ARMY, MARINE CORPS, NAVY, AIR FORCE

AUO

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

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MCRP 3-20.4
NTTP 3-01.04
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MULTI-SERVICE TACTICS, TECHNIQUES, AND PROCEDURES

FOREWORD

This multi-Service tactics, techniques, and procedures (MTTP) publication is a product of the Air Land Sea Application (ALSA) Center in accordance with the memorandum of agreement between the headquarters of the United States (US) 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.

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PREFACE

1. Purpose

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

2. Scope

This manual is a tactical-level document for planning and conducting aviation 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 executing tactical aviation support to urban operations. It promotes an understanding of the complexities of urban terrain, incorporating lessons learned into MTTP. This publication does not fully address all functions of airpower employment used in urban operations, as these topics are addressed in other appropriate joint and Service publications.

3. Applicability

This publication applies to all tactical-level commanders and their staffs that participate in aviation urban operations.

4. Implementation Plan

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

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

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

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5. User Information

a. US Army Combined Arms Center; USMC, TECOM; NWDC; Curtis E. LeMay Center for Doctrine Development and Education; and Air Land Sea Application

[1] Marine Corps PCN: 144 000088 00

(ALSA) Center developed this publication with the joint participation of the approving Service commands. ALSA will review and update this publication as necessary.

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

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

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SUMMARY OF CHANGES

ATP 3-06.1/MCRP 3-20.4/NTTP 3-01.04/AFTTP 3-2.29, *Multi-Service Tactics, Techniques, and Procedures for Aviation Urban Operations*.

This revision:

Updates:

- Describes small unmanned aircraft systems (SUASs).
- Replaces fratricide terminology with friendly fire.
- Updates space support terminology.
- Changes night vision goggle terminology to night vision devices.
- Updates considerations for personnel recovery operations.
- Expands convoy security communications planning considerations.
- Simplifies sensor posture techniques.

Removes:

- AC–130 attack techniques, as these assets are organic to special operations forces, not necessarily aviation urban operations.
- Outdated rotary-wing tactics, techniques, and procedures with urban pre-assault fires and air movement.
- Outdated or not applicable references.
- Collateral damage methodology mitigation techniques removed as it is nonspecific to aviation urban operations.
- Discussion of history, intent, and priority with intelligence, surveillance, and reconnaissance (ISR) in the urban environment.
- Munitions versus acoustic warning chart as it is nonspecific to aviation urban operations.

Adds:

- Implications of employing and avoiding SUASs in an urban environment.
- Table depicting the different groups of unmanned aircraft systems.
- Considerations for humanitarian assistance and disaster relief missions.
- Description of ISR tactical controllers.
- Considerations for electromagnetic interference.

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

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EXECUTIVE SUMMARY

AUO

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 executing tactical aviation urban operations.
- Applies to all elements of force planning and conducting aviation urban operations, including commanders, planners, aircrews, and ground personnel requiring aviation support.

Chapter I
The Urban Environment

Chapter I provides a detailed description of the urban environment, including the components of the urban environment, the areas and zones within an urban environment, and the types of structures.

Chapter II
General Planning Considerations

Chapter II discusses areas of concern when planning operations in the urban environment, including intelligence, command and control, airspace usage, reference techniques, and rotary-wing, tiltrotor, and fixed-wing operations.

Chapter III
Urban Aviation Missions

Chapter III discusses a range of aviation missions in support of urban operations. These include intelligence, surveillance, reconnaissance, escort, aviation fire missions, air assault, air movement, medical missions, rescue operations, humanitarian assistance, and disaster relief operations.

Chapter IV
Weapons Employment

Chapter IV discusses specific considerations for weapons employment in the urban environment. This includes targeting, marking, weapon selection, collateral damage considerations, and friendly fire considerations.

Appendix A
Urban Camouflage, Concealment, and Deception

Appendix A provides an overview of common urban camouflage techniques.

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Chapter I
The Urban Environment

1. The Nature of the Urban Environment

a. This publication addresses planners' and tactical operators' unique considerations for conducting aviation operations within topographically complex areas and the adjacent natural terrain, where man-made construction or the density of population are the dominant features.

b. Analysis of conflicts involving state-actor militaries shows that ill-equipped enemy forces may successfully use the complex nature of urban combat to overcome disadvantages in technology, numbers, and firepower. Urban terrain inherently favors the defense.

Urban Growth

"Humanity is now a predominantly urban species. Urbanization will likely continue to increase into the foreseeable future, with some 60% of the global population living in cities, usually near oceans, by 2035."

SOURCE: Joint Operating Environment 2035;
The Joint Force in a Contested and Disordered World
Joint Chiefs of Staff, Washington D.C., 14 July 2016

c. Man-made structures and the population density in urban terrain affect tactical options available to commanders and aircrews. These man-made structures mask the true number of occupants. Analyzing and understanding daily routines and traffic patterns of each urban environment enables aviation operations without unnecessary disruption of societal interconnectedness.

d. The sheer density of the urban environment increases the complexity of planning and execution. For example, a one-block radius may include mixed-use skyscrapers, tunnels, utilities, traffic, infrastructure, and an extremely diverse population. Expect adversaries to use urban terrain for cover and concealment.

2. Components of the Urban Environment

a. The three components of urban environments are terrain (natural and man-made), society, and supporting infrastructure. The particulars of these components vary from one urban area to another. Knowledge of these components is important for planning and executing operations in an urban environment.

b. Urban terrain has four categories: airspace, supersurface, surface, and subsurface as illustrated in figure 1. All aspects of urban terrain require careful analysis during planning.

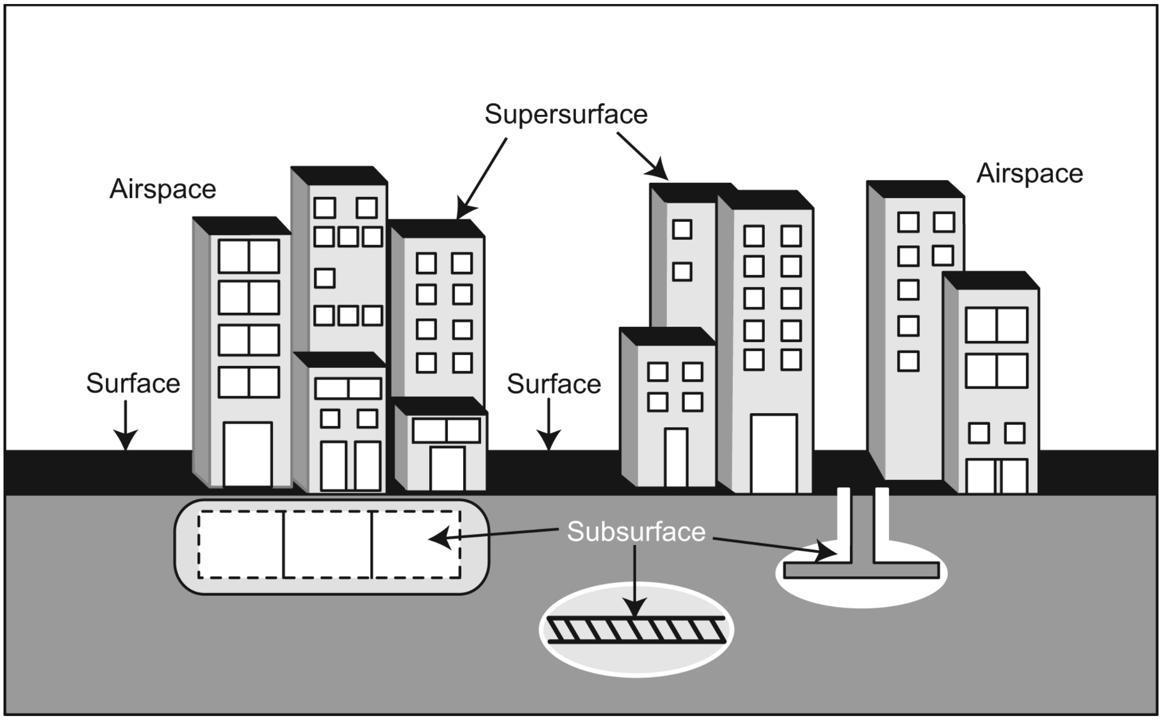


Figure 1. Urban Terrain

(1) Airspace. Urban-area airspace may be congested due to civilian air traffic operating under the host nation's air traffic control system. Planners should identify all risks associated with operating among civilian air traffic and deconflict air operations to mitigate risk and to reduce disrupting air traffic. Planners should develop letters of agreement and emergency security control of air traffic procedures with host nations to operate within the airspace. With the proliferation of small unmanned aircraft systems (SUASs), planners and aircrews should be aware of and account for emerging aviation technology (e.g., commercial off-the-shelf, swarm technology) employed in the airspace by friendly and enemy forces and commercial users with no direct involvement in the conflict.

(2) Supersurface. The supersurface is the area above ground level (AGL) consisting of man-made structures (e.g., buildings, towers, and power lines). The enemy can use the supersurface for cover, concealment, movement, and fighting positions. The supersurface provides the enemy excellent fields of view for antiaircraft defenses and can restrict friendly observation, communication, and weapons employment. Additional supersurface considerations include:

(a) The supersurface can block radio transmission and video downlink. Ground personnel, including joint terminal attack controllers (JTACs), must understand the supersurface can restrict line of sight (LOS) communications.

(b) The supersurface contains urban canyons, which can cause weapons delivery restrictions (i.e., the podium effect). The depth, length, and width of urban canyons varies based on the supersurface composition. See chapter 4 for more details.

(c) The height of structures within the supersurface can limit aircraft maneuvers and air-to-ground approach vectors.

(3) Surface. The surface is everything at ground level including streets, alleys, open lots, and parks. Normally, the surface is the maneuver space for ground forces.

(4) Subsurface. The subsurface is the area below ground level consisting of sewers, drainage systems, subway tunnels, utility corridors, basements, bunkers, or other subterranean spaces. This space can be used for cover, concealment, and movement. Refer to Army Techniques Publication (ATP) 3-21.51, *Subterranean Operations,* for more information on the subsurface environment. The enemy's knowledge of the subsurface may provide an advantage.

(a) Communication is degraded from aviation assets to the subsurface due to LOS obstruction, distance below the surface, and construction materials.

(b) Planners should consider using weapons capable of creating penetrating effects when engaging subsurface targets. However, consider the weapons effects to critical infrastructure (e.g., building foundations, power lines, gas lines, and water lines) prior to employment.

