, AFTTP(I) 3-2.6, Multi-
Service Tactics, Techniques, and Procedures for the Joint Application of
Firepower contains additional TTPs for airdrop operations.

d. Intelligence Surveillance and Reconnaissance (ISR). ISR is any activity that
synchronizes and integrates the planning and operation of sensors, assets, and
processing, exploiting, and dissemination systems in direct support of current and
future operations. These operations are usually accomplished by U-2, C-12 with
aerial reconnaissance multi-sensor (ARMS) or medium altitude reconnaissance and
surveillance system (MARSS-II), and C-23 Constant Hawk. UAS aircraft and lighter-
than-air systems are discussed in the following paragraphs.

   (1) Capabilities. ISR aircraft possess robust data collection capabilities, including
electro-optical (EO) and IR cameras, synthetic aperture radar, and other
specialized sensors. Obtained data is normally routed to distributed common
ground station locations for processing, analysis, and exploitation. The aircraft
can also transmit data directly to the tactical user when required. Specially
equipped aircraft sensors also can use lasers to designate targets for attack
aircraft allowing the assets to operate as hunter-killer teams.
   (2) Specific Urban Considerations.
      (a) ISR missions are usually requested/scheduled days in advance of
execution. The urban environment is very fluid and, by mission execution, the
commander may no longer require the ISR aircraft to collect data as originally requested.

(b) Urban environments contain significant clutter which increases the time required to process information and produce intelligence. Due to the changing ground conditions, any time-lag between collection and dissemination may invalidate the intelligence.

(c) Increased urban ground noise may allow ISR aircraft to fly at lower altitudes without detection, increasing sensor effectiveness.

(3) Mitigation and Employment Techniques.

(a) The MC-12 is very effective in urban environments. It provides the direct communication between the aircrew and ground commander, allowing the commander to adjust collection near instantaneously.

(b) The MC-12 also has a direct link to an intelligence analyst that conducts real-time analysis for the ground commander. This quick analysis helps reduce fratricide potential and CD. It also expedites the find, fix, track, target, engage, and assess kill chain.

(c) The pilot in a manned ISR aircraft can assist in data collection by preemptively updating the aircraft’s flight route or orbit to maintain LOS contact with a target. The piloted ISR aircraft has an excellent advantage over UASs in the urban environment. Their additional situational awareness of their environment, and vantage point, can significantly influence mission success.

(d) ISR aircrews should contact the supported unit prior to departure to gather last minute changes to the mission.

e. Tactical Show of Force (SoF). A tactical SoF is a non-kinetic operation designed to demonstrate friendly forces’ resolve. A SoF involves increased visibility of CAS aircraft in an attempt to defuse a specific situation which, if allowed to continue, may be detrimental to friendly forces, interests, or objectives.

(1) Capabilities. Although CAS aircraft executing a SoF will produce dramatic effects, any aircraft flown at an altitude and airspeed outside its normal operating profile will effect ground observers. This may include high speed, low-altitude passes of attack aircraft.

(2) Specific Urban Considerations.

(a) Planners should consider airspace and fires coordination prior to conducting a SoF.

(b) If the commander’s desired effects are not achieved when the SoF is executed, weigh additional SoF against kinetic options and additional aircraft exposure events.

(c) SoF over-employment will lead to diminished effects; particularly if not occasionally accompanied with some form of kinetic action.

(3) Mitigation and Employment Techniques.

(a) Vary ingress and egress directions for follow-on SoF missions to increase aircraft survivability.
(b) Sparingly use SoF flights to maintain the desired effects without desensitizing the intended population.

c) Refer to ATP 3-09.32, MCRP 3-16.6A, NTTP 3-09.2, AFTTP(I) 3-2.6, *Multi-Service Tactics, Techniques, and Procedures for the Joint Application of Firepower* for additional SoF TTPs.

3. Rotary-Wing Missions

a. Close Combat Attack (CCA) (Army). Rotary wing CCA is a hasty or deliberate attack by Army aircraft providing air-to-ground fires for friendly units engaged in close combat. Due to the proximity of friendly forces, detailed integration is required. These operations are usually accomplished by AH-64 and OH-58 aircraft.

(1) Capabilities. CCA is used to support guard missions, area security operations, convoy security, and troops-in-contact. CCA quickly focuses aerial firepower onto enemy forces in the close fight to support friendly ground maneuver.

(2) Specific Urban Considerations.

(a) The OH-58D lacks a multidirectional suppressive weapon system. If AH-64s are available, utilize the OH-58D for supporting fires rather than direct fires, in CCA operations in urban terrain.

(b) To achieve the desired effects and reduce the risk of fratricide, air-ground integration should take place at company, platoon, and team levels.

(c) Attack rotary-wing aircraft should standoff to the extent possible to engage targets in urban areas. LOS restrictions will require the aircraft to operate well inside its maximum effective range.

(d) Overflight and engagement of targets within urban areas may require night operations and special preparation due to possible enemy direct fire at very close range.

(3) Mitigation and Employment Techniques.

(a) CCA fire missions are requested using a standard Army 5-line CCA brief found in ATP 3-09.32, MCRP 3-16.6A, NTTP 3-09.2, AFTTP(I) 3-2.6, *Multi-Service Tactics, Techniques, and Procedures for the Joint Application of Firepower*.

(b) Running and diving fire TTP are the preferred engagement techniques.

(c) The attack air mission commander should consider their aircrew’s skills and select weapons to produce the desired effect while minimizing CD and maximizing standoff.

(d) Aircrews should avoid hovering in urban areas due to small arms threats. Only hover if it is essential to the mission and adequate over watch fires are available.

(e) Ground commanders should include the civilians presence information in their initial 5-line CCA brief.

(f) The transmission of the 5-line CCA request is the aircraft’s clearance to fire unless the ground unit specifies danger close. For danger close engagements, the ground observer must accept responsibility for increased
risk and state, “Cleared Danger Close” (with the ground commander’s initials), on line 5. The observer may also utilize positive control of the attacking aircraft by stating, “At My Command,” on line 5. The aircraft will respond with, “Ready to Fire,” when ready.

b. CAS (US Marine Corps (USMC)). The USMC employs rotary-wing aircraft to perform CAS missions as described above in paragraph 2.a., ATP 3-09.32, MCRP 3-16.6A, NTTP 3-09.2, AFTTP(I) 3-2.6, Multi-Service Tactics, Techniques, and Procedures for the Joint Application of Firepower, and JP 3-09.3, Close Air Support.

c. Air Assault. Air assault operations move friendly assault forces (i.e., combat, combat support, and combat service support) using the firepower, mobility, and total integration of rotary-wing aircraft to engage and destroy enemy forces, or to seize and hold key terrain. These operations are usually accomplished by AH-64, AH-1, OH-58D, UH-60, UH-1, V-22, CH-46, CH-47 and CH-53 aircraft.

(1) Capabilities. Air assaults allow friendly forces to strike over extended distances and terrain barriers to attack the enemy when and where it is most vulnerable.

(2) Specific Urban Considerations.
   (a) Air assault operations are deliberately and precisely planned combat operations.
   (b) Urban environments have limited options for HLZ/pickup zone (PZ) selection. This will limit the ground commander’s ability to place mass on the objective. Commanders should also assume all suitable HLZs within urban areas are known to the enemy and aircraft are vulnerable to precise, indirect fire during the landing phase.
   (c) Suppression of enemy air defenses (SEAD) is often required for successful air assault operations; however, employment in urban areas has CD implications.
   (d) The flight distances involved may require all or some of the rotary-wing aircraft to refuel en route, driving the requirement to establish a forward arming and refueling point (FARP).

(3) Mitigation and Employment Techniques.
   (a) Develop a ground tactical plan that utilizes HLZs away from the urban area objective. Assault forces should arrive at the HLZ as a tactical unit ready to rapidly advance toward the objective.
   (b) Minimize exposure to small arms threats by conducting night operations.
   (c) Plan to execute three days of condition setting operations to reduce overall risk. Operations may include intelligence gathering, target detection and engagement, and information operations.

d. Air Movement. Air movement operations involve the use of rotary-wing aircraft to move troops, equipment, and supplies. The same planning sequence and phases used for air assault operations apply to air movement operations. In these operations, aircraft are not necessarily task-organized with other members of the
combined arms team. These operations are usually accomplished by H-60, UH-1, V-22, CH-46, CH-47 and CH-53 aircraft.

(1) Capabilities.
   (a) Utility and cargo rotary-wing aircraft provide the commander the ability to move time-sensitive, mission-critical personnel and cargo rapidly to sustain continuous offensive and defensive operations.
   (b) Air movement is useful when:
      • Ground routes are nonexistent, limited, congested, damaged, or blocked by enemy activity or obstacles.
      • The supported unit does not have adequate available vehicles.
      • Time is critical.

(2) Specific Urban Considerations.
   (a) Most air movements are centrally planned with decentralized execution.
   (b) Air movement requires extensive pre-coordination with the supported force to ensure loads are properly rigged and placed in the PZ.
   (c) Supported units must avoid loading vehicles, trailers, pallets, and other containers beyond maximum weights pre-coordinated with the supporting aviation unit.
   (d) Air movement operations tend to utilize smaller HLZs throughout the city, such as governmental buildings, culturally significant land marks, and urban parks. Urban man-made structures were not designed to withstand helicopter rotor wash and are susceptible to CD.
   (e) Lift aircraft are a limited resource and commanders should set movement priorities.

(3) Mitigation and Employment Techniques.
   (a) Task organize rotary-wing aviation units to the lowest echelon practical. This provides responsive support to the supported commander while reducing mission request processing.
   (b) Have ground forces secure HLZs when aircraft are scheduled to arrive to protect the aircraft and civilian populace.
   (c) Conduct a detailed HLZ reconnaissance to certify the HLZ is safe for daily aircraft use.

Medical Evacuation (MEDEVAC). MEDEVAC is the timely, efficient movement and en route care by medical personnel of wounded, injured, or ill persons from the battlefield and/or other locations to medical treatment facilities.

(1) Capabilities. MEDEVAC aircraft can immediately respond to a MEDEVAC request and provide critical en route care from as far forward as the point of injury to the medical treatment facility.

(2) Specific Urban Considerations.
   (a) MEDEVAC aircraft are a limited resource. Special planning is required to determine how many aircraft are needed to support friendly forces in the urban environment given the distance to the treatment facility.
(b) Due to the constrained nature of the urban terrain, landing the MEDEVAC aircraft at the point of injury is usually not possible.
(c) Civilian casualties are more likely in the urban setting and commanders may face moral dilemmas to use MEDEVAC assets for civilians.

(3) Mitigation and Employment Techniques.
(a) Prior to commencing operations, identify and publish patient collection and ambulance exchange points within the urban limits. This expedites the ground commander’s decision process to locate the nearest MEDEVAC supportable location.
(b) Clearly define the limits of medical support and care to the civilian populace in the theater engagement policy.

f. Casualty Evacuation (CASEVAC). CASEVAC is the use of standard mission aircraft to move wounded, injured, or ill persons from the battlefield and/or other locations to medical treatment facilities when MEDEVAC assets are unavailable. CASEVAC aircraft and crews do not include medical personnel, are not able to provide en route medical care, and are not protected under the Geneva Convention.

(1) Capabilities.
(a) Utility aircraft may perform CASEVAC as an opportunity lift with no prior designation as a CASEVAC platform or as a dedicated CASEVAC mission.
(b) Utility aircraft are generally not configured to carry litters and require time (and special equipment not usually onboard the aircraft) to accommodate litters. The ground unit must provide litters and tie-down straps if required.
(c) Utility aircraft generally are not equipped with hoist capabilities and require a HLZ.
(d) US Air Force combat search and rescue (CSAR) aircraft and crews can perform the CASEVAC mission with on-board recovery teams and provide critical care from the point of injury to the treatment facility. The CSAR aircraft can also provide forces trained and equipped for self-protection.
(e) CSAR aircraft are configured to operate with or without landing areas in all weather and illumination conditions and may be the most appropriate asset based on mission, enemy, terrain, troops, time, and civil considerations (METT-TC).

(2) Specific Urban Considerations.
(a) Utility aircraft and crews are more available than MEDEVAC aircraft, but crews without medical personnel or knowledge of the specific scheme of maneuver may be a liability to urban operations. Commanders should weigh the expediency of required care with the risk to opportune CASEVAC aircraft and crews.
(b) Dedicated CSAR aircraft are an extremely limited resource. The joint personnel recovery center (JPRC) directs all CSAR missions and rarely dedicates CSAR aircraft for CASEVAC missions in urban areas. The JPRC typically provides CSAR capabilities to the entire area of operations.
Mitigation and Employment Techniques.

(a) When performing CASEVACs, utilize CASEVAC aircraft for the least injured and MEDEVAC aircraft for the most injured people. Medical personnel at the pickup site should assist in determining evacuation priority.

(b) Prior to commencing operations, identify and publish dedicated CASEVAC and CSAR contact information, capabilities, and appropriate signaling techniques.

(c) Utilize appropriate request procedures for dedicated assets (e.g., through the JPRC).

(d) Proactive planning and rehearsals are critical steps to reduce risk when performing CASEVACs. All crewmembers should know the location and capabilities of medical treatment facilities located within their area of operations.

(e) When possible, provide the supporting utility aviation unit with aeromedical personnel to administer treatment while on the aircraft.

(f) Although cargo helicopters such as the CH-47 can carry 24 litter patients, planners should understand it may take up to 45 minutes to load litter patients on the aircraft. If required to use cargo aircraft for CASEVAC missions, recommend using them to transport stable patients between fixed treatment facilities.

Personnel Recovery (PR)/CSAR. PR/CSAR respond to isolated, wounded, injured, or ill personnel at or near the point of injury with forces trained and equipped to provide self-protection from enemy threats and provided, as applicable, with trained supporting aviation assets to provide PR/CSAR aircraft protection. PR/CSAR differs from MEDEVAC and CASEVAC in the ability and focus on prosecuting recovery and medical missions in areas that are separated from friendly control.

1. Capabilities. Dedicated PR/CSAR aircraft are employed in multi-ship elements with applicable air support and are manned with on-board recovery teams providing the ability to provide critical care from the point of isolation and/or injury to friendly control and, if necessary, the medical treatment facility.

2. Specific Urban Considerations.

(a) Opportune PR aircraft may be available. However, untrained crews, without knowledge of the specific friendly and enemy scheme of maneuver, are at high risk of compromise. Commanders should weigh the expediency of returning isolated personnel with the risk to opportune PR aircraft and crews.

(b) Dedicated CSAR aircraft are an extremely limited resource. The JPRC directs all CSAR missions and will respond as appropriate in urban terrain. CSAR involves significant mission planning, however, CSAR crews and aircraft are prepared to immediately respond in a pre-planned operation with alert configurations suitable for all urban areas.


(a) Refer to JP 3-50, Personnel Recovery, chapter VI and appendix B to annex J for more information on employment techniques.
(b) Prior to commencing operations, identify and publish dedicated PR/CSAR contact information, capabilities, and appropriate signaling techniques.
(c) Utilize appropriate request procedures for dedicated assets (e.g., through the JPRC).
(d) Support PR/CSAR operations, per commander’s intent, with additional forces and movements as directed by the appropriate operations center.
(e) Report all potential isolating events through appropriate operations centers with sufficient detail to enable or expedient mission planning.