(c) Ground forces can identify entrances and exits to subsurface sites, which allows air assets to observe, disrupt, or destroy the enemy's use of subsurface areas.

c. Society. Joint Publication (JP) 3-06, *Joint Urban Operations*, states "The commander should keep in mind the overall objectives regarding the civilian populace: to minimize civilian interference with military operations, minimize mission impact on the population, and observe the necessary legal, moral, and humanitarian obligations toward civilians." Commanders should consider the population of an urban area as a center of gravity. Commanders should consider the societal and cultural implications of conducting operations in urban environments. For more information, see JP 3-06.

d. Supporting Infrastructure. Destroying, controlling, or protecting vital parts of 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 unintended consequences, particularly against the population.

3. Urban Areas

a. Urban areas are composed of more than one municipality; and large municipalities often have subordinate political units. Planners should identify and consider the boundaries of these political units. Planners should analyze civil considerations in terms of areas, structures, capabilities, organizations, people, and events (ASCOPE), which is outlined in ATP 2-01.3, *Intelligence Preparation of the Battlefield*. ASCOPE aligns with an urban area's overlapping components of terrain, society, and supporting infrastructure.

b. The most important characteristic of an urban area is its population. While there is no standard of population size for the various types of municipalities, for the purposes of this publication, urban areas are defined as seen in table 1.

Table 1. Population Breakdowns		
Area	**Description**	**Population**
Homestead	Single-family house, with associated buildings, in a rural area.	Under 25
Settlement	Small community or grouping of houses in a rural area.	25 to 100
Village	Small community incorporated as a municipality in a rural area.	100 to 2,500
Town (Rural)	Densely populated urban area incorporated as a municipality and surrounded by rural terrain.	2,500 to 100,000
Town (Urban)	Densely populated urban area incorporated as a municipality and part of a larger urban area.	2,500 to 100,000
City	Large, densely populated urban area incorporated as a municipality that may be part of a larger urban area.	100,000 to 1 million
Metropolis	Very large, densely populated urban area consisting of several cities and towns.	1 million to 10 million
Megalopolis (or megacity)	Huge, densely populated urban area consisting of several large cities and towns.	Over 10 million

4. Urban Zones

Most cities contain distinct zones, which are identified by geography. Normally, these zones are categorized by the predominate activity within their boundaries. Some typical urban zones are shown in figure 2. Planners can help reduce collateral damage (CD) by identifying population variances throughout the day (depending on the zone).

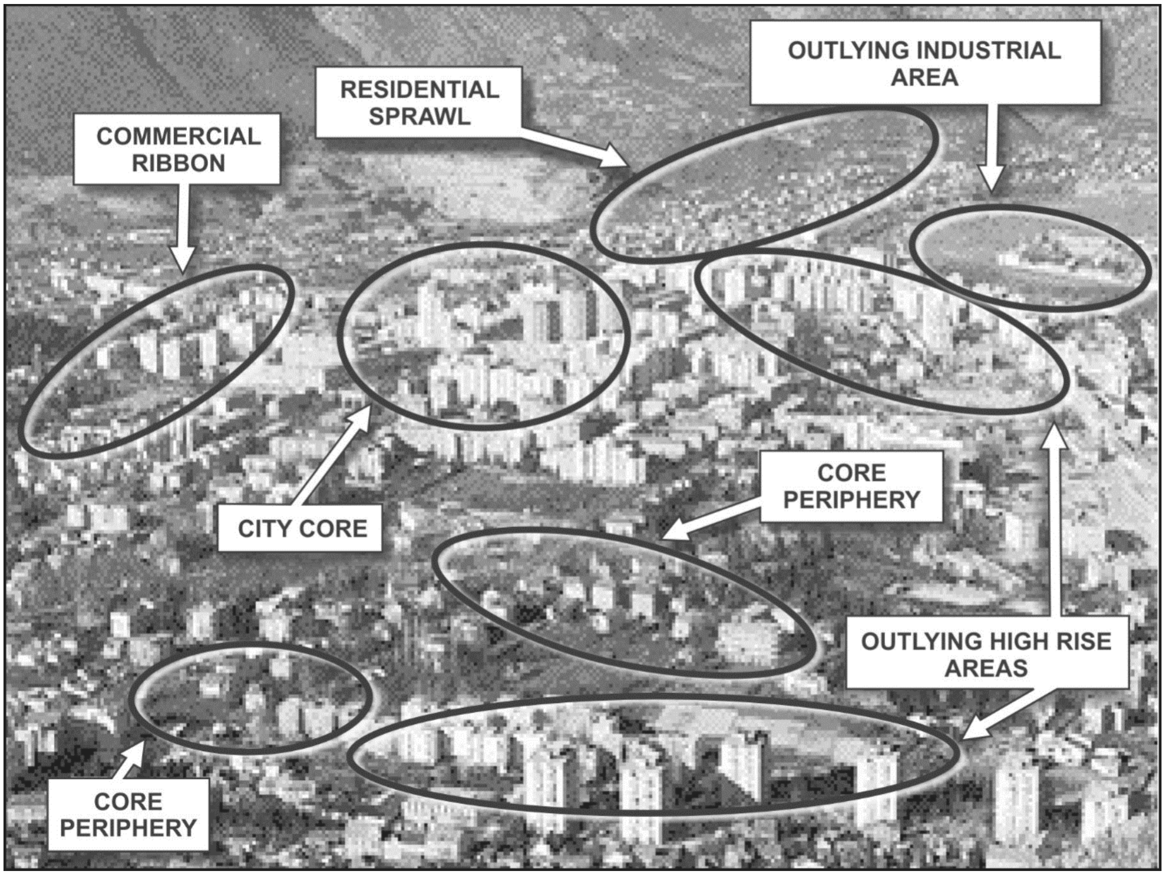


Figure 2. Urban Zones

a. City Core. The city core is the heart of the urban area (the downtown or central business district). It is relatively small and compact, but contains a large percentage of the urban area's shops, offices, and public institutions. Normally, it contains the highest density of supersurface and subsurface areas. In most cities, the core has undergone more recent development than the core periphery. As a result, the two regions are often quite different.

b. Core Periphery. The core periphery is located at the edges of the city core. Normally, the core periphery consists of streets 12 to 20 meters wide with continuous fronts of brick or concrete buildings. The building heights are fairly uniform; 2 or 3 stories in small towns and 5 to 10 stories in large cities.

c. High-rise Residential Areas. High-rise residential areas are typical modern construction in large cities and towns, consisting of multistory apartments, separated open areas, and single-story buildings. Their wide streets are normally in rectangular patterns. These areas are often contiguous to industrial or transportation areas or interspersed with close, orderly, block areas.

d. Commercial Areas. Commercial areas provide goods and services to the neighborhoods that surround them and to the city as a whole. Specific activities include buying and selling goods and services in retail businesses, wholesale businesses, and financial establishments.

e. Industrial Areas. Industrial areas are generally on or along major rail and highway routes in urban complexes. It is important to identify the type of industrial activity and the presence of toxic industrial materials that can affect operations in these areas.

f. Military Areas. Military areas are concentrated areas where the military operates and may include several types of fortifications or be part of a fortified line.

g. Low-rise Residential Areas. Low-rise residential areas consist of row houses or single-family dwellings with yards, gardens, trees, and fences. Street patterns are normally rectangular or nonlinear. Residential zones are typically subdivided by income or culturally important factors, such as ethnicity or religion.

h. Strip Areas. A strip area is a small urban area built predominately along a transportation route, such as a road or river (figures 3 and 4). The strip area may stand alone or link to nearby, larger urban areas. Strip areas often afford covered avenues of withdrawal to the flanks once an attacking force deploys and before the security force becomes decisively engaged.

Figure 3.   Strip Area in Farmland

Figure 4. Strip Area Near River

i. Shantytowns. Shantytowns are areas composed of low-income or unemployed elements of the population living in poorly constructed or older buildings in various states of decay (figure 5). Most towns and villages in developing countries have shantytowns, which are often in multiple zones throughout an area.

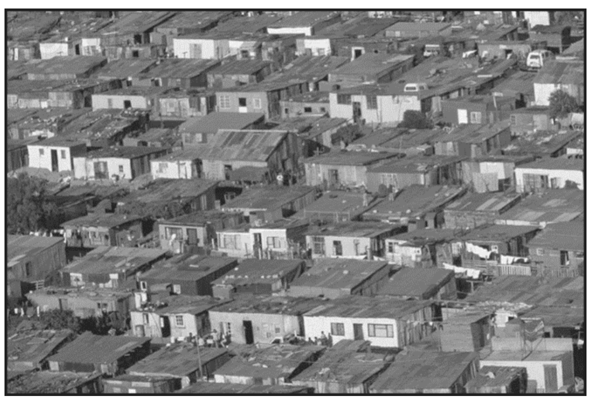


Figure 5. Shantytown

(1) Structures within shantytowns are made of readily available materials, such as cardboard, tin, adobe, or concrete block. These less structurally sound buildings have no common floor plan and often have only one room. Weapons fired in or at a structure may penetrate the walls of one or more adjacent structures and endanger friendly forces as well as noncombatants. There is also an increased risk of uncontrolled fires due to the flammability of the building materials.

(2) Armored vehicles may knock down and traverse most shantytown structures easily, without significantly affecting mobility. However, their destruction may cause unacceptable civilian casualties. Narrow pathways may also constrict mobility of vehicles in shantytowns. These unique characteristics increase the risk of friendly fire incidents and civilian casualties. Commanders should consider

the effects of their operations in this type of area based on the previous factors discussed.

5. Structures

a. Commanders and leaders should be capable of identifying the basic characteristics of buildings and be able to understand the effects of weapons against those buildings within their area of operations (AO). This enables commanders to give clear instructions concerning mission execution and assists leaders in choosing the appropriate effects to accomplish their missions.

b. In addition to billeting enemy troops, the city also accommodates the businesses, government, noncombatants, schools, and similar functions critical to the normal operations of the city. Minimizing CD reduces the hardships within the city and leads to a faster return to normalcy. Planners and personnel must abide by the applicable rules of engagement (ROE), and all other applicable laws, in the targeting process. Questions about the legality of targeting any structure (whether inhabited or uninhabited) should be referred to the appropriate legal advisor. Planners and decision makers should consider proportionality, military necessity, and the effects of physical infrastructure destruction or reduction on the information environment.

6. Characteristics of Buildings

Planners should consider the following characteristics while executing aviation urban operations: function, size, height, materials, exterior openings and floor plans, and typical distribution of buildings.

a. Function. The most important characteristic is the reason for the building, its function. The four categories of building functions are:

(1) Residential. Residential includes single-family and multifamily housing.

(2) Public and Civic. Public and civic include government buildings, schools and gyms, airports, bridges, parks and plazas, and stadiums.

(3) Commercial. Commercial includes hotels, restaurants, and retail stores.

(4) Mixed-use. Mixed-use includes a combination of commercial and residential buildings.

b. Size. The four sizes of buildings are small, medium, large, and massive. These four sizes have no firm dimensions and are often relative to the building's function and the size of other structures in the surrounding urban area. Residential buildings, particularly single family homes, are categorized separately from other structures. For this publication, square footage for each of the four building sizes are the following.

(1) Small buildings are less than 2,000 square feet in size.

(2) Medium buildings are 2,000 square feet to 22,000 square feet (one-half of an acre).

(3) Large buildings are 22,000 square feet (one-half of an acre) to 44,000 square feet (1 acre).

(4) Massive buildings are greater than 44,000 square feet (1 acre).

c. Height. The height of a single floor varies slightly by locale, function, and construction method. However, individual floors, except for the first floor, are normally the same height throughout a building. For the purposes of this publication, 13 feet (approximately 4 meters) is the average height for a floor. The following are terms commonly used to refer to building height.

(1) Low-rises. Low-rises are 5 floors (65 feet) or below, often without an elevator.

(2) Mid-rises. Mid-rises are 5 floors (65 feet) to 11 floors (150 feet). Common international building codes generally require at least one elevator.

(3) High-rises. High-rises are between 12 to 37 floors high (160-490 feet). Most model international building codes require at least one elevator, as well as stairs, in all high-rise buildings.

(4) Skyscrapers. Skyscrapers are taller than 500 feet (150 meters) or 37 floors. International building codes generally require skyscrapers to have at least two protected elevators and sets of stairwells that span the height of the building.

d. Materials. Knowing a building's materials and basic method of construction is important in urban operations. Leaders and planners should understand the basic effects that weapons cause on structures. Leaders should also understand the likelihood of fires starting or spreading and the potential effect the fires will have on thermal-imagery, other night-vision devices (NVDs), and the health of Service members and the local population. The following are four categories of building construction materials.

(1) Wood. Wood is normally limited in use do to its flammable characteristics when other less combustible materials are readily available in the construction of public, civic, and commercial structures.

(2) Masonry (brick, block, or stone). Masonry offers greater load-bearing capacity and fire resistance than wood. Brick is favored for residences, while block is favored for commercial purposes.

(3) Reinforced Concrete. Reinforced concrete is a major structural material in most buildings. It is used in most foundations and is commonly used as support columns, exterior walls, interior walls, and roofs. Reinforced concrete is very strong, resistant to wind and tremors, and provides weatherproofing. Due to its hardness and reinforcing steel bars, it is difficult to breach.

(4) Steel or Metal. Steel or metal is a major structural material in most framed buildings. Many public, civic, and commercial structures use steel frames because of large spans and future required flexibility.

e. Exterior Openings and Floor Plans. Exterior openings and floor plans vary by building function, size, material, and height. The height and function of a building can establish distinct common trends. Most buildings limit the number of exterior openings due to privacy requirements, temperature control, and the higher cost of constructing these openings. This is especially true for the ground floor of residential buildings. For most commercial and service-oriented buildings, the ground floor tends to be open and inviting to attract entry. The following are other common trends based on the building's height and function. The following descriptions should be considered typical but, variations may be encountered.

(1) Residential Buildings.

(a) Low-rise wood and light-metal frame houses have a variety of floor plans. Interior walls are often semi-permanent and relatively easy to remodel. Direct fire munitions, shell fragments, and shrapnel easily penetrate both exterior and interior walls. Breaching an entry point through walls is fairly simple with an axe or electric saw. The roofs vary greatly from slight, even slopes to steep, multiple slopes. Like the walls, most roofs are easily breached.

(b) Low-rise masonry houses normally have similar floor plans on each floor. Exterior and interior walls are permanent and are not easily penetrated by direct fire munitions, shell fragments, or shrapnel. Breaching an entry point through a masonry wall requires explosives or an armored vehicle. Roofing material is often masonry, shale, or other rock-like materials, and the roof slant varies from flat to a high-angle slant. Breaching deeply slanted roofs or hard surface roofs is often difficult. Usually, a sledgehammer can breach flat roofs and a pry bar can breach slanted roofs.

(2) Public, Civic, Commercial, and Mixed-use Buildings. The ground-level floor plans of these buildings are usually different from the upper-level floor plans. The ground floor tends to support the primary purpose of the building, and a large section of the ground floor is often very open, possibly two or three stories high. Typically, rooms (offices) are adjacent to this large ground floor area. Exterior walls and interior load-bearing walls typically extend throughout all floors, reducing in thickness with each height level. These walls can be breached with explosives. Non load-bearing interior walls are of light construction and easily breached. Roofs are typically flat and can typically be breached with a sledge hammer.

(3) Low-rise and Mid-rise Reinforced-concrete Buildings. Reinforced concrete is relatively inexpensive and easily manufactured. It is used for many public, civic, commercial, and mixed-use buildings; and for multifamily, low-rise, and mid-rise apartments and condominiums. However, single-family residences are rarely made of reinforced concrete.

(4) Residential and Mixed-use Buildings.

(a) Normally, the ground floor of multistory, residential or mixed-use buildings are different from the upper floors. The floor plans of multistory reinforced concrete buildings usually are based on a centralized hallway, with stairways on opposite ends of the building. All four walls, load-bearing interior walls, and the roof are made of reinforced concrete. However, the ground floors of multistory buildings tend to include additional exterior openings and internal space.

(b) For a residential building or the residential upper floors of a mixed-use building, the floor plans of each residential floor (other than the ground floor) are usually similar. The only common exception to this is the penthouse floor, which tends to have larger sized residences. Additionally, the roofs of these buildings often have roof access doors. Normally, the best way to enter this type of building is through a door or a ground floor opening.

(5) Public-gathering Buildings. Public gathering buildings (such as theaters, auditoriums, and gyms) have large, open interiors. Normally, interior walls are often not reinforced concrete and are easy to breach or dismantle. The roofs, for aesthetic purposes, are often geometric and not easily accessible. Public gathering buildings are most common in dispersed residential and high-rise residential areas.

(6) Low-rise and Mid-rise, Steel-frame Buildings. Normally, steel frame buildings are recognized by the concrete beams and columns surrounding the steel and visible from the outside. The floor plans vary depending on the building's function. Additionally, the use of light or heavy cladding varies in terms of aesthetics and function. Light cladding includes glass and light metal coverings. Heavy cladding includes reinforced concrete and thick composite materials. The floors of these buildings are heavy and provide moderate overhead cover.

(7) Office and Residential Buildings. Normally, these buildings have three or four small offices or rooms connected to form an office group or residence. The offices have dimensions based on the distance between the steel columns and are connected to an interior hall, which is connected to stairs; and often, an elevator. Core rooms in framed buildings are much bigger than in other buildings. Light-weight materials used as partitions often subdivide the core rooms.

(8) Factories. Factories have large windows and open interiors, which favor the use of most weapons. Since the structures are often made to support heavy machinery, these reinforced surfaces provide good overhead cover.

(9) Commercial Buildings. Large commercial stores have large, open interiors. Steel fire doors, which are heat activated, often exist between sections of the buildings. Once closed, they are difficult to breach or force open, but they effectively divide the store into sections.

(10) Public and Civic Buildings. Public and civic buildings are rarely made to the height of a high-rise or skyscraper. However, public and civic services may be integrated into the lower floors of a high-rise or skyscraper.

(11) High-rise, Reinforced-concrete and Steel-frame Buildings and Skyscrapers. All high-rise buildings use a skeleton frame, and most have a central core containing two stairwells, elevators, and all other environmental support items. In some cases, lower floors of high-rise buildings use heavy cladding, while upper floors use light cladding.

f. Typical Distribution of Buildings. Certain types of buildings dominate certain parts of a city, which establishes patterns within a city. Analysis of the distribution and nature of these patterns directly affects planning and selecting weapons (figure 6).

Figure 6. Distribution of Building Types

(1) Urban zones and building types are interrelated. Residential areas predominately have low-rise framed or masonry buildings, while commercial and industrial zones have masonry and reinforced-concrete buildings. Availability of material and local culture determines which materials predominate. The central core usually contains the majority of high-rise, steel- and concrete-frame buildings. These multistory buildings occupy core areas (a city's most valuable land), usually the center of the city's economic and political power.

(2) Open space accounts for about 15 percent of an average city's area. Many open spaces are grass-covered parks, athletic fields, and preserves. Some are broad, paved areas. The largest open spaces are associated with suburban residential areas, where large tracts of land often act as recreation areas.

(3) Streets serving areas that consist of primarily one building type, normally, have a common street pattern. For example, high land values in downtown areas often result in narrow angular streets. Street widths are grouped into three major classes:

(a) Seven to 15 meters, located in older historical sections of pre-industrialized cities.

(b) Fifteen to 25 meters, located in newer, planned sections of most cities.

(c) Twenty-five to 50 meters, located along broad boulevards or set far apart on large parcels of land.

(4) Streets consist of varying types of materials (asphalt, cement, gravel, and stone) which have different load bearing capabilities and take varying amounts of

force to render impassable. It is also important to consider the 2nd and 3rd order effects of targeting road surfaces. Once destroyed they will be rendered impassable to everyone (friendly forces, enemy forces, and the civilian population).

g. Street Patterns.

(1) Street patterns within an urban environment can be attributed to deliberate design, natural features, man-made structures, and the changing needs of the inhabitants. Urban areas can have any or all of the seven patterns shown in figure 7.

(2) Street patterns influence all warfighting functions. For example, knowledge of street patterns and widths gives commanders and leaders a good idea of whether or not mounted mobility corridors permit movement and maneuver of wheeled or tracked vehicles, and facilitates command and control (C2) and sustainment operations.