4. Unmanned Aerial System (UAS) Missions

a. Fixed Wing. UAS missions in the urban environment include ISR, armed surveillance/armed over watch, CAS, CCA (Army), targeting, communication support, and attack, strike and engagement. Although commanders may utilize UAS platforms to perform traditional missions, they must understand the unique challenges and limitations common to UAS missions in the urban environment. For more information on UAS operations and missions, refer to ATTP 3-04.15, MCRP 3-42.1A, NTTP 3-55.14, AFTTP 3-2.64, Multi-Service Tactics, Techniques, and Procedures for Unmanned Aircraft Systems.

(1) Specific Urban Considerations. Operational UASs have matured to multi-role platforms capable of multiple tasks in the urban environment. The wide variety of platforms is constantly evolving, but all UASs generally have the same urban considerations.

(a) UAS mission planners should conduct proper mission planning by considering UAS maneuverability limits and the supported ground commander’s mission and intent. This allows the UAS operators to visualize the mission before execution and increases mission success.
(b) Due to airspace congestion in the urban environment, commanders should prioritize airspace use. These priorities may require UAS aircraft to operate at altitudes and locations not optimal for the UAS sensors and/or weapons.
(c) The vertical nature of urban canyons may interrupt target tracking for orbiting UASs. This affect is more apparent at lower altitudes.
(d) The look-down nature of UAS sensors makes it difficult for UAS operators to dynamically adjust the air vehicle’s flight path to avoid upcoming visual obstructions caused by vertical structures. If the UAS is tracking a specific target, this may cause loss of positive identification (PID).
(e) UASs equipped with Hellfire missiles can engage urban targets with the same accuracy as rotary wing attack aircraft. The MQ-1 and MQ-9 can fire a missile and re-engage a target with a second missile in under two minutes, depending on the aircraft’s relative position to the target. When attacking dismounted troops in the open, those not incapacitated from the first attack will, in most cases, disperse in various directions and disappear in the urban camouflage, reducing re-engagement opportunities.
(f) The real-time sensor video ROVER, or an equivalent system, is useful for commanders to make quick decisions; especially when they are in contact with the enemy. Use caution as the video is raw data and not intelligence. Utilize trained imagery analysts to provide the transition from raw data to intelligence to help the ground commander make decisions.

(2) Mitigation and Employment Techniques.

(a) UAS crews can preemptively plan to see and avoid obstacles through proper mission preparation. Adequate planning and having target developmental awareness on the specified target area are essential to maintain PID and the ability to maneuver the UAS in a timely and efficient manner.

(b) The video downlink capability to transmit sensor video directly to ground parties, specially equipped AC-130s, and JTACs, is highly effective to PID targets for UAS CAS and reduce CD incidents.

(c) The combination of robust sensors for target detection and identification, ability to pass target information to other strike aircraft, ability to assist in target prosecution through laser designation, and real time processing of sensor data for strike assessment have effectively allowed the aircraft to perform as a persistent surrogate targeting pod.

(d) Long loiter and slow speeds permit methodical sensor scans of urban canyons.

(e) Consider the effects of a persistent UAS over the urban environment. Flying at low altitudes will increase the audible signature and detection of the aircraft at street level; this may produce a desired psychological effect on the enemy and civilian population. It may also cause the enemy to hide until the overhead threat is gone; also a possible desired effect. Flying at high altitudes reduce the chance of detection and allow the commander to view the enemy and population that is not influenced by the UAS’ presence.

(f) Due to UAS radio communication limitations (only one radio in many situations), radio transmission delays, and use of tactical chat by ground forces to communicate with UAS operators, manned aircraft can have reduced situational awareness of UAS operations in their vicinity without sufficient prior coordination and control measures.

b. Lighter-than-air. Tethered airships are employed in an ISR and surveillance roles for fixed base locations. These systems provide a persistent presence over the area of operations and carry a variety of sensor packages.

(1) Capabilities.

(a) The Army’s 74K Aerostat System can operate at altitudes up to 4,900 feet (ft). The Air Force has systems that can operate up to 15,000 ft.

(b) Depending on the aerostat, the vehicle can utilize EO sensors for observation or wide area surveillance radars to detect low-flying aircraft.
(2) Specific Urban Considerations.

(a) Aerostats are mobile, but operated from a fixed base. Vertical construction will produce line of sight (LOS) blind spots.

(b) Aerostats with surveillance radars are less effective in the urban environment due to urban clutter. If deployed in the urban environment, these systems are most suitable for detecting flying objects beyond the city limits.

(c) Aerostats are not all weather capable and have significant wind restrictions. Haze and other obscurants can also degrade sensor capabilities.

(d) Aerostats require airspace deconfliction and integration. Although not highly mobile, their employment will affect other aircraft operations.

(e) The visible presence of a persistent aerostat affects the enemy and civilian population. From the enemy perspective, ground personnel cannot determine if they are under observation and this generally acts as a deterrent. The civilian populace may also feel a heightened sense of security when the aerostat is airborne.

(f) When aerostats are operated from an operational airfield, the aircraft approach minimums will vary depending on placement and flight status of the aerostat. This may result in unfavorable restrictions for approaching aircraft.

(3) Mitigation and Employment Techniques.

(a) Aerostats are typically standalone systems and are not organized into units. Commanders should request the system and provide the manpower to operate and maintain it from their force structure. The commander is also responsible for training their operators.

(b) Even if the aerostat sensors are non-functional, fly the aerostat to create the illusion of persistent observation.

(c) Create a direct link between the appropriate weather officer and aerostat operators to rapidly disseminate changing weather conditions and warnings.

(d) Establish a restricted operations zone (ROZ) around the aerostat and publish in the daily ACO and notice to airmen (NOTAM). Expect a minimum 1,000 foot radius ROZ around the aerostat up to the altitude coordinated in the ACO.

(e) Aerostat tether cables are not visible at night or during limited visibility conditions. Operators should ensure a functional, highly visible flashing light is attached to the cable at 50 foot intervals. This is a risk reduction measure to avoid a mid-air collision with low-flying, manned aircraft.
Chapter IV
WEAPON EMPLOYMENT

1. Introduction
Aviation urban operations require extensive intelligence collection and a flexible targeting capability. Weapon selection is very different for urban operations than other environments. Planners and operators should consider military necessity, proportionality, CD, noncombatant casualties, fratricide avoidance, weaponeering, and employment techniques.

2. Weapon Selection
a. The focus of weapons selection is to determine the quantity of specific types of lethal or nonlethal weapons required to achieve a specific level of damage to a target, considering target vulnerability, weapons characteristics and effects, and delivery parameters. Other factors influencing weapons selection are commander’s intent, LOAC, ROE, day or night employment, target type, proximity of buildings, friendly/noncombatant positions (fratricide prevention), and CD restrictions. In the urban environment, weapon accuracy is critical. See appendix A for advantages and disadvantages of different munitions.

b. CD. Minimizing CD protects noncombatants and property, facilitates future operations, and reduces the costs of rebuilding. The presence and proximity of friendly ground forces and the effects of rubble are important considerations in weapons selection.
   (1) It is necessary to carefully select the weapons load to achieve the desired effect.
   (2) Weapons with low explosive yield or delayed fusing with near vertical impact angles resulting in bomb burial, have demonstrated reduced CD.
   (3) The requesting commander should know the type of munitions scheduled for delivery and their residual effects.

c. Considerations. Planners and aircrews should consider the following when choosing weapons:
   (1) Hard, smooth, flat surfaces with 90-degree angles are characteristic of manmade targets. Weapons achieve maximum penetration from a perpendicular impact in all relative directions (i.e., azimuth and elevation).
   (2) Due to aerial delivery parameters, munitions will normally strike a target at an angle of less than 90 degrees and may also have an adverse azimuth angle. This can reduce the effect of munitions and increase the chance of ricochets.
   (3) Non-coordinate dependent, point-and-shoot weapons with low CD will shorten the engagement time necessary to engage fleeting targets.
   (4) Depression and elevation limits create dead space. Tall buildings form deep canyons, often safe from direct fire. Consider target engagement from horizontal and vertical oblique angles.
(5) Destroyed targets in an urban environment will cause varying degrees of debris. Consider the affect this debris will have on friendly and enemy freedom of maneuver.

(6) Smoke, dust, and shadows mask targets; even close-range targets are indistinct. Also, rubble and manmade structures can mask fires.

(7) Urban fighting often involves units attacking on converging routes. Consider the risks from friendly fires, ricochets, and fratricide during the planning of operations.

(8) Continually adjust control measures during operations to reduce risks.

(9) Friendly and enemy ground forces might occupy the same area inside, or around the target building. Consider the effect of the weapon and the position of friendly/enemy personnel with relation to structures.

(10) Attack the manmade structure before attacking the enemy personnel inside. When enemy forces occupy buildings, select weapons based on effects against the building, not enemy personnel.

(11) Consider secondary munitions effects (i.e., burning fires).

3. Tactical Target Development
   a. The urban environment presents a variety of potential targets.
   b. In addition to military targets, the staff and aircrew should train to analyze and positively identify all potential targets, determine if they are suitable for engagement, and select the type and quantity of weapons required to achieve desired effects.
   c. The importance of a tactical target to post-combat operations, (e.g., water well, bridge, airfield), might restrict the level of force employed.
   d. Enemy personnel can present fleeting targets of opportunity providing the aircrew with limited engagement time from target discovery to weapons application.

4. Urban Grids and Reference Techniques
   a. It is essential for all forces to use the same reference system and gridded reference graphic (GRG). Ground maneuver elements generally use a terrain-based reference system during urban operations because they allow for quick correlation between air and ground assets. Ground units can also pass location information using reference techniques.
   b. Planners can overlay a grid reference system to most urban areas to produce the GRG. One technique utilizes the military grid reference system (MGRS) coordinate system while the second uses a simple grid system. Both techniques utilize a number to identify each building, and coding the corners of buildings facilitates rapid fires. Target handover to the aircrew is simply the location from the grid system and a brief target description.
      (1) Joint planners can produce the required GRG for an entire area of responsibility very quickly prior to commencement of hostilities using the MGRS coordinate system technique. The MGRS coordinate system provides easy
plotting, distance and reference determination for air and ground elements. For example “Grid 9633” in figure 4 references the position marked by the “X”.

Figure 4. MGRS Grid Reference Graphic

(2) The simple grid system technique is useful when the objective area is not aligned with a “north is up” orientation or the objective area is small and requires additional detail. Scale of the grid should relate to distance common to urban engagements while making it usable as a quick reference for approximate an initial location of interest. Label each grid and building in a consistent, sequential manner. For example, “B 3” in figure 5 references the position marked by the X.
Figure 5. Urban Sector Gridded Reference Graphic

c. The GRG is the supported ground commander’s product. The commander is responsible for dissemination to supporting units, appropriate joint agencies and commands. Specifically the commander should ensure GRGs are included in the Joint Force Air Component Commander’s special instructions included in the ATO. Graphics should include version numbers with a point of contact, phone numbers, and/or email to ensure the latest updates are used and versions are controlled.

d. Everyone, from convoy truck drivers to tactical aircraft operators, must use a common reference system.

e. As time and mission objectives allow, add basic named areas of interest (such as cloverleaves, bridges, and other choke points) to the template graphics.

f. Upon arrival in the objective area, aircrews should transition to the system in use by the ground element.

g. Objective area and target reference point reference techniques are used to identify targets given a known fixed point, distance and direction. Pre-planned TRPs have multiple uses to control and distribute fires, but not all TRPs are suitable for use as target reference systems when coordinating CAS. The unit in contact and the aircrew must easily recognize the TRP, or known point, which is either pre-planned or agreed to on site. Figure 6 identifies five TRPs from the commander's fire support plan. TRP 004 is unsuitable for the target reference technique because it is not easily identifiable from the air, but the water tower identified as TRP 002 is suitable. Also, figure 6 provides an example of a CAS 9-line excerpt using the objective area reference grid technique.
h. The building marking technique gives the aircrew a specific location in reference to a building or fixed structure. All buildings sides are numbered clockwise with the front being the starting point as shown in figure 7. The designated front is normally along the main street or main avenue of approach. The floors, windows, and openings of the structure are labeled numerically (floors) and then alphabetically (windows, openings). Numbering of the floors begins with the ground floor and ascends to the top floor. Windows and openings are assigned letters, beginning with A, and are labeled from left to right. The lettering sequence begins over with each floor ensuring all windows, openings, and obvious holes and/or breaches are assigned the appropriate letter. This technique may also incorporate a direct description (the window to the right of the flames). Figure 8 depicts an example of the floor and window lettering convention.
5. Marking Positions and Targets
   a. When working in proximity to friendly forces, marking and positively locating friendly units and targets are critical to preventing fratricide. Clearly define marking procedures and verify that all participants understand the procedures and have the appropriate devices.
b. Planners should ensure the marks are visible to ground and air forces, compatible with fielded systems and all personnel are familiar with friendly marking systems.

c. Aircrews require a positive location of the target and must deconflict their weapons effects from friendly positions before expending ordnance. Positive air-to-ground communications are essential to coordinate and authenticate markings. Table 1 lists some common marking methods and describes their characteristics.

<table>
<thead>
<tr>
<th>METHOD1</th>
<th>DAY/ NIGHT</th>
<th>VISIBLE TO FRIENDLY MARKS</th>
<th>TARGET MARKS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke</td>
<td>D</td>
<td>• Unaided2</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Smoke, infrared (IR)</td>
<td>D/N</td>
<td>• Forward-looking infrared (FLIR) • Unaided2</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Illumination, ground burst</td>
<td>D/N</td>
<td>• Unaided2 • Night vision goggles (NVG)</td>
<td>N/A</td>
<td>Good</td>
</tr>
<tr>
<td>Signal mirror</td>
<td>D</td>
<td>• Unaided2</td>
<td>Good</td>
<td>N/A</td>
</tr>
<tr>
<td>Spot light</td>
<td>N</td>
<td>• Unaided2 • NVG</td>
<td>Good</td>
<td>Marginal</td>
</tr>
<tr>
<td>IR spot light</td>
<td>N</td>
<td>• NVG</td>
<td>Good</td>
<td>Marginal</td>
</tr>
<tr>
<td>METHOD</td>
<td>DAY/ NITE</td>
<td>VISIBLE TO</td>
<td>FRIENDLY MARKS</td>
<td>TARGET MARKS</td>
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<td>-------------------------------</td>
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</tr>
<tr>
<td>IR pointer (below .4 watts)</td>
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<td>• NVG</td>
<td>Good</td>
<td>Marginal</td>
</tr>
<tr>
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<td>• NVG</td>
<td>Good</td>
<td>Good</td>
</tr>
<tr>
<td>Visible pointer</td>
<td>N</td>
<td>• Unaided² • NVG</td>
<td>Good</td>
<td>Marginal</td>
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<td>Laser designator</td>
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<td>• Hellfire • Maverick • Spot tracker</td>
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</tr>
<tr>
<td>Tracer</td>
<td>D/N</td>
<td>• Unaided² • NVG</td>
<td>N/A</td>
<td>Marginal</td>
</tr>
<tr>
<td>Strobe (overt)</td>
<td>N</td>
<td>• Unaided² • NVG</td>
<td>Marginal</td>
<td>N/A</td>
</tr>
<tr>
<td>Strobe, IR</td>
<td>N</td>
<td>• NVG</td>
<td>Good</td>
<td>N/A</td>
</tr>
<tr>
<td>Handheld signal flare (overt)</td>
<td>D/N</td>
<td>• Unaided² • NVG</td>
<td>Good</td>
<td>N/A</td>
</tr>
<tr>
<td>Handheld signal flare, IR</td>
<td>N</td>
<td>• NVG</td>
<td>Good</td>
<td>N/A</td>
</tr>
<tr>
<td>Gated laser intensifier tape</td>
<td>N</td>
<td>• AC-130 • NVG</td>
<td>Good</td>
<td>N/A</td>
</tr>
<tr>
<td>VS-17 panel</td>
<td>D</td>
<td>• Unaided²</td>
<td>Marginal³</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Table 1. Target and Friendly Marking Methods (cont.)