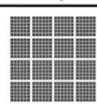
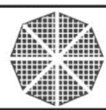
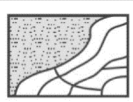
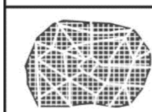
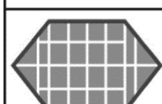
Shape	***Street Pattern***	***Effect***
	Rectangular or Chessboard	Grid-like streets with parallel streets intersected by perpendicular streets.
	Rayed	Streets fanning out at various angles from a given focal point and through less than 360 degrees.
	Radial	Primary thoroughfares radiating out from a central point, which may extend outward 360 degrees around the central point or within an arc from a point along a natural barrier, such as a coastline.
	Radial Ring	Loops or rings surrounded by successively larger ones that are usually found with larger radial patterns. Radial rings incorporate the elements of radial and ring or concentric designs.
	Contour Forming	Primary streets running parallel to control lines, with intersecting roads connecting them. Pronounced terrain relief influences construction of roadway along lines of elevation.
	Irregular	Irregular street patterns specifically engineered without geometric patterns for aesthetic or functional reasons.
	Combined Pattern	Any combination of those above.
	Linear Pattern	A primary thoroughfare running down the center with buildings on either side.

Figure 7. Urban Street Patterns and Effects

7. Aviation Operations in the Urban Environment

Aviation units are involved in a variety of operations in an urbanized environment (e.g., decisive action or stability operations). Employment of aviation assets enhances urban operations, but presents unique tactical challenges.

a. Aviation enhances urban operations by providing:

(1) Intelligence, surveillance, and reconnaissance (ISR).

(2) Security.

(3) Responsive and flexible resupply.

(4) Rapid troop movement.

(5) Rescue and evacuation of personnel and equipment.

(6) Precision fires in support of ground forces.

(7) The ability to quickly transition to new missions.

b. Tactical challenges of aviation urban operations are as follows:

(1) Physical Limitations.

(a) Enemy Advantages. The availability of obstacles, cover, concealment, and familiarity of environment (e.g., subsurface, surface, and supersurface) to complement defense and maneuver.

(b) Layouts. City layouts complicate traditional methods of military operations due to limited maneuvering space within the surface, supersurface, and airspace.

(c) LOS Issues. Operating within vertical construction or subterranean infrastructure limits LOS communications.

(d) Night Operations. Cultural lighting can degrade aircrews' NVDs, reducing their effectiveness and obscuring low-flying aircraft.

(2) Logistics and Medical Support.

(a) Urban operations require a flexible logistical support systems due to potential unit dispersion in nonconsolidated urban areas. Units may be required to inhabit multiple bases of operation as opposed to consolidated staging areas.

(b) A responsive and robust treatment and evacuation plan for casualties is critical.

(c) To meet casualty and evacuation requirements, plan to establish aid stations, ambulance exchange points, and landing zones (LZs) as far forward as the situation allows.

(3) Urban Population. The most difficult tactical challenge is the operators' ability to distinguish between combatants and noncombatants.

c. Commanders conducting operations on or against objectives located within or adjacent to complex urban topology should emphasize the following:

(1) Unified planning from concept through execution.

(2) A single, common set of standards (e.g., graphics, terms, and times) usable by all ground, naval, and aviation forces.

(3) C2 considerations requiring early integration and synchronization of:

(a) Spectrum management.

(b) Airspace management, with emphasis on SUAS employment and identification.

(c) Precision fires in the vicinity of civilian populations and noncombatants.

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Chapter II
GENERAL PLANNING CONSIDERATIONS

1. Introduction

a. A clear understanding of the commander's intent and ROE is imperative for mission planning and operations. Normally, the ground force commander is the supported commander for urban operations.

b. Operations in urban terrain follow traditional planning and execution concepts with additional, unique planning considerations, which include:

(1) Aircraft deconfliction in confined airspace.

(2) Operations in urban canyons.

(3) Urban terrain to include surface, supersurface, and subsurface development.

(4) The presence of towers, wires, and antenna hazards.

(5) The complications with target correlation in the supersurface and subsurface.

(6) Difficulty in threat detection and identification.

(7) A high concentration of noncombatants.

(8) Political, social, cultural, operational, and strategic considerations, which influence ROE.

(9) An increased potential for CD.

c. Urban operations require planners to have a thorough knowledge and understanding of key terrain (i.e., intersections, roads, bridges, hospitals, schools, and cultural, religious, and municipal buildings), flight routes, and flight hazards (i.e., towers, wires, and power lines). Space support personnel can produce a number of products to assist in the mitigation of unknown obstacles, such as recent unclassified satellite imagery that is releasable to coalition partners or the geographical view from a specific point and a virtual flythrough. These products can assist aircrews by minimizing the number of unknowns and for visualizing an objective area.

d. Due to high concentrations of civilians and potential concealment advantages, urban operations require a significant planning effort devoted to suppression of enemy air defenses (SEAD). However, planners must be aware that effective SEAD effects may be unattainable in urban environments. While this publication will not address the specifics of SEAD, planners must consider CD concerns for SEAD operations in an urban environment.

2. Joint Intelligence Preparation of the Operational Environment (JIPOE)

Planners face unique challenges when conducting JIPOE in an urban environment. Environmental variables and vertical development may preclude the effectiveness of overhead imagery systems (i.e., intelligence collection operations). Planning considerations for JIPOE in support of urban operations include the following.

a. Urban Terrain. Urban terrain presents the enemy unique cover and concealment requiring the detailed integration of multiple intelligence sources such as signals intelligence (SIGINT), human intelligence, and geospatial intelligence.

b. Hazards. Detailed analysis of flight hazards during mission planning is critical to safe flight operations and mission accomplishment. Flight hazards include:

(1) Physical Hazards. The majority of physical hazards within an urban area are man-made and include kites, antennas, wires, power lines, and other obstructions (e.g., trash and debris). Cluttered environments (e.g., lights, fires, smoke, and marking lasers) may make identification of enemy surface-to-air fires difficult.

(2) Environmental Hazards. These include impacts caused by meteorological effects conditions (e.g., haze, mist, dust, smog, precipitation, natural illumination, cloud cover, and winds), artificial illumination, turbulence caused by uneven convective heating, and unpredictable wind effects.

(3) Natural Hazards. These include mountains, hills, trees, and areas with high concentrations of birds.

(4) Air Traffic Hazards. A high volume of air traffic within urban areas include rotary-wing, tiltrotor, and fixed-wing aircraft, commercial and military SUAS, and civilian traffic. Missions employing SUASs, rotary-wing, or tiltrotor aircraft must consider vertical fields of fire for artillery, armor, and heavy machine guns. Furthermore, SUAS operations by friendly ground forces presents air hazards and must be integrated into airspace control planning.

(5) Electromagnetic Hazards. High-intensity radio transmission areas (HIRTAs) may adversely affect aircraft communication, navigation, and electrical systems. Planners should review the location and effects of known and suspected HIRTA sites. Electromagnetic hazards can include the enemy's use of Global Positioning System (GPS) jammers and spectrum interference from friendly jammers. Space operators can provide navigational accuracy predictions and plotting of known jammer effects to assist with planning considerations.

c. Enemy.

(1) JIPOE should account for surface and supersurface threats to ground forces. Such threats include the presence of snipers, improvised explosive devices (IEDs), explosive hazards, booby traps, subterranean fires assets, and high-energy laser pointers.

(2) Urban operations provide opposing forces with unique options for surface-to-air attacks against friendly aircraft and a complex threat for friendly forces. The predominant threats to aviation assets in an urban environment include:

(a) Small arms and machine guns. Weapons emplacement include supersurface (e.g., the upper floors of buildings and roof tops), ramps, and approach paths to airfields.

(b) Antiarmor rockets, such as rocket-propelled grenades (RPGs) and antitank guided missiles. These are readily available, inexpensive, and normally standard equipment at small-unit levels.

(c) Light-to-medium air defense artillery (ADA). Adversaries can employ light-to-medium ADA from ground sites, tops of buildings, in or near otherwise protected structures (e.g., areas selected due to friendly force ROE constraints), or mounted on civilian vehicles.

(d) Man-portable air defense systems (MANPADSs). MANPADs are small, allow for rapid engagements, and are easy to conceal.

(e) Tank guns and antitank guided missiles. These contain modern fire control systems that permit effective engagements against hovering or slow-flying helicopters.

(f) Commercial off-the-shelf SUAS. These SUAS can be weaponized or modified to carry military-grade munitions, can be employed alone or as swarms against ground forces and rotary-wing or tiltrotor aircraft while hovering, during takeoff and landing, or while refueling or rearming on the surface.

(g) Heavy ADA and surface-to-air missiles (SAMs). Normally, heavy ADA and SAMs require extended beyond LOS detection capabilities due to radar or system aiming requirements. Adversaries can employ them within urban boundaries.

(3) Every structure in an urban area is a potential enemy position. For example, enemy forces can establish a command post in a basement to take advantage of concealment and survivability.

(a) Surface obstructions and airspace coordinating measures over urban areas limit low-altitude aircraft maneuvering options while providing the enemy excellent opportunities for establishing ambush sites.

(b) Joint fires observers, JTACs, forward air controller (airborne) (FAC(A)) and aircrews should anticipate danger-close scenarios when planning urban operations. For more information, refer to JP 3-09.3, *Close Air Support*.

d. Friendly.

(1) Pilots of low-flying aircraft need to be aware of fields of fire from air and ground forces. Low-flying aircraft can inadvertently fly through fields of fire from dismounted troops (e.g., troops firing at roofs of buildings).

(2) Aircraft firing at enemy positions must ensure friendly forces are clear of weapons effects at the intended target.

(3) Two-way communication and accurate graphic control measures tied to identifiable terrain features increases the ability to synchronize aviation effects in support of ground force.

(4) A planner should consider the following civilian population issues:

(a) Population density.

(b) The ability to distinguish combatants from noncombatants.

(c) Neighborhoods and their characteristics.

(d) Patterns of life (e.g., religious practices, normal movements, and unique cultural characteristics).

(e) Cultural and historical significance of structures and areas.

3. Command, Control, and Communications Considerations

a. C2 Planning.

(1) A detailed, flexible, and redundant C2 plan alleviates the electromagnetic challenges associated with urban environments and enables uninterrupted communication.

(2) Vertical structures can limit or negate LOS radio communications.

(3) Natural disasters can degrade or damage preexisting C2 networks.

(4) Airborne C2 and radio relay support systems, rooftop retransmission systems, radios using high-power transmissions, and remote antennas may overcome some of the transmission problems.

b. Combined Arms Rehearsal. Joint operations in urban environments benefit from detailed combined arms rehearsals to synchronize effects. Combined arms rehearsals should include all aerial assets assigned or attached for the duration of the operation.

c. Pre-mission Briefing. Prior to each mission, planners brief and update the aircrews with the most current intelligence assessments to include friendly force updates.

d. Air Asset Deconfliction and Integration.

(1) Airspace control elements (e.g., Airborne Warning and Control System (AWACS), tactical air operations centers (TAOCs), and control and reporting centers (CRCs)) use both positive and procedural control methods to deconflict and integrate air assets above the coordinating altitude. Beneath the coordinating altitude, other airspace control elements (e.g., joint air-ground integration center), direct air support center, airspace information center, and JTACs) use procedural control methods to deconflict and integrate air assets.

(2) Other than Army attack aviation procedure missions, the JTAC, FAC(A), or air officer are the primary controllers for aircraft operating within their assigned AO.

(3) Due to the high density of air traffic (military and civilian) in the urban environment it is important to properly plan for airspace control through effective use of coordination measures, air defense measures and fire support coordination measures.

(4) Following natural disasters, both civilian and government aircraft can be present and not in communication with military airspace control elements.

(5) Aircrews should establish communications with ground maneuver elements as soon as possible while en route to the objective. Additionally, aircrews should establish communications with controlling agencies before crossing airspace boundaries.

e. Frequency Management.

(1) Saturation of the electromagnetic spectrum within the urban environment makes it essential to have a detailed frequency management plan for all voice and data spectrum users.

(2) Urban areas can reduce radio frequency availability for airborne platforms due to preexisting public safety and commercial aviation usage.

(3) Subordinate commands should deconflict all radio frequency assignments and requirements with the regional or area frequency manager.

4. Contested and Congested Cyberspace and Electromagnetic Spectrum Considerations

Commanders and staffs face the challenge of enabling joint, interorganizational, and multinational collaboration while assuring access to critical data and information networks in increasingly congested and contested cyberspace domain and electromagnetic environment while simultaneously denying the same to the enemy. Operating in congested and contested information environment requires commanders and their staffs to synchronize signal, cyberspace, and electromagnetic warfare capabilities through cyberspace electromagnetic activities. Cyberspace and electromagnetic activities must be planned, integrated, and synchronized with cyberspace and electromagnetic warfare operations in support of unified land operations.

5. Congested Airspace

a. A dense, three-dimensional, urban environment creates challenges in planning and executing airspace control. Planners should synchronize aviation assets and ground fires into the ground scheme of maneuver. 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 close air support (CAS) simultaneously, resulting in multiple aircraft operating within the same airspace.

b. Planners should determine the necessary minimum airspace required for a mission. Allocating minimum airspace allows more missions to fly in dense airspace but can hinder tactical execution and threat reaction options. Airspace control planning considerations must include:

(1) Host nation civil operations, foreign military airspace requirements, other governmental agencies, and civilian agencies.

(2) Boundaries for participating and nonparticipating aircraft operating in the AO.

(3) Airspace control plan, air tasking order, and airspace control order for deconfliction and synchronization of aviation assets, which may include multinational air assets.

(4) Positive control procedures. Refrain from using see and avoid or sense and avoid as a primary deconfliction measure. Visual detection is difficult in the urban environment.

(5) Communication procedures for aircraft to alert friendly ground forces of impending dangers (e.g., low passes, full-motion video (FMV) flight paths, and infrared (IR) pointer usage).

c. Holding and Assembly Area Techniques.

(1) Avoid loitering over urban terrain at low altitudes due to threats and physical hazards.

(2) Plan for in-flight contingencies to use rally points or holding areas.

(3) Select assembly or holding areas using the same considerations required when selecting helicopter LZs forward arming and refueling points (FARPs), and air-delivered ground refueling (ADGR) sites.

(4) Consider concealment, presence of friendly ground forces for security, and protected facilities for personnel and equipment.

d. Unmanned Aircraft System (UAS) Considerations.

(1) SUAS.

(a) SUAS are recognized as group 1 and 2 unmanned aircraft (UA) and its supporting ground control elements. These can be operated autonomously or remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload. Some Services include group 3 as SUAS. See table 2 for more information about UAS categories.

(b) Many SUAS are not capable of positive control. Many of the coordination measures and basic deconfliction methods (e.g., time, lateral, altitude, or combination thereof) used to procedurally control manned aircraft can be used to control SUAS. Planners must take into account most SUAS ground control stations do not allow the operator to program a large number of navigation waypoints, some allowing four or less. Simple routing of SUAS transiting the battlespace (e.g., paralleling roads, train tracks, power lines, lower transit altitudes, etc.) may help manned aircrew avoid SUAS collisions avoid airspace congestion.

(c) It is generally the low, slow, and smaller UASs (Groups 1, 2, and some 3) that pose a challenge to detect, track, identify, and engage. New capabilities are being developed to counter these systems and must be considered and integrated into the overall air defense plan.

(2) Remotely-piloted Aircraft (RPA). The Air Force refers to its groups 4 and 5 UASs as RPAs to differentiate its operators who have been trained to similar standards as manned aircraft pilots.

Table 2. UAS Categorization Chart				
UA Category	Maximum Gross Takeoff Weight (pounds)	Normal Operating Altitude (feet)	Speed (knots indicated airspeed)	Representative UAS
Group 1	0-20	< 1,200 AGL	100 knots	Wasp III, RQ-14A/B, Buster, Nighthawk, RQ-11B, FPASS, RQ-16A, Pointer, Aqua/Terra Puma
Group 2	21-55	< 3,500 AGL	< 250	ScanEagle, Silver Fox, Aerosonde
Group 3	< 1320	< 18,000 MSL	< 250	RQ-7B Shadow, RQ-15 Neptune, XPV-1 Tern, XPV-2 Mako
Group 4	< 1320		Any Airspeed	MQ-8B Fire Scout, MQ-1C Gray Eagle, MQ-1A/B/C Predator
Group 5	> 1320	>18,000 MSL	Any Airspeed	MQ-9 Reaper, RQ-4 Global Hawk, RQ-4N Triton
Legend AGL—above ground level FPASS—force protection airborne surveillance system MSL—mean sea level UA—unmanned aircraft UAS—unmanned aircraft system				

(3) Route Planning. Planners must consider UAS lost-link contingency procedures. The pilot or operator should announce a lost-link condition over tactical chat and the common air battle net as soon as the tactical situation allows. This announcement should include the immediate contingency actions the UAS will take in its lost-link condition. Consider using airspace control elements (e.g., AWACS, TAOC, and CRC) to relay a lost-link situation.

6. Operational Planning Products

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

(1) Maps with a large scale provide greater detail for urban mission planning and execution than small-scale maps.

(2) 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, the current joint standard, and Tokyo Special). Different datum can cause significant confusion, position errors, and lead to friendly fire incidents.

Note: Planners should ensure operational planning products are discernible from 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 are identified. This is a shared responsibility for aircrews, intelligence personnel, and operations staff 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-Intelligence Agency and the airspace control element which publishes known flight hazards, such as notices to airmen.

c. Common Operations Graphics.

(1) Due to the constantly changing nature of the urban environment, it is especially important for participating units to have common operational graphics pertaining to the mission. Version control of paper and electronic mission products (i.e., maps, graphics, gridded reference graphic (GRG), etc.) is critical to planning and execution. Joint force, theater, or organizational standard operating procedures are typical documents where common terms and graphics are defined for the area of interest.

(2) Depicting objectives and phase lines on common graphics illustrates the ground force commander's scheme of maneuver and established control measures.

7. Urban Grids and Reference Techniques

a. It is essential for all forces to use the same reference system and GRG. Ground maneuver elements use a terrain-based reference system during urban operations because they allow for quick correlation between air and ground assets.

b. Planners can overlay a grid reference system to most urban areas to produce the GRG. One technique uses the military grid reference system (MGRS) while the second uses a simple grid system. Both techniques use a number to identify each building, and code the corners of buildings to expedite fires. Target handover to the aircrew is simply the location from the grid system and a brief target description.

c. The MGRS coordinate system allows joint planners to efficiently produce the required GRG for an entire AO. It provides easy plotting, that is, distance and reference determination for air and ground elements. For example Grid 96, 33 in figure 8 references the position marked by the X.

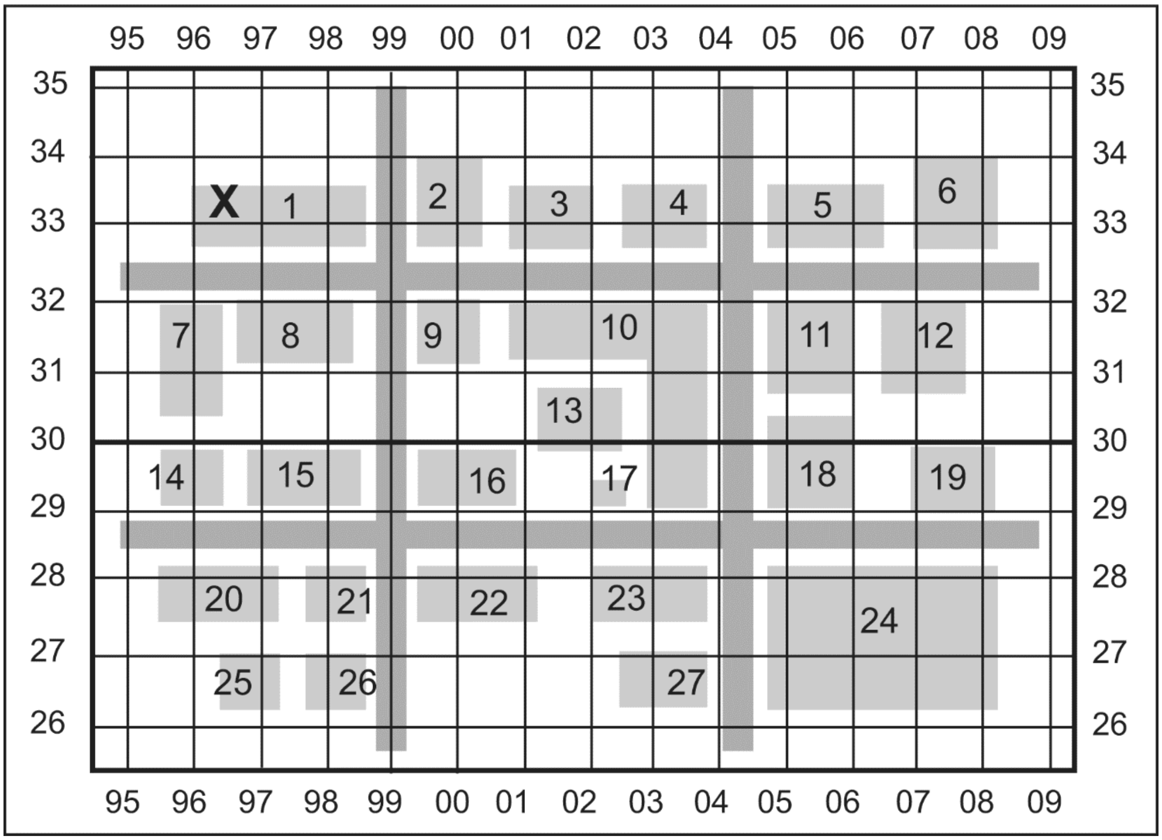


Figure 8. MGRS GRG

d. The simple grid system technique is useful when the objective area is not aligned with a north-up orientation or the objective area is small and requires additional detail. The scale of the grid should relate to distances common to urban engagements while making it usable as a quick reference. Label each grid and building in a consistent, sequential manner. For example, B3 in figure 9 references the position marked by the X.