<table>
<thead>
<tr>
<th>METHOD</th>
<th>DAY/NIGHT</th>
<th>VISIBLE TO</th>
<th>FRIENDLY MARKS</th>
<th>TARGET MARKS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS-21 panel, IR</td>
<td>D/N</td>
<td>• Unaided(^2) • FLIR</td>
<td>Good</td>
<td>N/A</td>
<td>Easily masked by urban structures. Provides unique signature.</td>
</tr>
<tr>
<td>Chemical heat sources (i.e., meal, ready to eat heaters)</td>
<td>D/N</td>
<td>• FLIR</td>
<td>Poor</td>
<td>N/A</td>
<td>Easily masked by urban structures and lost in thermal clutter. Difficult to acquire.</td>
</tr>
<tr>
<td>Spinning chemical light (overt)</td>
<td>N</td>
<td>• Unaided(^2) • NVG</td>
<td>Good</td>
<td>N/A</td>
<td>Provides unique signature. Provides a distinct signature easily recognized. Effectiveness depends upon degree of urban lighting.</td>
</tr>
<tr>
<td>FLIR tape</td>
<td>D/N</td>
<td>• FLIR</td>
<td>Good</td>
<td>N/A</td>
<td>Best at lower slant ranges.</td>
</tr>
<tr>
<td>Spinning chemical light (IR)</td>
<td>N</td>
<td>• NVG</td>
<td>Good</td>
<td>N/A</td>
<td>Provides unique signature. Effectiveness depends upon degree of urban lighting.</td>
</tr>
</tbody>
</table>

1. Simultaneous use of multiple marking methods could cause confusion.
2. Unaided is visible to the unaided eye. Unless otherwise noted in remarks, marking devices visible to unaided sources are also visible to television, electro-optical, charged coupled device, or direct view optics sensors during daytime operations.
3. The VS-17 panel is impractical and unusable to fixed-winged aircraft for marking friendly positions.
4. The VS-21 panel is only visible to the unaided eye during day conditions.

d. The following are considerations when using marking methods and equipment.
   1. Ground units may use spray paint or bed sheets hung out windows to mark their progress (horizontally and vertically) during building clearing operations.
   2. Often, the simplest methods are best.
   3. Ground unit may use signaling procedures to mark targets or orient aircraft onto enemy positions.
   4. Gated laser intensifier (GLINT) tape, combat ID panels, radar, and IR beacons assist identifying friendly ground forces on urban terrain. Standardized usage of ground lighting, thermal contrast, and interposition of structures influence the effectiveness of these devices.
   5. All friendly marking methods may compromise friendly locations.

e. During high and low ambient light conditions, significant urban shadowing from buildings can exist when cultural lights are present. Shadows may hide personnel and/or vehicular targets from ground forces and aircrew.
6. Munitions Delivery

a. Urban terrain introduces unique challenges to aircrews and ground personnel due to urban canyons. Urban canyons exist when a target set is shielded by vertical structures. The vertical characteristics of urban terrain can limit delivery options.

b. Urban terrain creates visibility corridors running between structures. This will mask street-level targets, making them only visible along the street axis or from high angles.

1. Structures around a target may interrupt LOS from many directions.
2. Aircraft may approach rooftop targets from a wide range of azimuths.
3. Targeting a specific side or story of a building can limit engagement heading.
4. The presence of buildings and other structures in urban terrain creates corridors of visibility along streets, rivers, and railways.
5. Achieving LOS with an objective at street level is easier along the axis of a roadway as opposed to perpendicular, as illustrated in figure 9.

![Figure 9. View Along Street (Low Angle is Possible)](image)

6. Look down into areas surrounded by tall structures is required if roadways do not create an adequate avenue of observation, as illustrated in figure 10.
c. Fixed- and rotary-wing aircraft may experience significantly reduced ordnance employment ranges in urban areas. Reasons for this include the following.

(1) Delivery of direct fire weapons is typically at medium to close range due to masking effects of city structures.

(2) The lateral distance to masking structures and their height will determine the look-down angle required to achieve LOS.

(3) Higher angle deliveries may provide better look-down angles and visibility into a target area as well as a better ballistic trajectory when delivering ordnance near tall structures, as shown in figure 11.
(4) Attack planning should allow for the ability to maintain LOS to the intended target with enough time to acquire the target, achieve a weapons delivery solution, and fly to those parameters.

(5) The aircraft must also have LOS with the target to acquire a target mark. The proximity of structures may narrow fields of view and limit axes of approach.

(6) Urban fire support is time consuming and greatly depends on good communications. Safe and effective fire support is achieved through combinations of marking devices and clear talk-on procedures.

d. JTACs/FAC(A)s may require run-in headings that allow the maximum probability of target/mark acquisition and reduce the risk to friendly troops. Factors such as threats or weather may force the aircraft to deliver from low altitude. This increases the importance of attacking from an avenue of approach that allows target/mark acquisition and weapons employment within LOS limitations.

7. Munitions Effectiveness

a. Building Target Vulnerability

(1) Large Buildings.

(a) Most large buildings, constructed after World War II, are resilient to blast effects due to engineering and design improvements. Aerial delivered bombs or heavy artillery are more suitable for destroying buildings. Even though modern buildings may burn easily, they often retain their structural integrity and remain standing.

(b) Once high-rise buildings burn out, they are still militarily useful and are almost impossible to damage further. A large structure can take 24 to 48 hours to burn out and become cool enough for people to enter.

(2) Small Buildings.

(a) The small explosive yield of helicopter-fired weapons makes them generally only suitable for the destruction of rooms or room-sized buildings. However, accurately placed missiles, rockets, or even multiple cannon or machinegun hits can produce significant structural damage to larger structures. The best aimpoint to drop a structure is a free-standing column or load-bearing wall. In many buildings, the loss of one column can initiate a progressive collapse of the entire structure.

(b) The effects of over pressurization on manmade structures vary by size, construction materials, and construction techniques. For example, a small hut is susceptible to disintegration at relatively low blast pressures. If there is significant target venting due to wall collapse, the resulting rapid blast dissipation may only cause incapacitation effects on personnel in the immediate vicinity.

b. Weaponeering.

(1) Mission planners should understand the factors of blast effects, fragmentation, circular error probable (CEP), and target location error (TLE). The weapon’s accuracy is a combination of CEP and TLE. Information specific to all these planning factors is found in the Joint Munitions Effectiveness Manual.
(JMEM). Planners can determine rough estimates of possible CD by using the JMEM target offset algorithms.

(2) The JMEM does not describe collateral weapons effects on friendly personnel in proximity and shielded by some form of structure. The Joint Warfare Analysis Center (JWAC) located at Dahlgren, Virginia, performs classified computer simulations for these situations. Primarily tasked by the theater commander for deliberate targeting, JWAC can provide the weapons effect characteristics in an urban area for general purpose bombs, laser-guided bombs (LGBs), Maverick missiles, high-speed antiradiation missile (HARM), and Joint Direct Attack Munition (JDAM).

(3) Units can request JWAC support through their land or air component targeting cells. They may require scene composition, aim points, attack direction, weapon/fuze combination, and time over target. Additionally, JWAC can provide glass breakage plots, eardrum rupture plots (friendly, enemy, and noncombatant concerns), and panel damage versus distance from impact point using their CD estimate tool.

c. Shape Charge Munitions.

(1) Shaped charged warheads are not optimized against urban structures; however, shape charge munitions over pressurization effects can immobilize and possibly kill the enemy as described in table 2.

<table>
<thead>
<tr>
<th>Pressure (pounds per square inch)</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Shatter glass</td>
</tr>
<tr>
<td>10</td>
<td>Rupture eardrums</td>
</tr>
<tr>
<td>30</td>
<td>Collapse lungs</td>
</tr>
<tr>
<td>70</td>
<td>Fatal</td>
</tr>
</tbody>
</table>

(2) To illustrate the overpressure capability of a specific munition, the Hellfire shaped charge warhead is capable of achieving the following peak overpressure effects: 3 pounds per square inch (psi) at 60 feet, 6 psi at 40 feet, and 12 psi at 25 feet.

8. Lasing

a. Laser designation requires uninterrupted LOS to designate a target.

b. Rotary-wing aircraft can provide flexible laser designation capability, but should only hover in a permissive environment. Additionally, their reduced stand-off in urban terrain will require them to designate very near the target until ordnance impact.

c. Smoke from burning buildings or other fires can drift across the laser-to-target line causing beam attenuation.

d. Some laser designating platforms cannot see their laser spot on a target. Lasers are often bore sighted to other supporting sensors like FLIR or television (TV)/EO/charged coupled device (CCD)/direct view optics (DVO). As a rule of thumb, if the supporting sensor cannot see the target, the laser cannot effectively designate it. Conversely, even when a sensor can see a target, obscurants can attenuate the
laser energy, preventing designation. If a supporting sensor can detect and a laser can consistently range a target, it is likely that the laser will designate satisfactorily for a laser-guided weapon.

e. When lasing a building, it is possible for the laser to enter an open window or door and become trapped. Laser entrapment will prevent the aircraft or weapon from picking up any reflected energy.

f. Platform Synergy.

Attack helicopters can complement fixed-wing attack platforms during targeting. This enhances the lethality and survivability of both platforms. See table 3 for a comparison.

Table 3. Buddy Lase / Remote Lase Advantages and Disadvantages

<table>
<thead>
<tr>
<th>Type Designator</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Airborne</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airborne Platform</td>
<td>• Increased standoff.</td>
<td>• Large laser spot size.</td>
</tr>
<tr>
<td></td>
<td>• Great target area visibility/line of sight (LOS).</td>
<td>• Possibility of decreased mutual support between aircraft.</td>
</tr>
<tr>
<td></td>
<td>• Can designate specific impact points on roofs of buildings.</td>
<td></td>
</tr>
<tr>
<td>Airborne Platform - Trail Position</td>
<td>• Increased probability of spot detection.</td>
<td>• Attack axis restrictive.</td>
</tr>
<tr>
<td></td>
<td>• Increased standoff.</td>
<td>• Increased platform predictability.</td>
</tr>
<tr>
<td></td>
<td>• Reduced podium effect.</td>
<td>• May not enable continuous target observation (small targets).</td>
</tr>
<tr>
<td>Airborne Platform - Overhead Wheel Position</td>
<td>• Decreased platform predictability.</td>
<td>• Increased susceptibility to podium effect.</td>
</tr>
<tr>
<td></td>
<td>• Good standoff.</td>
<td>• Possible targeting pod masking.</td>
</tr>
<tr>
<td></td>
<td>• Enables continuous target observation (optimized for small targets).</td>
<td></td>
</tr>
<tr>
<td>Airborne Platform - Offset or Opposing Wheel Position</td>
<td>• Decreased platform predictability.</td>
<td>• Attack axis restrictive.</td>
</tr>
<tr>
<td></td>
<td>• Excellent standoff.</td>
<td>• Increased susceptibility to podium effect.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coordination intensive.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Possible targeting pod masking.</td>
</tr>
<tr>
<td><strong>Ground</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground Platform</td>
<td>• Small laser spot size.</td>
<td>• Attack axis restrictive.</td>
</tr>
<tr>
<td></td>
<td>• Decreased targeting ambiguity.</td>
<td>• Increased designator exposure.</td>
</tr>
<tr>
<td></td>
<td>• Rapid battle damage assessment.</td>
<td>• Target LOS dependent/limited mobility.</td>
</tr>
</tbody>
</table>

(1) Rotary-wing crews can provide nonlethal target marks (i.e., laser, IR pointer) or buddy-lase for fixed-wing aircraft in accordance with JP 3-09.3.

(2) Rotary-wing attack crews are less likely to compromise their position by limiting their engagements with on-board weapons.

g. Lasing Considerations.

(1) When designating with a ground based laser along a narrow street bounded by tall buildings, LOS geometry may only allow the weapon to receive laser energy within the 20 degree safety zone.
(2) Consider the potential miss distances for laser guided munitions that lose their guidance source in attack planning.

(3) It is critical the individual lasing a target with a ground designator at very short ranges realizes the laser energy coming from the designator’s aperture can be seen and tracked by a missile, in effect making the ground designator a target.

(4) The high number of reflective surfaces in an urban setting can reflect the laser energy causing multiple false returns.

(5) Angled engagements can reflect a compact spot to somewhere other than the intended target. The missile may acquire this reflected laser energy and cause the missile to track to the unintended location. Employ techniques to reduce this possibility and/or hide the reflected spot from the missile seeker.

(6) Aircrews should consider employing buddy lasing or remote lasing tactics for laser-guided munitions when urban obstructions preclude the attacking aircraft from maintaining LOS with the target through ordnance impact.

(7) When employing buddy lasing tactics, the terrain may restrict the attack axis due to the designator’s position.

(8) Buddy Lasing.

(a) Rotary-wing Hellfire engagements:

- UAS operators, fixed-wing strikers and buddy helicopter crews should understand the exaggerated third dimension due to the UAS often flying almost directly overhead. Due to the overhead location of UAS and fixed-wing platforms, it may be necessary to place the laser designation on the top of vertical structures.

- Most airborne laser designators incorporate an IR pointer coincident with the laser used for a visual mark at night. For vertical targets, the UAS designator may need to provide a visual IR mark to the helicopter crews to ensure proper target correlation. Even if the missile profile can make the strike, the UAS operators may need to move the IR pointers and their talk-on start points to something the rotary-wing platform can see and slowly move to the intended target. The rotary-wing crew may require positive indications the missile seeker is tracking reflected laser energy to place the aircraft into proper firing constraints for successful missile launch, continuous tracking of laser energy, and impact on the intended target.

- Designators should lase a vertical surface, not the top of the target to avoid creating a podium effect as illustrated in figure 12. Mitigate podium effects by deconflicting gun and laser target lines prior to engagement.
(b) Fixed-wing engagements: When lasing for medium-to-high altitude attack aircraft, picking a desired point of impact on top of a vertically developed structure could prove most desirable. Rotary-wing aircraft can lase for fixed-wing aircraft, but should consider the possibility of spillage when lasing a horizontal surface at an oblique angle. Aerial deconfliction plans should include safety cones to ensure high altitude attack aircraft are not dropping munitions through a lower aircraft’s altitude/airspace.

(9) Laser Designation of Windows.

(a) Near perpendicular engagement against highly reflective targets, such as windows, can return dangerously high levels of laser energy to the designator operator. Employment of a Hellfire in an urban environment requires careful consideration of LOS geometry.

(b) If lasing a window, more reflection is returned from a dirty window than a clean window; however, with any window, some laser energy will penetrate through and into the room, reducing the reflected laser energy available for the Hellfire to track. While windows can reflect dangerously high levels of laser energy, very little may reflect toward the missile’s seeker. It is possible the laser can directly penetrate a clean window resulting in laser spot entrapment and failure of the Hellfire to lock on as shown in figure 13. To attenuate this effect, place the laser designator on a non-reflective surface adjacent to the desired aim point and shift the laser spot to the final aim point as the time-of-flight counts down to zero.
Lasing techniques in the urban environment are susceptible to backscatter, obscurants, attenuation, beam divergence, spot jitter, refraction, and over and under spill. These factors are discussed in detail in the Army’s FM 3-04.155 Army Unmanned Aircraft System Operations and FM 3-04.140 Helicopter Gunnery.

![Diagram of laser designation reflection considerations]

**Figure 13. Laser Designation Reflection Considerations**

9. **TV/EO/CCD/DVO Considerations**

   a. TV/EO/CCD/DVO sensors are subject to many of the same limitations as the naked eye, particularly TV without low light capability.

   b. Aircrews may encounter difficulties in acquiring a target and achieving lock-on if smoke, buildings, or other urban factors interrupt LOS.

   c. Low-light or all-light TV/EO/CCD/DVO sensors may require frequent gain and filter changes to accommodate varying light levels in urban areas.

   d. Typical TV/EO/CCD/DVO sensors may not provide sufficient resolution at medium and extended ranges to discriminate between a friendly position or a target and its surrounding urban features.

   e. The FLIR system may detect targets not visible using TV/EO/CCD/DVO systems. However, FLIR systems are degraded during IR crossover periods; normally twice a day for an hour to hour and a half. The urban environment can produce the same effect when the target temperature matches the environment temperature. This is common with stove pipes on roof tops and when following vehicles on bridges.

10. **Indirect Fires**

    a. Background. Artillery, mortars, AC-130, and naval surface fire support are used in aviation urban operations for target marking, illumination, SEAD, as a diversion to mask the sound of rotary-wing aircraft, or to draw attention from the primary attack.

       1. Planners can employ white or red phosphorous marking smoke, or illumination rounds set for ground burst as a diversion. Careful fire planning is required as any artillery round has the potential to cause CD in urban terrain.
(2) Illumination rounds provide additional light to aid in night operations. They are used to illuminate areas of suspected enemy activity, provide direction, mark targets, or "wash out" enemy passive NVD when used at ground level.

(3) IR illumination rounds are especially effective in urban areas devoid of artificial light sources.

(4) Planners should coordinate the use of illumination rounds for target marking with aircrews flying with NVDs because of the increased likelihood of unwanted smoke and fires.

(5) Mortars, with a high angle fire, are ideally suited for SEAD against highly mobile MANPADS often employed from rooftops.

b. Artillery.

(1) Commanders should carefully consider the use of SEAD in urban areas and balance the mission, potential threat to aircrews, possible CD, negative enemy information operations, and the ROE prior to commencing operations. Generally, commanders should consider alternative courses of action before employing SEAD.

(2) Artillery can provide effective SEAD fires in the urban environment because of their high trajectory firing capability. Aircrews may rely largely on closely delivered SEAD fire for protection against surface-to-air threats. Closely coordinate all details of SEAD missions among aircrews, terminal controllers/observers, and fires and effects coordinators. Coordination should ensure aircraft are protected from both enemy and SEAD fires. Aircraft and indirect fire separation techniques provide protection from friendly SEAD fires.

(3) See appendix D, Urban Suppressive Fires, for more information on the application of SEAD and suppressive fires.
Appendix A
MUNITIONS CONSIDERATIONS

Note: This appendix will assist planners when considering munitions for aviation urban operations. Planners should use this appendix with the joint munitions effectiveness manual and Army techniques publication 3-09.32, Marine Corps reference publication 3-16.6A, Navy Tactics, Techniques, and Procedures 3-09.2, Air Force Tactics, Techniques, and Procedures (Instruction) 3-2.6 Multi-Service Tactics, Techniques, and Procedures for the Joint Application of Firepower.

### Table 4. Munition Advantages/Disadvantages

<table>
<thead>
<tr>
<th>Type Munitions</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
</table>
| General Purpose Bombs            | • Selectable fusing options • Multi-target effective  
|                                  | • Varying weapons effects • Flexible delivery options  
|                                  | • Multi-Service commonality  
|                                  | • Non-precision                                                           | ihe • Non-precision  
|                                  | • Decreased standoff  
|                                  | • Increased rotary-wing exposure  
|                                  | • Ineffective against masonry buildings  
|                                  | • APKWS requires laser guidance post release  |
| Rockets                         | • Light armor effective  
|                                  | • Varying weapons effects  
|                                  | • Good marking device  
|                                  | • Low collateral damage (CD)  
|                                  | • Rapid point and shoot delivery  
|                                  | • Advance Precision Kill Weapon System (APKWS) provides laser guided 2.75 inch with increased accuracy  
|                                  | • Non-precision  
|                                  | • Decreased standoff  
|                                  | • Increased rotary-wing exposure  
|                                  | • Ineffective against masonry buildings  
|                                  | • APKWS requires laser guidance post release  |
| 20/25/30/40/105 millimeter Cannon | • Light armor effective (all)  
|                                  | • All armor effective (30 millimeter cannon)  
|                                  | • Low CD  
|                                  | • Rapid point and shoot delivery  
|                                  | • Decreased standoff  
|                                  | • Increased rotary-wing exposure  
|                                  | • Depleted uranium clean-up concerns  |
| Guided Missiles (Maverick, Hellfire) | • Increased standoff  
|                                  | • Precision capability  
|                                  | • Mobile target effective  
|                                  | • Low CD  
|                                  | • Decreased employment options in adverse weather and non-optimal atmospheric conditions  
|                                  | • Requires guidance post release (Excluding electro-optical/imaging, imaging \  
|                                  | infrared Maverick, and radar frequency Hellfire)  
| Laser-guided Bomb (LGB)           | • Increased standoff  
|                                  | • Precision capability  
|                                  | • Multi-target effective  
|                                  | • Mobile target effective  
|                                  | • Selectable fusing options  
|                                  | • Decreased employment options in adverse weather and non-optimal atmospheric conditions.  
<p>|                                  | • Requires guidance post release  |</p>
<table>
<thead>
<tr>
<th>Type Munitions</th>
<th>Advantage</th>
<th>Disadvantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Direct Attack Munitions (JDAM)</td>
<td>• Near-precision&lt;br&gt;• Selectable fusing options&lt;br&gt;• Multi-target effective&lt;br&gt;• All-weather capable&lt;br&gt;• Good standoff&lt;br&gt;• Steep Impact angles</td>
<td>• Limited compatibility with moving targets (predictive only)&lt;br&gt;• Requires accurate target coordinates</td>
</tr>
<tr>
<td>Dual Mode LGB Laser JDAM</td>
<td>• Increased standoff&lt;br&gt;• Precision capability&lt;br&gt;• Multi-target effective&lt;br&gt;• Mobile target effective&lt;br&gt;• Selectable fusing options&lt;br&gt;• Fast Moving Target capability&lt;br&gt;• All-weather capable&lt;br&gt;• Can be employed as either LGB or Inertially Aided Munition</td>
<td>• Requires guidance post release, if autonomous lasing is desired</td>
</tr>
<tr>
<td>Joint Standoff Weapon (JSOW)/air-to-ground missile (AGM)-154</td>
<td>• Selectable fusing options&lt;br&gt;• Multi-target effective&lt;br&gt;• All-weather capable&lt;br&gt;• Good standoff</td>
<td>• Compatible for some moving targets&lt;br&gt;• Requires precise target coordinates&lt;br&gt;• Planning intensive</td>
</tr>
<tr>
<td>Cluster bomb unit</td>
<td>• Multi-target effective&lt;br&gt;• Multi-Service commonality</td>
<td>• Unexploded ordnance possibility&lt;br&gt;• Significant risk estimate&lt;br&gt;• Distance/CD&lt;br&gt;• Estimation considerations</td>
</tr>
</tbody>
</table>
Appendix B

C-130 Gunship Operations

1. AC-130 Gunship Overview

   a. The AC-130 is uniquely designed to support small unit tactics, such as special operations force (SOF) units in a close air support (CAS) role. The AC-130 also may perform armed overwatch, armed reconnaissance, air interdiction, command and control (C2), and personnel recovery (PR) support missions in an urban environment due to its accuracy, low yield munitions, robust communication suite, and extended loiter time. Situational awareness for the aircrew and ground commander is provided with enhanced visual sensors and a communication suite designed to quickly identify friendly locations, positively identify targets, and relay information to either the ground commander or a C2 agency. The AC-130 is considered “user friendly” in a CAS scenario because of its specialized equipment and the aircrew’s proficiency in CAS. This makes the AC-130 an ideal CAS platform for small, isolated units in need of fire support, especially in a dynamic urban environment. In addition, a joint terminal attack controller is not required.

   b. The Air Force Special Operations Command currently employs three AC-130 variants. The AC-130H and AC-130U are the traditional gunships with multiple guns and sensors. The AC-130W Stinger II has an upgraded visual sensor suite and robust communication package with a single 30 millimeter (mm) GAU-23/A gun and stand-off precision guided weapons, such as the Griffin missile and small diameter bomb (SDB).

2. KC-130J Harvest Hawk Overview

   The United States Marine Corps KC-130J Harvest Hawk is equipped with an infrared (IR)/television targeting system, Griffin and Hellfire missiles and provides CAS in accordance with Joint Publication 3-09.3, Close Air Support. The Harvest Hawk employment tactics in urban operations are similar to other fixed-wing CAS aircraft, but differs from the employment of the US Air Forces’ AC-130s.

3. AC-130 Sensor Capabilities

   a. The AC-130U is the only AC-130 equipped with an APQ-180 synthetic aperture radar, giving it an all-weather CAS capability in instrument meteorological conditions (IMC). The AC-130H and AC-130W have color detection capability with the MX-15 or MX-20 turret balls, giving both aircraft a daylight positive identification (PID) capability and better stand-off range than previous AC-130s. The use of radar beacons in an urban environment is important for the AC-130H/U along with a target reference point (TRP), grid, universal transverse mercator, or latitude/longitude methods to identify friendly positions and initiate calls for fire.

   b. Under IMC conditions, AC-130 reconnaissance capabilities are degraded and limited to detect only radar significant targets (e.g., buildings, lines of communication (LOCs), vehicles, etc.). AC-130 radars cannot detect human movement.

   c. Under daylight visual meteorological conditions (VMC), the AC-130H and AC-130W can employ the MX-15/20 sensor to provide color detection capabilities to identify friendly locations and target PID.
d. Under nighttime VMC, IR sensors are used to identify friendly locations and target PID among the ambient urban environment light noise. See (U) Air Force Tactics Techniques Procedures (AFTTP) 3-1.AC-130, Tactical Employment AC-130 (classified Secret) for further details on friendly marking devices that work well in the urban environment.

4. AC-130 Weapons Employment:

a. 25 mm GAU-12/A. The AC-130U is equipped with a five-barrel, 25 mm GAU-12/A capable of firing 1,800 rounds per minute with an automatic storage and handling capacity of 3,000 rounds. The crew selects a burst length of 15 to 350 rounds, depending on the situation and target type. The 25 mm is ideal for soft-skinned vehicles and personnel in the open and is considered a type of area suppression weapon. The gun is trainable and tied to the sensor aim point allowing the AC-130U crew to walk a long burst length in along a LOC or tree line which is a unique capability among CAS platforms.

b. 30 mm GAU-23/A. The AC-130W is equipped with the single barrel, rapid fire 30 mm GAU-23/A gun. The gun is fully trainable and has an automatic storage and handling capacity of 510 rounds. The crew can program a variety of burst lengths from a single shot up to 500 rounds. The preferred method is to shoot a 3 to 15 round burst, observe and adjust as necessary with another 3 to 15 round burst. The AC-130W uses the PGU-46, which is a modified MK-266 with the tracer removed. The GAU-23/A also can shoot PGU-13A/B or PGU-15, if necessary. The AC-130W does not shoot the 30 mm sabot variety due to the gun’s placement in front of the propellers.

c. 40 mm Cannon. The AC-130H/U gunship employs the M2A1 modified 40 mm cannon and fires various types of high explosive incendiary (HEI) rounds. This weapon is a good compromise between lethality, CD, and fratricide potential. Most 40 mm munitions have limited penetration capability. This is a significant factor limiting 40 mm effectiveness against targets under cover in urban terrain. The gun fires high explosive-plugged (HE-P), high explosive incendiary-plugged (HEI-P), and HEI zirconium rounds.

(1) The AC-130H and AC-130U have a 40 mm storage and handling capacity of 256 rounds.

(2) The HE-P cartridge is used against material and personnel targets. The round utilizes the MK-27 impact fuze; giving the ammunition limited penetration capability. This round is fair against hard targets, but does provide suppression for personnel in the open or under light cover.

(3) The HEI-P cartridge is used against material targets. It was developed specifically to increase fire-starting capability against trucks. The round has good incendiary potential but contains less trinitrotoluene (TNT), producing less fragmentation than HE-P. Upon detonation, the round produces bright sparks making it a good choice for target marking. Carefully consider the fire-starting potential of this round prior to use during urban operations.

(4) The HEI zirconium cartridge is used against material and personnel targets. It was developed specifically to increase fire-starting capability, while maintaining
adequate fragmentation for antipersonnel use. Carefully consider the fire-starting potential of this round prior to use during urban operations.

d. 105 mm Cannon. The AC-130H/U gunship carries the M102 105 mm cannon. This gun fires the PGU-44/B and PGU-45/B 105 mm HE rounds.

(1) The AC-130U has a storage and handling capacity of 100 rounds, whereas the AC-130H may carry up to 136 rounds.