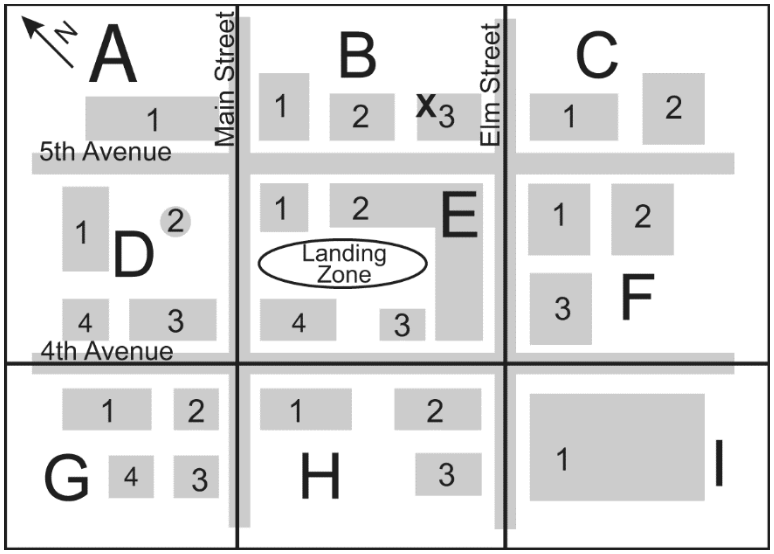


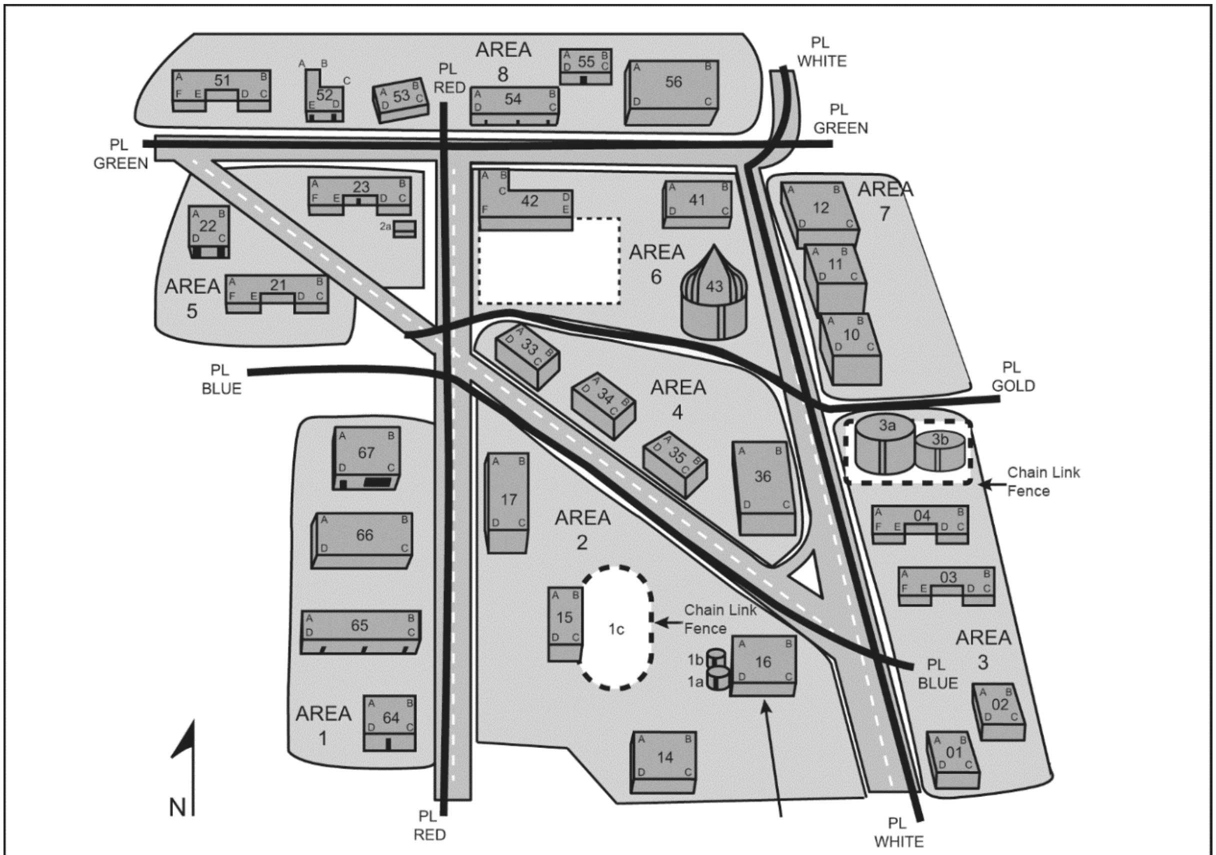
Figure 9. Urban Sector GRG

e. The GRG is the supported ground force commander's product. The commander is responsible for disseminating it to supporting units, appropriate joint agencies, and subordinate commands. Graphics should include version numbers, a point of contact, phone numbers, and email addresses so the issuing organization can ensure it controls the versions and operators use the latest update. Graphics should also include date and time that the product was published to ensure that planners and operators are using proper documents.

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

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

h. Figure 10 is an example of reference areas. Reference areas are created by intersections of roads or by other dominant geographical features. For nonlinear road structures in some cities, this type of system may be useful.



Legend:
PL—phase line

AREA 1:
64 = Factory Office
65 = Warehouse
66, 67 = Factories

AREA 2:
14 = Fire Station
15 = Sports Complex
16 = Sewage Treatment Plant
17 = Municipal Building

AREA 3:
01, 02, 03, 04 = Apartment Complexes
03a, 03b = Grain Storage

AREA 4:
33, 34, 35 = Private Residences
36 = Hotel/Restaurant

AREA 5:
21 = Fire Department
22 = Public Library
23 = University
2a = University Outbuilding

AREA 6:
41 = Post Office
42 = School and Playground (Chain Link Fence)
43 = Religious Building

AREA 7:
10, 11 = Apartment Complexes
12 = Shopping Center/Super Market

AREA 8:
51 = Hospital
52 = Pharmacy/General Merchandise
53 = Unoccupied Building
54 = Medical Facility/Medical Offices
55 = Printing Press Office
56 = Printing Press/Storage

Figure 10. Urban Operations Sketch

i. Planners and operators use objective area and target reference point (TRP) techniques to identify targets when given a fixed point, distance, and direction. Preplanned TRPs have multiple uses to coordinate fires, but not all TRPs are suitable for use as a target reference system when coordinating CAS. The supported unit and the supporting aircrew must recognize the TRP, or known point, which is either preplanned or agreed to on site. Figure 11 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 11 provides an example of a CAS 9-line excerpt using the objective area reference-grid technique.

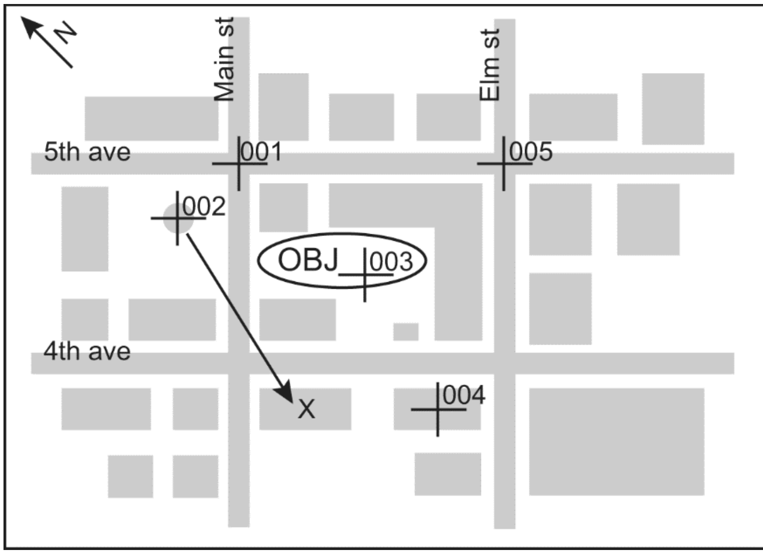


Figure 11. Target Reference Point Technique

j. Building marking techniques give the aircrew a specific location in reference to a building or fixed structure. In figure 12, all building sides are numbered clockwise starting with the front. In figure 13, the floors, windows, and openings of the structure are labeled numerically (floors) and alphabetically (windows, openings). Number the floors starting with the ground floor and ascending to the top floor. Windows and openings are assigned letters, beginning with A, and are labeled from left to right. The lettering sequence starts over with each floor, ensuring all windows, openings, and obvious holes or breaches are assigned the appropriate letter. This technique may also incorporate a direct description (i.e., the window to the right of the flames).

Note: Any numbering or labeling method can be used as long as agreed upon and easily understood by all participants (e.g., colors, phase lines, and cardinal directions).