(2) The M102 105 mm HE cartridge is used against personnel, material, and light-to-medium structures. It has a large lethal fan from shrapnel and blast. Upon detonation, this projectile produces approximately 3,000 fragments. Since urban terrain often requires target engagement near friendly positions, use M102 HEs only if adequate cover is available. For other than general purpose applications, the M102 round can accommodate various fuzes. The M-557 fuze is good for general purpose point detonation or selectable delayed detonation. It requires a minimum of 1 inch of wood to function reliably. The M102 performs poorly against hard targets or buildings with thick concrete, brick, or rock walls, unless specifically fuzed for this application. The fuze munition unit (FMU), FMU-153B hardened fuze, gives the M102 capability against hard targets in the delay mode. It requires a minimum of 2 inches of wood to reliably function. The M102 with this fuze will penetrate 10 inches of 5,000 pounds per square inch reinforced concrete (0 degrees obliquity). When fired against typical structures, the point detonating function opens holes about 3 feet in diameter and the delay function results in penetration of exterior walls with detonation immediately inside the wall. For antipersonnel applications, the PGU-45/B high explosive high fragmentation (HEHF) round with the FMU-160/B fuze detonates the projectile at about 14 feet above the ground. Large buildings in urban terrain may cause the fuze to function early, reducing effectiveness, and increasing CD. The fuze will also point detonate if the proximity function fails.

e. See table 5 for a comparison of AC-130 weapons and capabilities.
### Table 5. AC-130/KC-130 Weapons Data

<table>
<thead>
<tr>
<th>Weapon</th>
<th>Target Types</th>
<th>Maximum Altitude Above Ground Level</th>
<th>Rounds / Minute</th>
<th>Combat Load</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 millimeter (mm)</td>
<td>Personnel under light cover and light vehicles.</td>
<td>15,000 feet (ft)</td>
<td>Burst lengths range from 15 to 350 rounds per target engagement depending on the target and the tactical situation.</td>
<td>3,000</td>
<td>• high explosive incendiary (HEI) (AC-130U Only)</td>
</tr>
<tr>
<td>30 mm</td>
<td>Personnel under medium cover and all light vehicles.</td>
<td>20,000 ft</td>
<td>200</td>
<td>510</td>
<td>• high explosive/target practice (AC-130W Only)</td>
</tr>
<tr>
<td>40 mm</td>
<td>Personnel under medium cover and all light vehicles.</td>
<td>18,000 ft</td>
<td>100</td>
<td>256</td>
<td>• HEI • HEI-plugged (HEI-P)</td>
</tr>
<tr>
<td>105 mm</td>
<td>Personnel, light vehicles, and buildings.</td>
<td>20,000 ft</td>
<td>10 (AC-130H) 100 (AC-130U) 136</td>
<td></td>
<td>• HE (point detonate or delay) • HE high fragmentation (HEHF) Note: HEHF has a proximity fuze.</td>
</tr>
<tr>
<td>AGM-176 Griffin</td>
<td>Moving targets (light vehicles), Personnel under light cover, structures.</td>
<td>Classified</td>
<td>10 Shots loaded in Dragon’s Breath.</td>
<td>20*</td>
<td>• AC-130W • KC-130J</td>
</tr>
<tr>
<td>SDB I</td>
<td>Static targets (buildings, air defense systems, bunkers, static vehicles).</td>
<td>Classified</td>
<td>4 8**</td>
<td></td>
<td>• AC-130W Only</td>
</tr>
<tr>
<td>Hellfire</td>
<td>Moving Targets (light armor), personnel under cover.</td>
<td>Classified</td>
<td>4</td>
<td></td>
<td>• KC-130J</td>
</tr>
</tbody>
</table>

*Greater than 20 if utilizing a derringer door equipped KC-130J Harvest Hawk aircraft
** If equipped with additional BRU-61 instead of Dragons Eye Radar on Left Wing (AC-130W)

AGM– air-to-ground missile  BRU– bomb rack unit
5. **AC-130 Specific Urban Considerations.**

a. AC-130H/U/W has a psychological impact on the battlefield. During Operation IRAQI FREEDOM and Operation ENDURING FREEDOM a significant drop in enemy activity was identified when the AC-130 was simply heard overhead.

b. Urban canyons may restrict the AC-130’s firing arcs depending on the depth of the canyon. Urban environments however, allow for friendly forces to take cover, which may allow the AC-130 to safely engage targets at a much closer range than normal. Rules of engagement and danger close rules should always apply.

c. **Mitigation and Employment Techniques.**

   (1) It is critical for commanders and planners to consider the threat determined in the planning process before employing the AC-130.

   (2) Extensive mission planning is critical, with special consideration given to collateral damage concerns, for CAS and interdiction during IMC.

   (3) The 25/30/40/105 mm cannon, Griffin, and Hellfire missiles (theater dependent) are considered direct fire weapons, which allows fewer restrictions for collateral damage estimation and makes them the weapons of choice in an urban CAS scenario.

   (4) Unlike other airborne assets, locating the target usually is accomplished by locating the friendly forces first. From the friendly location, a bearing and range offset is used to orient the AC-130 to the target area. Also, the AC-130 can perform offsets from TRPs or grid coordinates. The gunship attempts to positively identify the target from its description. In urban terrain, a detailed talk-on with reference points expedites target acquisition.
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Appendix C

ROTARY WING URBAN TACTICS, TECHNIQUES, AND PROCEDURES

1. Urban Flight Techniques

a. A rotary-wing urban flight profile may consist of low- or high-altitude techniques. Aircrews should evaluate types and locations of threat sources to determine optimum altitude and airspeeds. Additional factors include obstacles, ambient light levels, aircraft survivability and available navigation cues.

   (1) Nap-of-the-earth flight at slow speeds or hovering may expose the aircraft to engagements from surface-to-air fires.
   (2) A low density of structures or extensive enemy use of high rooftops diminishes the masking advantages of low flight profiles.
   (3) Consider increasing the day/night obstacle and hazard buffer clearance over urban areas.
   (4) A flight at high en route altitudes exposes the aircraft to observation as it approaches the objective and increases its vulnerability to engagement during the descent for landing. This trade-off provides an improved margin of safety from the hazards of obstacles and enemy ground threats.
   (5) Commanders should evaluate the tactical situation and weigh the requirements for tactical surprise. Low flight profiles increase surprise and risk of controlled flight into terrain. High profiles will allow enemy early detection but will lower the risk of enemy engagement with small arms and rocket-propelled grenades (RPGs) and lower the risk of controlled flight into terrain.

b. Flight Profile. Areas of consideration when determining flight profiles include the:

   (1) Mission requirements.
   (2) Hazards to flight.
   (3) Integrated air defense system in use by adversary forces.
   (4) Small arms, man-portable air defense systems (MANPADS), surface-to-air missiles (SAMS), and RPG threat.
   (5) Terrain relief and building height in and around the area.
   (6) Density of structures.
   (7) Accessibility/security of high, dominant rooftops.
   (8) Dominant natural terrain around the urban area.
   (9) Aircraft survivability equipment (ASE).

2. Urban Navigation Techniques

a. The over-abundance of visual cues in urban terrain may increase navigation difficulty. Navigation is more difficult for rotary-wing aircraft because maps do not show the vertical development of structures in urban terrain.

b. Challenges in Urban Terrain.

   (1) High density of structures.
   (2) Variety of geographical references.
(3) High light levels can create “visual saturation.”
(4) Rapid displacement from position to position can create confusion between aerial and ground observers as to cardinal directions or locations.
(5) Buildings may cause interference with navigation systems.

c. Mitigation Methods.

(1) Familiarity with the characteristics of urban terrain allows aircrews to discern key features in this environment.
(2) Navigational aids have reduced the pilot’s terrain navigation workload.
(3) Effective navigation over large towns and cities requires the use of a variety of navigational systems and techniques to include dead reckoning and pilotage.
(4) The use of Global Positioning Systems (GPSs) eases the problems associated with night navigation and orientation; whereas, handheld laser pointers or designators ease the problems associated with orientation and target identification (ID).
(5) Aircrews should monitor their equipment closely and crosscheck their position by all available means. Aircrews should perform detailed mission planning to maximize the effectiveness of all available assets.


(1) When flying without reference to GPS, a small navigational error (i.e., a couple of city blocks) can rapidly evolve into disorientation.
(2) Although natural land features (e.g., rivers, lakes, etc.) are preferable landmarks, their usability is dependent on various flight profiles.
(3) Manmade features may provide the majority of available navigation aids. If possible, pick unique and large recognizable features for navigation, such as cemeteries, stadiums, cathedrals, and major roads.
(4) Linear features, such as major highways, rivers, railways, canals, and coastlines, provide easily recognizable boundaries and references to assist aircrews in maintaining orientation.
(5) Prominent rail and highway interchanges are useful as en route checkpoints. Remember, the enemy may employ antiaircraft weapons to protect prominent features in enemy-held areas.
(6) As aircrews become more familiar with the operational area, more use is made of local landmarks during flight.

3. Survivability Enhancement Techniques

a. Employ adapted urban flight profiles and tactics, techniques, and procedures (TTP) to enhance survivability.

b. Remain unseen visually and electronically, this is the most effective method of preventing an engagement by hostile forces.

c. Have planners and aircrews familiar with the urban TTP select altitudes and flight profiles best suited for the situation.
d. Aircrews should maintain airspeeds above 60 knots to avoid effective small arms fire.

e. Generally, aircrews should plan to operate at the highest altitude possible consistent with threat avoidance/defeat, but should prepare to adjust employment as the scenario unfolds and contingencies arise.

f. The combination of navigation techniques, night systems and aircraft survivability equipment multiply the effectiveness of the low-level flight profile.

g. Reduce the aircraft’s audible signature by flying at the aircraft’s maximum endurance airspeed and avoiding aggressive flight maneuvers.


a. Multi-ship, rotary-wing operations are challenging and can require unique formation techniques, especially when operating with night vision devices. Limiting the number of aircraft in a flight will ease control and provide greater flexibility in flight maneuvering.

   (1) Consider using a nontraditional vertical “stack-down” formation to prevent the loss of visual contact with other aircraft among ground lights. Note a wingman flying in a vertical “stack-down” position from the preceding helicopter will not have normal maneuver flexibility.

   (2) When multiple aircraft are operating together, consider greater formation spacing to facilitate more flexible maneuvering while still providing mutual support.

b. Plan to include a formation break-up and a rendezvous procedure, if visual contact is lost within the flight or evasive maneuvering is executed.

c. Maintain a position that compensates for the illumination pollution, but avoids jeopardizing the aircraft by greater exposure to obstacle hazards or increased formation collision potential.

5. Aircraft Lighting Techniques

a. For day and night operations, aircrews should experiment with lighting to best accommodate the mission, if not specified in standard operating procedures.

b. If overt external lighting is mandated, aircrews should use flashing position lights to better distinguish aircraft from static light sources.

c. The visibility of covert lights is degraded in brightly lit areas. Commanders should weigh mission lighting needs against the possibility of visual detection by the enemy.

6. Drop Zone (DZ) Techniques

a. DZ operations in urban terrain are difficult due to availability, surface obstructions, navigation, and positive ID of the DZ.

b. Parks, roads, railroad yards, airfields, athletic stadiums, and industrial storage sites are the most suitable locations for airdrops.

c. Communication limitations, positive marking, DZ control, and the availability of accurate, timely intelligence also affect airdrop accuracy.
d. Lessons from recent operations emphasize the importance of positively controlling personnel near the DZ or concealing the DZ until right before airdrops occur. This reduces the possibility of the airdrop injuring civilians. The exception is the airdrop of meals, ready to eat using the tri-wall aerial distribution system. The distribution system free-falls and spreads individual packets over a wide area.

7. **Forward Arming and Refueling Point (FARP) Operations**
   a. Assessment of potential FARP locations is similar to the basic considerations for helicopter landing zone (HLZ)/pickup zone selection. Consider the location's ability to accommodate the refueling/rearming element, the number of points required, whether the landing and holding area is adequately sized for the number and type of aircraft, and if there is sufficient movement area.
   b. Aircraft in an urban FARP are vulnerable during refuel/rearm operations due to the proximity of available concealed enemy positions.
   c. FARP locations should provide concealment from the surrounding terrain, buildings, and facilitate securing potential ground entry and exit routes. Consider the use of sports stadiums or established airfields. However, when using sports stadiums or other urban locations surrounded by vertical structures, consider the reduced climb/hovering capability of heavily loaded aircraft upon exit from the FARP.
   d. Consider normal and low-light visibility conditions at proposed FARP sites before designing marshalling plans, especially when both fixed- and rotary-wing assets are involved in the FARP operation.

8. **Contingency Area Techniques**
   a. Avoid loitering in-flight over urban terrain. This is very dangerous at low altitude, especially during day combat operations.
   b. Planning for in-flight contingencies may require using assembly or holding areas.
      1. Plan to loiter or hold at control points well away from the urban area.
      2. Select assembly or holding areas using the same considerations required when selecting HLZs and FARPs.
      3. Consider concealment, presence of friendly ground forces for security, and protective or covered facilities for personnel and equipment.
      4. Ensure the communications plan allows all elements, ground and air, in the holding area to communicate.
      5. Use an airborne command and control or retransmission platform, if necessary.

9. **Helicopter Landing Zone Considerations**
   a. Studying city composition, imagery, and maps provides a good foundation for choosing HLZs; however selecting a HLZ solely from a map in the urban environment is not recommended. Review current imagery to accurately assess HLZ size and hazards. If possible, use imagery taken at the same time of day as when the aircraft will use the HLZ. This allows analysis of illumination and shadow conditions present during the actual mission. Ground photos can provide valuable
hazard information and terrain references. Examine products from reconnaissance assets and make these available to all participants. Annotate all images and diagrams with magnetic north and navigation references.

b. Selection.

(1) Primary HLZ: Consider selecting an urban HLZ readily identifiable and accessible. Most major cities have urban parks near the central business district that may provide a suitable HLZ. Other potential HLZs include athletic stadiums, golf courses, parking lots, and rooftops.

(2) Alternate HLZ: Plan alternate and emergency HLZs en route to the same degree of detail as a primary HLZ. Select alternate HLZs at least the same size to prevent unnecessary exposure to aircraft waiting to land.

(3) Load Bearing: Some structures can accommodate helicopters landing on the rooftop, but planners cannot accurately determine the load bearing capacity by observation unless marked accordingly (e.g., existing rooftop helipads).

(4) Hazards: Roof clutter such as antennas, lightning rods, and wires can obstruct the landing area. Aircrews should expect unpredictable winds and venturi effects associated with flight in proximity to very tall buildings. These effects require hover out-of-ground-effect power during operations to and from high-rise rooftops.

(5) Tactical Considerations.

(a) If there are more aircraft than a single HLZ can accommodate, select multiple HLZs in proximity to the objective.

(b) Control measures are essential to deconflict movement of all elements.

(c) The vertical fields of fire of the aircraft door gunner are limited. Generally, the gunner cannot engage threats from multistory buildings above their position.

(d) Balance the limited availability of suitable HLZs and exposure to observation, direct fire, or ambush.

- Consider whether the mission is conducted during daylight or darkness. Daylight allows rapid ingress, egress, and facilitates navigation, but also allows for easier observation and engagement by the enemy.

- Night missions offer improved concealment and HLZ security, but require slower airspeeds and increase navigation difficulty.

- Due to the limited number of suitable HLZs in the urban environment, planners should assume the majority of HLZs are known to the enemy and observed.

C. Steady State HLZs. As operations progress, forward operating bases' HLZs enter steady state operations and provide hubs to move personnel around the urban terrain and operational environment. Units should take a disciplined approach to manage their HLZ.

(1) Continuously review and evaluate the HLZ for hazards to flight.

(2) Control the passenger manifest process.
(3) Determine the need for air traffic controllers to manage arriving and departing flights.
(4) Evaluate the need and capability to collocate a FARP with the HLZ.
(5) Establish a notification system to disseminate flight schedules.
(6) Manage space-available passengers.
(7) Be prepared to provide transitory lodging and meals to passengers.

10. Alternate Insertion/Extraction (AIE)

a. Due to varying load bearing capabilities of urban structures, aircrews can use a variety of techniques for AIEs onto rooftops. These techniques include:
   (1) Remaining light on the landing gear after touchdown.
   (2) Hovering with a single skid or landing gear touching the structure.
   (3) Low hover at 5 feet or less.
   (4) Rappelling.
   (5) Fast rope.
   (6) Rope ladders.
   (7) Hoist operations.

b. If rooftop insertions are required, planners should consider enemy line of sight (LOS) to the rooftop and potential exposure of helicopters and troops to enemy fire while in critical flight profiles.

c. If more than one insertion/extraction element is required, consider utilizing multiple insertion flight profiles to remain unpredictable and to avoid objective area congestion.

d. Planners should ensure AIE equipment is available and missions are not assigned exceeding current inventories and configurations.

e. The tactical employment of AIE equipment requires additional aircrew and ground force proficiency/qualification training; especially in the urban environment.