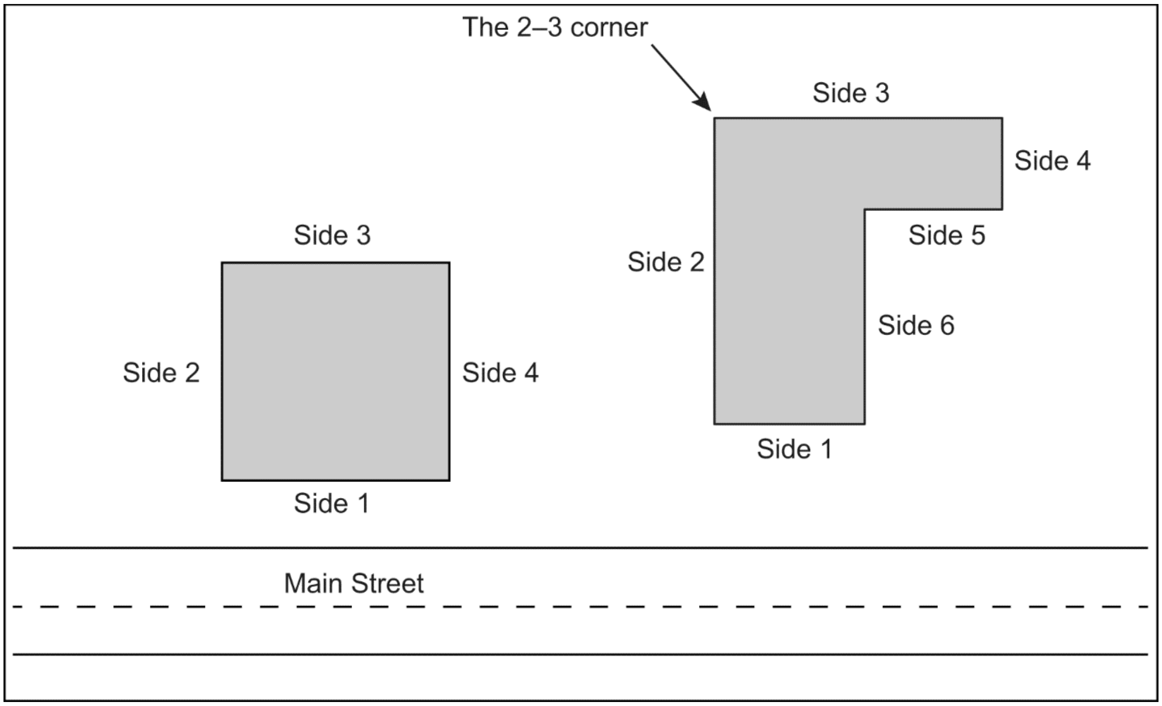


Figure 12. Building Wall (Side) Naming Convention

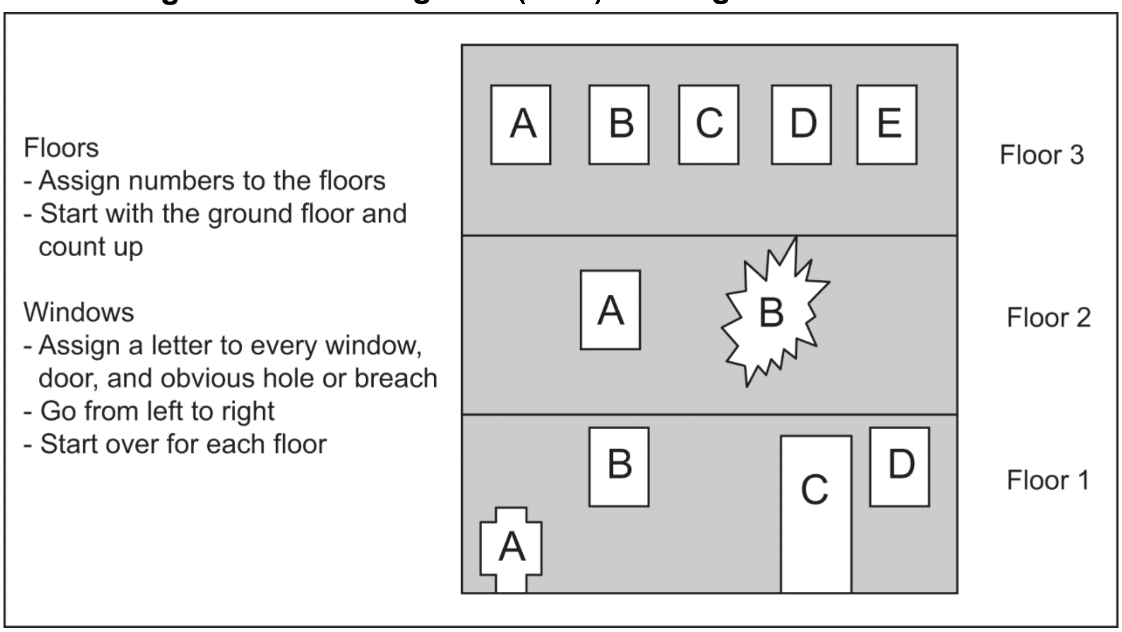


Figure 13. Floor and Window Naming Conventions

8. Urban Flight Techniques

a. Commanders should evaluate the tactical situation and weigh the requirements for tactical surprise. While low flight profiles increase surprise, they can increase the risk of controlled flight into terrain or obstacles. Conversely, while high profiles may enhance early enemy detection, they may lower the risk of enemy fire with small arms.

b. Factors to consider when determining flight profiles include:

(1) Tactical mission.

(2) Risk assessment and mitigation.

(3) Terrain relief and building height in and around the flight path.

(4) Density of structures.

(5) Accessibility and security of high rooftops.

(6) Dominant natural terrain around the urban area.

(7) Integrated air defense system.

(8) Small arms, MANPADS, SAMs, RPGs, and laser pointers, which are easily concealed and operated from multiple urban vantage points.

(9) Aircraft survivability equipment.

(10) Aircraft defense or survivability tactics, techniques, and procedures.

(11) Audible signature.

(12) Terrestrial lighting.

9. Urban Navigation

a. Challenges in Urban Terrain.

(1) A high concentration of structures.

(2) A variety of geographical references.

(3) Increased cultural lighting.

(4) LOS interference.

(5) Changing landscapes due to combat operations.

(6) GPS and spectrum jamming.

b. Mitigation Methods.

(1) Familiarity with the characteristics of urban terrain and clearly identifiable landmarks for navigation.

(2) The use of GPS reduces problems associated with night navigation and orientation. IR pointers, markers, or laser target designators may reduce the problems associated with orientation and target identification.

(3) Effective navigation over large towns and cities requires using a variety of navigational systems and techniques discussed in the following paragraphs.

c. Navigation Techniques. Man-made 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 highways.

(1) Linear features, such as major highways, rivers, railways, canals, and coastlines, provide easily recognizable boundaries and references to assist aircrews in maintaining orientation.

(2) Prominent rail and highway interchanges are useful as en route checkpoints. However, these areas are high risk for enemy activity.

10. Drop Zone (DZ) Techniques

a. DZ operations in urban terrain require extensive planning due to limited availability of suitable sites. Surface obstructions, availability of alternate DZs, and positive identification (PID) of the primary DZ make airdrop operations difficult in the urban environment.

b. Parks, roads, railroad yards, airfields, athletic stadiums, and industrial storage sites are examples of possible locations for airdrops.

c. Positive control of personnel near the DZ or concealing the DZ until immediately before use, reduces the possibility of injuring civilians.

11. LZ Considerations

a. Studying city composition, imagery, and maps provides a good foundation for choosing LZs. However, selecting a LZ from only a map of the urban environment is not recommended because of the rapidly changing environment. Special considerations in an urban environment include enemy disposition, suitability, environment, and obstacles.

b. Review current imagery to accurately assess LZ size and hazards. Ground photos can provide valuable 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. Reference a LZ planning guide. See table 3 for LZ size requirements.

Table 3. Helicopter and Tiltrotor Landing Zone Considerations

Aircraft Type	Landing Zone Size (Length x Width) Feet		Remarks
	Single Ship	Two Ship	
AH-1/64	100 x 100	200 x 200	Narrow footprint; requires a smooth, flat surface.
A/OH-6, H-6	65 x 65	130 x 130	Require a smooth, flat surface.
H-47	120 x 120	240 x 240	Large rotor wash.
H-53	200 x 300	300 x 400	Large rotor wash.
H-60	100 x 100	200 x 200	Large rotor wash.
UH-1	100 x 75	150 x 150	Requires a 25 foot clearance from the helicopter.
CV-22	240 x 240 (170 x 170 visual conditions)	240 x 740	Significant rotor wash. Brown-out conditions should be anticipated. Numbers listed are for brown-out conditions.
MV-22	200 x 200 (160 x 180 night visual conditions)	600 x 600	
Notes: Service or unit standard operating procedures or aircrew proficiency may require adjusting the landing zone size.			

c. LZ Selection.

(1) Primary LZ. LZs should be easily identifiable and accessible from the air and ground. Most major cities have urban parks that may provide a suitable LZ. Other potential LZs include athletic stadiums, golf courses, and parking lots. Due to the limited number of suitable areas, planners should assume the enemy knows and will observe the majority of suitable LZs.

(2) Alternate LZ. Planners should use the same considerations and levels of detail when selecting alternate and emergency LZs.

(3) Load-bearing Structures. Some structures can accommodate helicopters landing on their rooftop, but planners cannot accurately determine the load bearing capacity through observation unless they are marked (i.e., existing rooftop helipads).

(4) Rooftop LZ Hazards. Roof clutter (e.g., antennas, satellite dishes, lightning rods, wires, furniture, and trash) can obstruct the landing area. Cultural considerations (e.g., building occupants sleeping on residential roof tops during summer months) should also be taken into account. Aircrews should expect unpredictable winds, turbulence, or vortices while flying in the urban environment. Mechanical turbulence will often be encountered near large heating, ventilating, and air conditioning and exhaust systems usually located on commercial and industrial building roof tops. Additionally, rooftop perimeter walls will amplify aircraft rotor downwash during landing. This will often create a pronounced suction effect, causing a rapid descent during the last few feet prior to landing. If not properly accounted for, the aircraft will land abruptly. Due to these conditions,

hover out-of-ground-effect power may be needed to conduct a safe roof-top landing, even when the crew is planning to conduct a maneuver which may only require in-ground-effect performance associated with flight in proximity of tall buildings.

(5) LZs should be placed as close as tactically feasible to the periphery of the urban area edge. Additionally, approach and departure directions should be planned in advance to minimize exposure to enemy fire.