11. Urban Rotary Wing Attack Positions.

a. Avoid hovering in urban environments because this exposes the aircraft to small arms fire. Only plan or execute hovering fire if essential to the mission and adequate overwatch fires are available. Preferably, only hover over friendly controlled areas that exploit aircraft standoff capabilities. Figure 14 illustrates hovering fire engagement techniques.
b. Attack by Fire (ABF) Position Selection. The urban environment offers attack and scout Helicopters a unique advantage for hovering observation position and ABF/support by fire positions.

(1) Buildings can provide masking from visual/infra-red/radar detection and targeting and direct hard-cover from enemy fire.

(2) When masking/unmasking from behind buildings, the crew should select a position that maximizes the aircraft’s sensors and weapons capabilities while degrading or eliminating the enemy’s ability to acquire and/or target the aircraft.

(3) By executing lateral unmasking techniques and selecting an unmasking position several stories up, as shown in figures 15 and 16, the aircrew can make it virtually impossible for enemy tank forces to detect or engage its position.
12. Running and Diving Fire
   a. Use running and diving fire; these are the preferred engagement techniques in urban terrain.
b. Consider all maneuvers associated with high energy weapons platform employment.

c. When able, attack targets from different directions to avoid effective enemy small arms fire as shown in figure 17.

![Figure 17. Running/Diving Fire Engagement](image)

13. Target Detection

a. Effectiveness of attack and reconnaissance helicopter electro-optical (EO) targeting systems are degraded in the urban environment. The combination of low altitudes, urban canyons, constant movement and limited LOS hinders long-range target detection. It is desirable to maintain standoff but this is not always possible.

b. Unaided visual detection in proximity is more effective in urban areas than aided detection due to the enemy’s ability to conceal its position. When possible confirm and positively identify the target from various directions.

c. Observing enemy fire is less preferred but very effective in detecting enemy locations.

d. Understand how the average civilian reacts to the aircraft’s presence overhead. A normal reaction includes a brief glance and acknowledgement of the aircraft. Gait is another good indicator as many populations have their own rhythm and tempo. An individual that both ignores an aircraft and accelerates foot speed is someone attempting to go unnoticed and whose goal is to quickly disappear.
14. Engaging Fleeting Targets in the Urban Environment

a. Anticipating Target Movement.
   (1) Short engagement distances, and the lethality and dynamic nature of urban combat will routinely result in very limited target engagement opportunities in the urban environment.
   (2) Aircrews should expect stationary enemy targets only when they achieve tactical surprise.
   (3) Targets only remain stationary as long as the enemy believes standing still makes him harder to find or his present environment offers the best protection.
   (4) Once attacked, most targets will move; therefore, when engaging stationary targets, crews should always plan to transition to a moving target engagement.
   (5) Consider moving target engagements as the standard and engaging stationary targets as the exception.

b. Audio Cueing of the Target.
   (1) The sound of weapon firing or functioning (e.g., illumination rocket deployment) may alert the enemy.
   (2) Dismounted enemy personnel can hear incoming missiles in the last few seconds of flight.
   (3) At certain ranges the sound of the fired weapon will reach the enemy before projectiles do, thus providing a cue for the enemy to take cover or commence evasive action.

c. Countering Target Movement.
   (1) Expect the enemy to use speed to its maximum advantage.
      (a) The enemy may use slow speeds to prevent detection.
      (b) When detection is likely, the enemy may use its maximum speed to minimize exposure time and reduce the accuracy of an incoming attack.
      (c) Once fired upon, an enemy may vary speed depending on sustained damage or as an attempt to optimize the ability to accurately return fire.
      (d) Aircrews should plan to engage enemy targets up to highest nominal target speed. See figure 18 for nominal speeds of dismounted personnel.
   (2) Target movement affects most aspects of the engagement and the components of ABF position selection.
      (a) Temporal evaluation considers the interaction of target speed, size of kill zone, time to employ weapon, and time of flight (TOF) of the weapon to impact.
      (b) Even dismounted personnel could quickly move out of the engagement area and deploy to cover or transition into a collateral damage sensitive area prior to weapon impact.
Dismounted Personnel Speed:

- Walking: 1 mps (2.23 mph)
- Jogging: 2 mps (4.47 mph)
- Running: 3 mps (6.71 mph)
- Sprinting: 4 mps (8.94 mph)

mps – meters per second
mph – miles per hour

Figure 18. Targeting a Dismounted Moving Target

Note: An otherwise perfect firing position for engaging an armored target may be totally unsuitable to engage a high speed wheeled vehicle. At 3,000 meters (m) the nominal TOF of a Hellfire missile is ten seconds. A wheeled tactical vehicle has a nominal maximum road speed of 80 kilometers per hour or 22 m per second (m/s). During the ten-second TOF of the missile, the target would travel 220 m, or more than a quarter of a mile. In the urban environment, the crew also should factor in target detection, gunner reaction time, and time from the trigger pull to missile launch. Engaging a fleeting target at short ranges is easy; however, engaging the same target at longer ranges or when significant time delays are expected (multi-ship remote engagement) may result in the target escaping the engagement area prior to weapons impact.

d. Indexing Moving or Fleeting Targets.

1. The gunner may detect several targets simultaneously; therefore, the gunner utilizes a deliberate system to remember target locations called indexing. To index locations for fleeting or moving targets, the shooter uses prominent terrain features or landmarks near targets to keep track of their locations.

2. The gunner should lase and store the anticipated destination or last known location of moving targets with a target description announced onto the gun camera video.

3. If necessary, the aircraft can remask or seek cover/standoff and replay the video and/or study the stored targets on the tactical/horizontal display.

4. Anticipate and compensate enemy movement for all engagements. When tactically feasible, the easiest way to attack a moving target is from its six o’clock position.

15. Aerial Sniper Platform in the Urban Environment

a. An urban conflict may require the employment of extremely low-yield, precision fires. In these cases, employment of snipers from rotary aircraft offers the commander great operational flexibility in a highly collateral damage sensitive environment. This technique is predominantly employed by special operations command forces from conventional force aviation assets in an urban environment.
b. Sniper teams in an urban environment may occasionally find staying on the ground to conduct their mission is not feasible or tactically sound; using an aerial platform may be a tactically advantageous method to rapidly position a sniper. Time constraints, possible loss of tactical surprise, and force protection challenges during sniper infiltration, or post-shot exfiltration, are difficulties associated with ground-mobile snipers.

c. Airborne snipers may employ weapons from 5.56 millimeter (mm) M-4 carbines through .50-caliber anti-material rifles, but generally use 7.62 mm weapons.

d. The main effort for rotary-wing aviation assets is to position the sniper to selectively engage and neutralize high-value individuals from various angles (elevations) at ranges of up to 250 m. Maximizing tactical surprise and effectiveness requires the practiced, coordinated effort of the entire aircrew and sniper team.

e. The necessity of providing the sniper with a stable firing platform, within rifle range of the enemy target, potentially exposes the aircraft and its crew to a high risk. Should the threat condition escalate, sniper teams may designate targets for the aircrew. This method allows the sniper team to use an area engagement weapon with a high volume of fire (door guns) to suppress targets beyond the capabilities of the sniper’s precision weapons fire.

f. The helicopter crew and door gunner must prepare to provide offensive or defensive machine gun fire to protect the aircraft, crew, and sniper team throughout the airborne sniper platform employment flight profile.

g. Utility and cargo aircraft units supporting organizations equipped with snipers should develop a training program to facilitate the employment and integration of sniper weapons and tactics with the aircraft’s organic weapons.

16. Helicopter Door Guns

a. Combat Search and Rescue (CSAR) and Special Operations Forces (SOF) Aircraft with Door Guns.

   (1) The primary purpose of CSAR and SOF aircraft door guns is the self-defense of the aircraft and associated team(s). However, crews are trained in providing suppressive fires in support of both aircraft formations and small ground units.

   (2) CSAR and SOF aircraft door guns, unlike the door guns associated with utility and cargo aircraft, possess extended ammunition capacity to support the aircraft formation and associated ground units during en route, terminal area, and egress phases of the mission.

   (3) Door gunners are normally equipped with full communication capabilities and the ability to mark targets with a night vision goggle (NVG)-compatible laser. Additionally, crews are trained to employ suppressive fire on the ground, in a hover, and from various side-fire gun patterns (e.g., race track, hover offset, L-attack, dogbone, and random).

   (4) CSAR and SOF crews are capable of responding to 5-Line Emergency Close Air Support requests from ground units.
b. Utility and Cargo Aircraft with Door Guns.

(1) The primary purpose of utility and cargo aircraft door guns is aircraft self-defense. Helicopter door gunners are concerned with threats to the helicopter and crew on board whether the helicopter is in the air or on the ground.

(2) Aircrews and troops are most vulnerable during the landing phase. Units should develop procedures to coordinate and employ simultaneous fires from multiple aircraft. Most door gun systems have limited ammunition and were originally designed to only provide suppressive fires during the assault landing phase.

(3) To prevent fratricide, units should carefully develop and train procedures for gunners firing during troop dismounting, and movement procedures from all aircraft-landing formations.

(4) Depending on the threat in the landing zone (LZ), ground commanders may require door gunners to continue suppression as they organize their actions during the ground tactical plan.

(5) Commanders should evaluate the tactical situation and potential for collateral damage when considering the employment of suppressive fires from utility and cargo aircraft in the urban environment. The gunner’s ability to suppress targets depends on the following considerations.

(a) When aircraft land in a staggered or trail formation, the door gunner has a clear field of fire, provided the troops egress away from the door gun and immediately take the prone position.

(b) When aircraft land in multiple LZs within another aircraft’s door gun maximum effective range, the aircrews should pre-brief and rehearse their suppressive fire plan on the objective. This may include placing specific door guns in a weapons tight status. This is common in urban cordon and search missions that require multiple LZs and troops to exit the aircraft near a target structure and immediately move to the objective.

(c) The ground commander cannot communicate with the door gunner to direct fires. This increases fratricide potential.

(d) Dust landings in urban environments may hinder the gunner’s visibility and exponentially increases fratricide potential. A door gunner should avoid employing suppressive fires without positive identification of the target. Using NVGs at night, the gunner may detect tracer rounds through a dust cloud but will not know if the rounds are from another helicopter, friendly ground forces, or the enemy.
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Appendix D

URBAN SUPPRESSIVE FIRES

Note: This appendix will assist planners with the basic concepts of urban suppression of enemy air defenses (SEAD). Planners should use this appendix with the Field Manual 3-01.4, Marine Corps reference publication 3-22.2A, Navy Tactics, Techniques, and Procedures (TTP) 3-01.42, Air Force Tactics, Techniques, and Procedures (Instruction) 3-2.28, Multi-Service Tactics, Techniques, and Procedures for the Joint Suppression of Enemy Air Defense and Anti-Radiation Missile Employment (J-SEAD), (document is classified Secret).

1. Urban Survivability and Enemy Weapon Engagement Zones (WEZs)

a. Defining the Enemy WEZ

(1) The lethality of enemy air defenses within the urban environment compels the aviation planner to have a method of negating enemy air defenses. The urban geometry may provide complete masking of friendly aircraft some of the time. At some point, however, friendly aircraft must break cover and enter the enemy’s air defense WEZ.

(2) First determine the enemy’s surface-to-air fire WEZ and ability to affect the friendly commander’s plan. Countering enemy air defenses requires a detailed understanding of the enemy’s WEZ. The four dimensions of the enemy WEZ (3-D spatial dimensions + Time) are evaluated to avoid or minimize the time spent in the heart of the enemy WEZ. The mission planner should know the following parameters for the likely enemy surface-to-air fire (SAFIRE) threats in their theater of operation:

(a) Define the enemy’s minimum range.

(b) Define the enemy’s maximum range (RMAX).

(c) Define the enemy’s lateral engagement limits or fields of fire based on the type of system, surrounding terrain and natural or man-made obstacles (i.e., azimuth (left/right) limits).

(d) Define the enemy’s vertical engagement limits (i.e., elevation limits).

(3) SAFIRE threat RMAX standoff considerations are as follows:

(a) Guns: All enemy gun systems have traverse limits producing vertical and horizontal blind spots.

(b) Man-portable air defense systems (MANPADS): Attack helicopters have a small infrared (IR) signature and can engage known MANPADS locations from standoff distances beyond the MANPADS’ maximum seeker lock-on distance.

(c) Radar Guided Surface-to-air Missiles (SAMs): Radar guided SAM systems can outrange the Hellfire missile, and all radar guided SAMs fly faster than the Hellfire.

b. Penetrating the Air Defense WEZ.

(1) The application of proper TTP can reduce an aircraft’s vulnerability to SAFIRE inside the enemy’s WEZ. During pre-mission planning, determine the
time and space friendly aircraft are vulnerable to enemy fires (the “vul window”). Support the transition with suppressive fires.

(2) Mission planning tools, such as Falcon View, can help determine when friendly aircraft are visually exposed to the enemy (provided enemy air defense types and locations are known or templated).

(3) Quantifying the time and place friendly aircraft are vulnerable to enemy detection can assist the mission planner in sequencing suppressive effects and determining the degree of risk for any air route. Table 6 helps quantify enemy reaction time to rotary-wing aircraft by displaying the interrelationship between the speed and sound of the aircraft. It also shows various rotary-wing weapon time of flight for aircraft travel distances compared with the nominal speed of sound. Table 7 shows the time required for rotary-wing aircraft to seek cover by vertical and horizontal remasking. It also provides a time estimate to determine the required duration of suppressive fires for aircraft transitioning the WEZ. These assist the mission planner in synchronizing the time of arrival of SEAD effects.

Table 6. Helicopter Vs. Sound Speed Comparison

<table>
<thead>
<tr>
<th>Range to target in kilometers (km)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-Sound (331 meters per second (mps))</td>
<td>0:03</td>
<td>0:06</td>
<td>0:09</td>
<td>0:12</td>
<td>0:15</td>
<td>0:18</td>
<td>0:21</td>
<td>0:24</td>
<td>0:27</td>
<td>0:30</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Time aircraft (or munitions) can travel the specified distance (minutes: seconds)</th>
</tr>
</thead>
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<tr>
<td>30 millimeter (mm)</td>
</tr>
<tr>
<td>Multipurpose Submunition</td>
</tr>
<tr>
<td>Hellfire</td>
</tr>
<tr>
<td>Aircraft Time of Flight (TOF) at 60 knots (kts)</td>
</tr>
<tr>
<td>Aircraft TOF at 80 kts</td>
</tr>
<tr>
<td>Aircraft TOF at 100 kts</td>
</tr>
<tr>
<td>Aircraft TOF at 110 kts</td>
</tr>
<tr>
<td>Aircraft TOF at 120 kts</td>
</tr>
<tr>
<td>Aircraft TOF at 150 kts</td>
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</table>
### Table 7. Aircraft Exposure: Distance to Re-mask at Various Speeds

<table>
<thead>
<tr>
<th>Rate of Climb</th>
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<tr>
<td></td>
<td>1 sec</td>
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<tr>
<td>500 feet per minute (fpm)</td>
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<td>8</td>
<td>17</td>
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<tr>
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<tr>
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<td>4,000 fpm</td>
<td>83</td>
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<tr>
<td>5,000 fpm</td>
<td></td>
</tr>
</tbody>
</table>

**Horizontal Distance**

<table>
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<tr>
<th>Airspeed (kts)</th>
<th>Meters traveled per second (sec)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1 sec</td>
</tr>
<tr>
<td>30 kts</td>
<td>15</td>
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<td>40 kts</td>
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<td>110 kts</td>
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<td>120 kts</td>
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<td>130 kts</td>
<td>69</td>
</tr>
<tr>
<td>150 kts</td>
<td>77</td>
</tr>
</tbody>
</table>

2. Urban Suppressive Fire Techniques

a. The complexity of the urban environment will not always provide the opportunity for friendly forces to apply decisive destructive fires. Consider using suppressive fires in conditions where destructive fires are inappropriate or by rules of engagement (ROE) are restricted. Careful selection of desired effect, weapons types, and TTP can ensure suppressive fires remain within ROE and law of armed conflict considerations. Lethal and non-lethal suppressive fires can shape the battle and maintain friendly freedom of maneuver.

b. Types of Suppression.

(1) Suppression of a target limits the ability of enemy personnel to perform their mission. Suppressive fire at known or suspected enemy targets is used to defend friendly forces from accurate enemy attack; it limits enemy movement and observation, thereby increasing friendly freedom to maneuver. Lethal suppressive fire reduces enemy combat effectiveness by creating apprehension or surprise. It causes enemy mounted air defense artillery (ADA) crews to button up, and dismounted ADA crews to seek cover. Effective suppressive fire will force a change in enemy behavior. This is normally accomplished by killing the enemy or forcing him to seek cover. Though direct destruction of the enemy is
decisive, it requires a target hit which may take longer to achieve. Suppression is quick and effective even if the enemy is not hit, as long as the weapon effects are close enough the enemy believes he is in danger. Suppressive fire can also fix the enemy in place or force him to move from a position. Commanders may employ non-lethal munitions, such as smoke or illumination, to create suppressive effects. The effect of suppressive fires usually lasts only as long as the fires are continued. Suppressive fire is both preplanned and employed reactively, as required.

(2) The three types of SEAD are listed as follows.
   (a) Physical lethal suppression.
   (b) Physical non-lethal suppression.
   (c) Psychological suppression.

c. Physical (Lethal or Non-lethal) Suppression

   (1) Physical suppression (incapacitation) is the degradation of performance of an individual or unit due to physical incapacitation such as death, injury, obscurcation, or other physical constraints. Neutralization is a result of physical suppression. Neutralization requires weapons effects to hit the target and cause damage to it. Neutralizing a target temporarily removes it from the battle.
   (2) Suppressive fire may precipitate enemy action, including return fire.
   (3) Physical suppression is accomplished with either lethal or non-lethal means. Physical suppression targets equipment or personnel and has the following purpose:
      (a) Destroy or damage equipment.
      (b) Kill or incapacitate weapon operators.
      (c) Force them to move.
      (d) Make them duck.
      (e) Obscure their vision.
      (f) Degrade their audio detection of aircraft (deafen).
      (g) Degrade their aim.

d. Physical Non-Lethal Suppression. The intent of non-lethal SEAD is to break the enemy’s warning, cueing, tracking or aiming portion of the kill chain.

e. Psychological Suppression. A psychological suppressive effect is created if the enemy is able to perceive he is under attack or has reason to fear attack. Suppressive fires must pose a creditable and perceivable threat by the enemy to achieve the desired effect. Psychological suppression can take the form of reasoned or unreasoned suppression.

   (1) Reasoned suppression instills the enemy with logical fear and trepidation and causes him or her to consciously choose a course of action. Reasoned suppression is used as a tactic to affect enemy movement based on a desired outcome. Use reasoned suppression to start or continue enemy movement in a desired direction (herding fire) or to stop or contain enemy movement (fixing fire). Achieve and maintain reasoned suppression by placing credible, dangerous fire
on or near the enemy every 10-20 seconds. This interval, and dramatic impact of high explosives, provides “reasoned suppression” of the enemy as the enemy is compelled to honor the threat. Reasoned suppression is also possible with radar, laser, visual, tracer, or other fires as long as the enemy knows he or she is under fire or, in the case of laser or radar designation, under weapons guidance. Reasoned suppression effectiveness usually diminishes over time and is dependent on enemy capabilities.

(2) Unreasoned Suppression instills panic in an undisciplined enemy or indigenous population. Unreasoned suppression renders the enemy ineffective; however, its effects are less predictable. Maximum surprise and violence of execution will maximize the shock effect of SEAD fires and maximize the potential to induce an unreasoned suppressive effect.

f. Suppression Considerations.

(1) Engage known or suspected enemy locations before they can affect friendly aircraft through preemptive targeting. Preemptive targeting of enemy SAFIRE systems maximizes tactical surprise and effectiveness. They can support either destructive or suppressive attacks. Whenever possible employ maximum stand-off systems such as J-SEAD, close air support, or artillery for preemptive fires. As approaching aircraft enter the danger close range of SEAD fires, shift the fires to avoid fratricide.

(2) During pre-mission planning, aimpoints are assigned to teams or individual aircraft for known or suspected SAFIRE threats along the route of flight and in the objective area.

g. Electro Optical (EO) and Audio Suppression.

(1) Physical suppression utilizes multi-spectral effects to delay the enemy’s ability to acquire friendly aircraft, and degrades his or her ability to accurately engage. Whether utilizing off-board or onboard weapons, full spectrum suppression is focused to achieve audio-visual suppression.

(2) Visual suppression disrupts the enemy’s line of sight (LOS) by:

(a) High explosive (HE) induced dust and smoke (day or night) and night flash blindness.

(b) White phosphorus (WP)/red phosphorous (RP) produced smoke (day or night).

(c) Illumination (flare) induced loss of unaided night vision (flash blindness) or night vision goggle shutdown.

(3) While flying en route, use HE-induced smoke and dust, and/or WP/RP smoke rockets to screen known or suspected enemy locations as illustrated in figure 19.
Figure 19. Electro-Optical (EO) SEAD TTP

(4) Degrade enemy audio detection and cueing capability with HE induced hearing loss.

Note: Carefully manage visual suppression in the engagement area. Obscuring the target may degrade friendly laser designation and possibly cause laser fratricide (backscatter or attenuation).

h. Suppression Consideration for Rockets.

(1) HE Point Detonating Rockets: The enemy may readily confuse HE rocket fire with artillery or mortar fire when the enemy cannot see or hear the attacking aircraft. The effectiveness of the suppression is based on the enemy’s perception. If the enemy perceives an artillery attack (effective SEAD), the enemy will seek cover. However a disciplined enemy that perceives an air attack may attempt to counter attack the aircraft. Long range self SEAD is required to produce this effect although less accurate. Further, a mounted enemy is less likely to hear the aircraft and believe he or she is receiving artillery fire.

(2) Flechettes: Accurate delivery of the M-255 Flechette rocket is excellent for attaining direct physical suppression against enemy air defenders, however, it has a significantly smaller signature in the target area than other weapon systems. A near miss does not produce a reasoned suppressive effect because the enemy may not detect the attack due to its subtle visual and auditory signature. The flechette does not provide audio, visual, IR, or EO suppression and is ineffective in breaking LOS.

i. Suppression Considerations. The following are suppression considerations for 20 millimeter (mm) high explosive incendiary (HEI), 25 mm HEI, 30 mm high explosive dual purpose (HEDP), and 40 mm HEI munitions. Engage suspected SAFIRE sites...
with gunfire at maximum range. The lack of tracers and flash suppression makes it very difficult to visually determine the source of incoming fire. The comparatively slow speed of the rounds means, at ranges beyond 2 kilometers (km), a dismounted enemy will hear the gunfire prior to the rounds impacting. It is possible to mask the sound of subsequent salvos with surface based HE detonations from previous salvos, through careful timing.


a. Small arms and rocket-propelled grenade (RPG). The enemy soldier is the critical element of the dismounted SAFIRE threat. Killing enemy dismounted soldiers is the most effective method of countering SAFIRE teams. When time does not permit the destruction of the small arms/RPG threats then all standard suppressive TTP are effective.

b. Armored Vehicles.

   (1) Physical Suppression. Tanks are invulnerable to all but purpose-built, anti-tank or armor defeating weapons. Only a limited number of weapon selections can result in physical destruction or physical suppression of tanks. Use standard non-lethal suppression techniques to break or deny the enemy’s line of sight with friendly forces.

   (2) Psychological Suppression. The protection of the tank’s armor makes the enemy soldier less vulnerable to reasoned psychological suppression. However, crews of vehicles equipped with defensive aids suites systems, such as laser detectors, are vulnerable to virtual suppression because they will react to the potential of lethal targeting.

c. Countering MANPADS and EO/IR SAMS.

   (1) Suppress known or suspected MANPADS or EO/IR SAM sites with preemptive targeting from standoff; preferably with off-board systems such as artillery, prior to WEZ penetration.

   (2) MANPADS rely on external, audio, or visual cueing to the target. Effective MANPADS suppression seeks to break audio or visual cuing. Regardless of cueing, all MANPADS require the gunner to see the target and carefully aim the MANPADS missile at it. In all cases, the missile guidance system must have an unobstructed view of the target until missile impact. This guidance system is the seeker head of an IR missile or the gunner/laser link on semi-automatic command to LOS systems.

   (3) MANPADS can be suppressed with rotary-wing aircraft cannons. It takes 10 seconds or less for the enemy to complete a MANPADS shot and 60 seconds to transition the nominal 3 km SAFIRE danger area at 100 knots. Therefore, six bursts on the target at 10-second intervals will deny the enemy MANPADS team an unmolested shot.

d. Urban Air Assault Objective Areas Suppression. Utilize pre-assault fires in the objective area to prevent the enemy from placing effective fires onto the air assault force. Figures 20 and 21 provide graphical depictions of pre-assault fires at the objective area.
1. Launch IR illum rockets at 3.5 km.
2. The M-255 flechette has an effective range of 1-3 km.
3. Employ flechettes to remove HMG, RPG, and MANPADS gunners from rooftops in objective area.

Figure 20. Urban Pre-Assault Fires (Attack Aircraft)

1. Use flechettes from attack aircraft to clear rooftops.
2. Assign desired means points of impact to assault helicopter doorgunners for air/landing phases based on threat and target building/landing zone layout.
3. Upon landing passengers should exit opposite primary doorgun arch of fire.

Figure 21. Urban Pre-Assault Fires (Lift Aircraft)
Background Information

Appendix E

URBAN CAMOUFLAGE CONCEALMENT AND DECEPTION

1. Traditional Camouflage
   a. Conventional camouflage systems are optimized to blend the target in with a natural environment. They are designed to make the protected target look like terrain or vegetation in all spectrums. Camouflage paints and nets have significantly evolved over the last several years.
   b. Urban camouflage may involve a geometric paint pattern, sophisticated multi-spectral nets or improvised camouflage of cardboard, tarps, sheets, and building debris.

2. Asymmetrical Stealth
   a. Asymmetrical stealth is the blend of camouflage and deception. Enemy forces may attempt to exploit our rules of engagement and fratricide reduction techniques by deliberately employing methods of blending in with friendly or neutral forces. Some military forces use uniforms nearly indistinguishable from American uniforms and employ copies of the M-16 rifle.
   b. The increase in world-wide urbanization has affected traditional camouflage systems. Previously, camouflage colors were selected to blend into surrounding vegetation, now some military forces use camouflage systems optimized to blend into an urban environment. The enemy desires to exploit US restraint and avoid targeting by making military equipment appear to be civilian in nature. Other nations may use military transport trucks with a commercial product logo and advertising depicted on the side with an additional “false skin” applied to the cab, externally transforming a military vehicle into an apparent commercial truck.
   c. The enemy also may use civilian equipment for military purposes. The most common example is the “technical”, a civilian pickup truck used as a mobile weapon’s platform. Enemy combatants in Iraq used modified civilian dump trucks as a type of improvised offensive fighting vehicle. Additionally, civilian vehicles are often used for hauling small-arms or vehicle-borne improvised explosive devices (VBIED). Technicals and VBIEDs are vulnerable to most aviation weapons but their high speed (up to 75 miles per hour/120 kilometers per hour/33 meters per second) can make them challenging to engage.
   d. VBIED sizes and effects, including required standoff when using helicopter delivered weapons to destroy VBIEDs, are shown in table 8.
### Table 8. Vehicle-borne Improvised Explosive Device (VBIED) Data

<table>
<thead>
<tr>
<th>Vehicle diagram</th>
<th>Vehicle description</th>
<th>Maximum explosive capacity</th>
<th>Lethal air blast range</th>
<th>Minimum evacuation distance</th>
<th>Falling glass hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="vehicle-diagram" alt="Compact sedan" /></td>
<td>Compact sedan</td>
<td>227 kilograms (kg) or 500 pounds (lbs) (in truck)</td>
<td>30 meters (m) or 100 feet (ft)</td>
<td>457 m or 1,500 ft</td>
<td>381 m or 1,250 ft</td>
</tr>
<tr>
<td><img src="vehicle-diagram" alt="Full size sedan" /></td>
<td>Full size sedan</td>
<td>455 kg or 1,000 lbs (in truck)</td>
<td>38 m or 125 ft</td>
<td>534 m or 1,750 ft</td>
<td>534 m or 1,750 ft</td>
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<tr>
<td><img src="vehicle-diagram" alt="Passenger or cargo van" /></td>
<td>Passenger or cargo van</td>
<td>1,818 kg or 4,000 lbs</td>
<td>61 m or 200 ft</td>
<td>838 m or 2,750 ft</td>
<td>838 m or 2,750 ft</td>
</tr>
<tr>
<td><img src="vehicle-diagram" alt="Small-box van" /></td>
<td>Small-box van</td>
<td>4,545 kg or 10,000 lbs</td>
<td>91 m or 300 ft</td>
<td>1,143 m or 3,750 ft</td>
<td>1,143 m or 3,750 ft</td>
</tr>
<tr>
<td><img src="vehicle-diagram" alt="Box van or water/fuel truck" /></td>
<td>Box van or water/fuel truck</td>
<td>13,636 kg or 30,000 lbs</td>
<td>137 m or 450 ft</td>
<td>1,982 m or 6,500 ft</td>
<td>1,982 m or 6,500 ft</td>
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<tr>
<td><img src="vehicle-diagram" alt="Semi-trailer" /></td>
<td>Semi-trailer</td>
<td>27,273 kg or 60,000 lbs</td>
<td>183 m or 600 ft</td>
<td>2,134 m or 7,000 ft</td>
<td>2,134 m or 7,000 ft</td>
</tr>
</tbody>
</table>

### 3. Deception and Decoys

Decoys are designed to force the shooter to waste time, combat power, and ammunition on non-valid targets. Decoys can range from very low to very high fidelity. On the low end, decoys range from a broom stick placed in a window to appear to be a light machine gun, to bifurcating smoke grenades leaving multiple hotspots in a smoke cloud to counter forward looking infrared targeting. High-end decoys provide a visible, infrared and/or radar signature to misdirect fire to areas of the enemy’s choosing or to dissipate probability of kill against primary targets.
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# GLOSSARY

## PART I – ABBREVIATIONS AND ACRONYMS

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<tr>
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<tr>
<td>AAA</td>
<td>antiaircraft artillery</td>
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<tr>
<td>ABF</td>
<td>attack by fire</td>
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<td>ACO</td>
<td>airspace control order</td>
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<td>ACP</td>
<td>air control point</td>
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<td>air defense artillery</td>
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<td>ADRP</td>
<td>Army Doctrine Reference Publication</td>
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<td>AFTTP</td>
<td>Air Force tactics, techniques, and procedures</td>
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<td>AGM</td>
<td>air-to-ground missile</td>
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<td>AIE</td>
<td>alternate insertion/extraction</td>
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<td>Air Land Sea Application [Center]</td>
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<td>APKWS</td>
<td>Advance Precision Kill Weapon System</td>
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<td>ARMS</td>
<td>aerial reconnaissance multi-sensor</td>
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<td>aircraft survivability equipment</td>
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<td>bomb rack unit</td>
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<td>Definition</td>
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<td>Combat Search and Rescue</td>
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<tr>
<td>CTAF</td>
<td>common traffic advisory frequency</td>
</tr>
<tr>
<td>DMPI</td>
<td>desired mean point of impact</td>
</tr>
<tr>
<td>DOD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>DVO</td>
<td>direct view optics</td>
</tr>
<tr>
<td>DZ</td>
<td>drop zone</td>
</tr>
<tr>
<td>EO</td>
<td>electro-optical</td>
</tr>
<tr>
<td>FAC(A)</td>
<td>forward air controller (airborne)</td>
</tr>
<tr>
<td>FARP</td>
<td>forward arming and refueling point</td>
</tr>
<tr>
<td>FLIR</td>
<td>forward-looking infrared</td>
</tr>
<tr>
<td>FM</td>
<td>field manual (Army)</td>
</tr>
<tr>
<td>FMU</td>
<td>fuzed munition unit</td>
</tr>
<tr>
<td>FP</td>
<td>firing point</td>
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<tr>
<td>fpm</td>
<td>feet per minute</td>
</tr>
<tr>
<td>ft</td>
<td>foot, feet</td>
</tr>
<tr>
<td>GLINT</td>
<td>gated laser intensifier</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning Systems</td>
</tr>
<tr>
<td>GRG</td>
<td>gridded reference graphic</td>
</tr>
<tr>
<td>HARM</td>
<td>high-speed antiradiation missile</td>
</tr>
<tr>
<td>HE</td>
<td>high explosives</td>
</tr>
<tr>
<td>HEDP</td>
<td>high explosive dual purpose</td>
</tr>
<tr>
<td>HEHF</td>
<td>high explosive high fragmentation</td>
</tr>
<tr>
<td>HEI</td>
<td>high explosives incendiary</td>
</tr>
<tr>
<td>HEI-P</td>
<td>high explosive incendiary-plugged</td>
</tr>
<tr>
<td>HE-P</td>
<td>high explosive-plugged</td>
</tr>
<tr>
<td>HIRTA</td>
<td>high intensity radio transmission area</td>
</tr>
<tr>
<td>HLZ</td>
<td>helicopter landing zone</td>
</tr>
<tr>
<td>HMG</td>
<td>heavy machine gun</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
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</tr>
<tr>
<td>ID</td>
<td>identification</td>
</tr>
<tr>
<td>IDS</td>
<td>integrated display system</td>
</tr>
<tr>
<td>IFF</td>
<td>Identification, friend or foe</td>
</tr>
<tr>
<td>IMC</td>
<td>instrument meteorological conditions</td>
</tr>
<tr>
<td>IP</td>
<td>initial point</td>
</tr>
<tr>
<td>IPB</td>
<td>intelligence preparation of the battlefield</td>
</tr>
<tr>
<td>IR</td>
<td>infrared</td>
</tr>
<tr>
<td>ISR</td>
<td>intelligence, surveillance, and reconnaissance</td>
</tr>
<tr>
<td>JDAM</td>
<td>Joint Direct Attack Munition</td>
</tr>
<tr>
<td>JMEM</td>
<td>Joint Munitions Effectiveness Manual</td>
</tr>
<tr>
<td>JP</td>
<td>joint publication</td>
</tr>
<tr>
<td>J-SEAD</td>
<td>joint suppression of enemy air defense</td>
</tr>
<tr>
<td>JPRC</td>
<td>Joint Personnel Recovery Center</td>
</tr>
<tr>
<td>JTAC</td>
<td>joint terminal attack controller</td>
</tr>
<tr>
<td>JWAC</td>
<td>Joint Warfare Analysis Center</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram</td>
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<tr>
<td>km</td>
<td>kilometer</td>
</tr>
<tr>
<td>kts</td>
<td>knots</td>
</tr>
<tr>
<td>LeMay Center</td>
<td>Curtis E. LeMay Center for Doctrine Development and Education</td>
</tr>
<tr>
<td>lb</td>
<td>pound</td>
</tr>
<tr>
<td>LGB</td>
<td>laser-guided bomb</td>
</tr>
<tr>
<td>LNO</td>
<td>liaison officer</td>
</tr>
<tr>
<td>LOAC</td>
<td>law of armed conflict</td>
</tr>
<tr>
<td>LOC</td>
<td>line of communications</td>
</tr>
<tr>
<td>LOS</td>
<td>line of sight</td>
</tr>
<tr>
<td>LZ</td>
<td>landing zone</td>
</tr>
<tr>
<td>MANPADS</td>
<td>man-portable air defense system</td>
</tr>
<tr>
<td>MARSS</td>
<td>medium altitude reconnaissance and surveillance system</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>--------------</td>
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</tr>
<tr>
<td>MCCDC</td>
<td>Marine Corps Combat Development Command</td>
</tr>
<tr>
<td>MCRP</td>
<td>Marine Corps reference publication</td>
</tr>
<tr>
<td>MEDEVAC</td>
<td>medical evacuation</td>
</tr>
<tr>
<td>METT-TC</td>
<td>mission, enemy, terrain, troops, time, civil considerations</td>
</tr>
<tr>
<td>MGRS</td>
<td>military grid reference system</td>
</tr>
<tr>
<td>m</td>
<td>meter, meters</td>
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<tr>
<td>mm</td>
<td>millimeter</td>
</tr>
<tr>
<td>MOUT</td>
<td>military operations on urbanized terrain</td>
</tr>
<tr>
<td>mph</td>
<td>miles per hour</td>
</tr>
<tr>
<td>mps</td>
<td>meters per second</td>
</tr>
<tr>
<td>MTTP</td>
<td>multi-Service tactics, techniques, and procedures</td>
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<tr>
<td>N-O</td>
<td></td>
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<tr>
<td>NAVSUP</td>
<td>Navy Supply Systems Command</td>
</tr>
<tr>
<td>NOTAM</td>
<td>Notice to Airmen</td>
</tr>
<tr>
<td>NTTP</td>
<td>Navy tactics, techniques, and procedures</td>
</tr>
<tr>
<td>NVD</td>
<td>night vision device</td>
</tr>
<tr>
<td>NVG</td>
<td>night vision goggle(s)</td>
</tr>
<tr>
<td>NWDC</td>
<td>Naval Warfare Development Command</td>
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<tr>
<td>P</td>
<td></td>
</tr>
<tr>
<td>PID</td>
<td>positive identification</td>
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<tr>
<td>PR</td>
<td>personal recovery</td>
</tr>
<tr>
<td>psi</td>
<td>pounds per square inch</td>
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<tr>
<td>PZ</td>
<td>pickup zone</td>
</tr>
<tr>
<td>Q-R</td>
<td></td>
</tr>
<tr>
<td>RMAX</td>
<td>maximum range</td>
</tr>
<tr>
<td>ROE</td>
<td>rules of engagement</td>
</tr>
<tr>
<td>ROVER</td>
<td>remotely operated video enhanced receiver</td>
</tr>
<tr>
<td>ROZ</td>
<td>restricted operations zone</td>
</tr>
<tr>
<td>RP</td>
<td>red phosphorus</td>
</tr>
<tr>
<td>RPG</td>
<td>rocket-propelled grenade</td>
</tr>
<tr>
<td>S</td>
<td></td>
</tr>
<tr>
<td>SAFIRE</td>
<td>surface-to-air fire</td>
</tr>
<tr>
<td>SAM</td>
<td>surface-to-air missile</td>
</tr>
</tbody>
</table>
SACLOS  semiautomatic command to line of sight
SEAD   suppression of enemy air defenses
sec    second
SOF    special operations forces
SoF    show of force

T
TAC(A) tactical air coordinator (airborne)
TLE    target location error
TNT    trinitrotoluene
TOF    time of flight
TOW    tube launched, optically tracked, wire guided
TRADOC US Army Training and Doctrine Command
TRP    target reference point
TTP    tactics, techniques, and procedures
TV     television

U
UAS    unmanned aircraft system
US     United States
USAF   US Air Force
USMC   US Marine Corps

V
VBIED  vehicle-borne improvised explosive device
VMC    visual meteorological conditions

W, X, Y, Z
WEZ    weapons engagement zone
WGS    World Geodetic System
WP     white phosphorus

PART II – TERMS AND DEFINITIONS

airspace control order — An order implementing the airspace control plan that provides the details of the approved requests for airspace coordinating measures. It is published either as part of the air tasking order or as a separate document. Also called ACO. (JP 1-02; SOURCE JP 3-52)

air tasking order — A method used to task and disseminate to components, subordinate units, and command and control agencies projected sorties, capabilities and/or forces to targets and specific missions. Normally provides
specific instructions to include call signs, targets, controlling agencies, etc., as well as general instructions. Also called ATO. (JP 1-02; SOURCE JP 3-30)

**close air support** — Air action by fixed- and rotary-wing aircraft against hostile targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the fire and movement of those forces. Also called CAS. (JP 1-02; SOURCE JP 3-0)

**close combat attack** — A coordinated attack by Army attack reconnaissance aircraft (manned and unmanned) against targets that are in close proximity to friendly forces. The close combat attack is not synonymous with close air support flown by Joint aircraft. Terminal control from ground units or controllers is not due to the capabilities of the aircraft and the enhanced situational understanding of the aircrew. Also called CCA. (ADRP 1-02; SOURCE FM 3-04.126)

**collateral damage** — Unintentional or incidental injury or damage to persons or objects that would not be lawful military targets in the circumstances ruling at the time. Such damage is not unlawful so long as it is not excessive in light of the overall military advantage anticipated from the attack. (JP 1-02; SOURCE JP 3-60)

**command and control** — The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission. Also called C2. (JP 1-02; SOURCE JP 1)

**danger close** — In close air support, artillery, mortar, and naval gunfire support fires, it is the term included in the method of engagement segment of a call for fire which indicates that friendly forces are within close proximity of the target. The close proximity distance is determined by the weapon and munition fired. (JP 1-02; SOURCE JP 3-09.3)

**datum (geodetic)** — 1. A reference surface consisting of five quantities: the latitude and longitude of an initial point, the azimuth of a line from that point, and the parameters of the reference ellipsoid. 2. The mathematical model of the earth used to calculate the coordinates on any map. Different nations use different datums for printing coordinates on their maps. The datum is usually referenced in the marginal information of each map. (JP 1-02; SOURCE JP 2-03)

**direct fire** — Fire delivered on a target using the target itself as a point of aim for either the weapon or the director. (JP 1-02; SOURCE JP 3-09.3)

**drop zone** — A specific area upon which airborne troops, equipment, or supplies are airdropped. Also called DZ. (JP 1-02; SOURCE JP 3-17)

**fire support** — Fires that directly support land, maritime, amphibious, and special operations forces to engage enemy forces, combat formations, and facilities in pursuit of tactical and operational objectives. (JP 1-02; SOURCE JP 3-09)

**forward-looking infrared** — An airborne, electro-optical thermal imaging device that detects far-infrared energy, converts the energy into an electronic signal, and provides a visible image for day or night viewing. Also called FLIR. (JP 1-02; SOURCE JP 3-09.3)
helicopter landing zone — A specified ground area for landing assault helicopters to embark or disembark troops and/or cargo. A landing zone may contain one or more landing sites. Also called HLZ. (JP 1-02; SOURCE JP 1-02)

indirect fire — Fire delivered on a target that is not itself used as a point of aim for the weapons or the director. (JP 1-02; SOURCE JP 3-01)

landing zone — Any specified zone used for the landing of aircraft. Also called LZ. (JP 1-02; SOURCE JP 3-17)

mission command — The conduct of military operations through decentralized execution based upon mission-type orders. (JP 1-02; SOURCE JP 3-31)

night vision device — Any electro-optical device that is used to detect visible and infrared energy and provide a visible image. Night vision goggles, forward-looking infrared, thermal sights, and low-light level television are night vision devices. Also called NVD. (JP 1-02; SOURCE JP 3-09.3)

night vision goggle(s) — An electro-optical image intensifying device that detects visible and near-infrared energy, intensifies the energy, and provides a visible image for night viewing. Night vision goggles can be either hand-held or helmet-mounted. Also called NVG. (JP 1-02; SOURCE JP 3-09.3)

positive control — A method of airspace control that relies on positive identification, tracking, and direction of aircraft within an airspace, conducted with electronic means by an agency having the authority and responsibility therein. (JP 1-02; SOURCE JP 3-52)

rules of engagement — Directives issued by competent military authority that delineate the circumstances and limitations under which United States forces will initiate and/or continue combat engagement with other forces encountered. Also called ROE. (JP 1-02; SOURCE JP 3-04)

Super-surface — Areas above ground level that consist of manmade structures such as buildings, towers, power lines, etc as well as natural features (hills, mountains, etc). (This term and its definition are applicable only in the context of this publication and cannot be referenced outside this publication.)

target — 1. An entity or object considered for possible engagement or other action. 2. In intelligence usage, a country, area, installation, agency, or person against which intelligence operations are directed. 3. An area designated and numbered for future firing. 4. In gunfire support usage, an impact burst that hits the target. (JP 1-02; SOURCE JP 3-60)

target reference point — An easily recognizable point on the ground (either natural or manmade) used to initiate, distribute, and control fires. Target reference points (TRPs) can also designate the center of an area where the commander plans to distribute or converge the fires of all his weapons rapidly. They are used by task force and below, and can further delineate sectors of fire within an engagement area. TRPs are designated using the standard target symbol and numbers issued by the fire support officer. Once designated, TRPs also constitute indirect fire targets. (MCRP 5-12A. SOURCE FM 3-90)

weapon engagement zone — In air defense, airspace of defined dimensions within which the responsibility for engagement of air threats normally rests with a particular weapon system. Also called WEZ. (JP 1-02. SOURCE JP 3-52)
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By Order of the Secretary of the Army

Official:

RAYMOND T. ODIERNO
General, United States Army
Chief of Staff

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
1306703

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*Supersedes FM 3-06.1 / MCRP 3-35.3A / NTTP 3-01.04 / AFTTP 3-2.29, 9 July 2005.