(6) Urban environments create significant challenges for LOS communications and aircraft might need to establish communications at increased altitudes and sacrifice communications during final approach to the LZ. This can be mitigated using multi-ship operations or by using other airborne assets to relay communications.

(7) Tactical Considerations.

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

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

- Give special consideration to deconflict egress routes from geographically separated LZs supporting the same objective area.
- Light pollution associated with large cities can mask aircraft from one another in low illumination environments once aircraft are in the LZ.

(c) Balance the availability of suitable LZs and exposure to observation, direct fire, or ambush. Execution considerations include:

- Day operations allow for rapid ingress and egress, but facilitates observation and engagement by the enemy.
- Night missions offer improved concealment and LZ security, but may require slower airspeeds and an increased pilot workload.

12. Rooftop Insertion and Extraction

a. Due to varying load bearing capabilities of urban structures, aircrews may use a variety of rooftop insertion and extraction techniques. Additionally, the presence of hazards (e.g., antennas, wires, and fences) present challenges to safe operations. These techniques include:

(1) Remaining light on the landing gear after touchdown. This prevents structural damage or roof-top cave in under the loads of the landing aircraft. Unless landing on a rated helipad in which the load bearing capability is known, this technique should be used and emphasized for all rooftop landings.

(2) Hovering with a single skid or landing gear touching the structure.

(3) Performing a low hover.

(4) Fast rope and rappelling.

(5) Using rope ladders.

(6) Performing hoist operations (preferred for evacuation of civilians).

b. If more than one insertion and extraction element is required, consider using multiple insertion flight profiles to remain unpredictable and to avoid congestion at the objective area.

13. FARP Operations and ADGR

a. Assessment of potential FARP and ADGR locations are similar to the basic considerations for selection of LZs or pickup zones. Planners must consider the following when planning FARP and ADGR operations.

(1) The size to accommodate the refueling and rearming element and the number and type of aircraft using the FARP and ADGR.

(2) The number of FARPs and ADGRs required.

(3) Security requirements of FARPs and ADGRs to mitigate the risk from combatants during refuel and rearm operations.

(4) Ground entry and exit routes.

(5) Predominant winds and obstacles.

(6) Sufficient maneuver space to reposition, hover, and climb out for aircraft with limited power and heavy loads.

(7) Ingress and egress routes to FARP are clear of wires, towers, and antennas to facilitate a shallow landing into a confined area.

(8) Marshalling plans during normal and low-light visibility conditions for rotary-wing, tiltrotor, and fixed-wing aircraft.

b. FARP and ADGR locations should provide concealment from the surrounding terrain and buildings to facilitate securing potential ground entry and exit routes. Consider the use of sports stadiums or established airfields.

c. Consider normal and low-light visibility conditions at proposed FARP and ADGR sites before designing marshalling plans, especially when rotary-wing, tiltrotor, and fixed-wing assets are involved in the FARP and ADGR operation.

14. Environmental and Night Considerations

a. Environmental Concerns. Environmental concerns can include weather, lighting conditions, IR signatures, visibility, thermal reflection, and smoke or fog. For a detailed discussion of these conditions, refer to JP 3-09.3.

b. Weather. Weather conditions affect individual weapons systems differently. Inertial navigation and GPS-aided guidance systems are not affected by weather conditions. While GPS is not affected by terrestrial weather, its accuracy can be affected during times of increased and excessive solar and geomagnetic storm activity. See JP 3-09.3 for weather effects on CAS.

(1) Ceilings.

(a) Low ceilings can obscure high-rise rooftops and other physical hazards and obstructions (e.g., power lines, towers, or smokestacks).

(b) Low ceilings can deny aircraft the required time and altitude to obtain satisfactory ordnance delivery and avoid fragmentation.

(c) Artificial lighting with a low, overcast cloud condition may highlight aircraft to ground observers and adversely affect NVD performance.

(2) Visibility. Reduced visibility (due to smog, smoke, rain, fog, or dust) can degrade the performance of aircraft sensors and weapon system effectiveness.

(3) Winds. In urban areas, city structures affect wind patterns. High winds in an urban area may adversely affect the accuracy of low-altitude, unguided weapons because wind patterns are disrupted and funneled down streets and alleys.

c. IR and NVD Use.

(1) IR signatures are affected by the proximity of buildings and structures. Urban temperatures are generally higher than rural areas and can be 10 to 20 degrees higher than the surrounding environment. Thermal heating can adversely affect thermal sights and other IR sensors. In many cases, unaided vision is sufficient for some portions of target acquisition and engagement.

(2) Urban lights may overwhelm aircrew NVDs and render them useless for standard night formation tactics. Plans may need adaptation to allow for additional deconfliction. The presence of urban lighting may preclude the use of IR strobe lights as effective marking tools, as it can be difficult for aircrew to discern one particular light sources from a multitude of others.

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Chapter III
URBAN AVIATION MISSIONS

1. Introduction

Aircraft perform the same missions in urban environments as in other, more permissive areas. The primary difference is the aircraft's effectiveness in the urban environment. It is important for ground force commanders, planners, and aircrews to understand the capabilities and limitations of various aircraft to optimize performance and effectiveness.

2. ISR

ISR synchronizes and integrates the planning and operation of sensors, assets, and processing, exploiting, and dissemination systems in direct support of current and future operations.

a. Specific Urban Considerations.

(1) Urban environments contain significant clutter, which increases the time required to process information and produce intelligence. Real-time situational awareness (SA) gained from aircrew callouts, in response to onboard sensors or FMV, can aid the ground force commander in dynamic decision making.

(2) ISR altitude selection criteria for urban environments.

(a) Low altitudes may result in a greater chance of visual and audible detection. However, increased ambient ground noise may allow aircraft tasked with ISR to fly at lower altitudes without audible detection.

(b) Sensor fidelity increases as slant range decreases.

(c) Field of view decreases as slant range decreases.

(d) Low altitudes increase the effects of urban canyons and grazing angle.

(e) High altitudes reduce the clarity of three-dimensional characteristics.

b. Specific Employment Techniques.

(1) Tactical ISR provides the supported commander increased SA. Tactical ISR can provide direct communication between the aircrew and the ground force commander, which allows the commander to quickly adjust collection priorities.

(2) When utilized, the ISR tactical controller synthesizes planning, execution, and initial assessments for near real-time, tactical integration of airborne collection assets into the supported commander's scheme of maneuver.

(3) Tactical ISR has a direct link to an intelligence analyst who conducts real-time analysis for the ground commander or airborne sensor operator trained to exploit raw data. This quick analysis helps mitigate risk from threats and reduce friendly fire and CD concerns. It also enables the find, fix, track, target, engage, and assess kill chain.

(4) As early as possible, ISR aircrews should contact the supported unit to gather last-minute changes to the mission.

(5) Sensor Integration.

(a) Ensure all available assets and sensors are tasked to create an integrated sensor solution to meet the commander's intent and priorities. Sensor postures can be offensive, defensive, or neutral. See table 4 for more information.

Table 4. Sensor Postures	
Sensor Postures:	Used during patrols and convoys to provide sensor taskings.
Neutral	Lead aircraft's responsibility is the friendly force. Wing aircraft is primarily responsible for scanning the objective (or assigned checkpoint) and back to the friendly force.
Offensive	Both lead and wing aircraft concentrate on the objective.
Defensive	Lead aircraft's responsibility is the friendly force. Wing aircraft is responsible for sanitizing the route directly in front of the friendly force.

(b) IR markers might be difficult to observe due to cultural lighting. Also, consider podium effect, direction of observation, and urban canyon situations with IR markers.

(c) Planners should consider orbit geometry to maximize continuous sensor fidelity while maintaining safety to ground forces and aircraft.

(d) Electro-optical (EO) and IR sensors require unobstructed LOS with the objective. Other sensors (i.e., SIGINT, electronic intelligence, and synthetic aperture radar) may require a specific orbit pattern relative to the objective. The commander's priority for selecting collection sensors will determine the required orbit geometries.

(e) Tasking handover between air assets may be difficult and require more time in urban environments due to population density (e.g., vehicles and people), the homogenous nature of urban terrain, differing perspectives of aircrews, large vertical structures, and urban canyons.

3. Escort

Urban operations provide unique challenges to commanders in regard to planning and executing operations. The two primary escort operations in an urban environment are escort of airborne and ground elements.

a. Detailed planning in communications, datalinks, and FMV frequency management is required to integrate the escort and escorted forces. The three-dimensional urban environment may drive an increased information flow with the presence of obstacles, defensive positions, or local populace and its canalizing effect. The need for increased vigilance for threat protection, coupled with the ability of the threat to remain camouflaged in the urban terrain, make the task of threat protection difficult. Consider the threat posture and activity to determine routes, altitudes, and airspeeds during the planning process.

b. The responsibilities of the escorting aircraft include route reconnaissance, security, and actions on the objective. Some key elements must be identified, regardless of the escort platform. They are the route (primary and any alternates), key terrain, threat identification, fires coordination, and the objective. Planners should consider dividing the tasks of route reconnaissance and protection of the escorted force.

c. Convoy security planning considerations are very similar to airborne escort. The primary differences are the reduced maneuverability and speed of the escorted force. Whether dismounted or in vehicles, the urban environment provides unique challenges. It is difficult for escort aircraft to determine friendly positions and distinguish friendly forces from combatants, which will determine the altitude and flight profile to mitigate friendly fire incidents. The escorts and escorted force should consider:

(1) Primary and alternate routes.

(2) Primary, alternate, contingency, and emergency communication plans.

(3) Communications out plan.

(4) Location reporting contracts (e.g., friendly centric, objective centric, checkpoint centric, and common reference point centric).

d. If available, planners should integrate all available battle-tracking capabilities (e.g., blue force tracker-Joint Capability Release, Tactical Airspace Integration System, and Link 16). Battle tracking capabilities will increase SA and allow time to scan for threats, turn points, and alternate routes.

4. Aviation Fires in Support of Ground Forces

The application of aviation fires in support of ground forces can occur in any phase of combat operations. The ground force commander’s intent, the proximity of fires to ground forces, and the level of detailed integration will determine the types of fires required for an operation. See JP 3-03, *Joint Interdiction*, and JP 3-09.3 for more information.

a. When a multitude of potential targets are contained in an urban area, numerous platforms may conduct offensive operations within a congested airspace, depending on the size of the urban area. In congested airspace, planners must provide aircrews with airspace coordinating measures that provide effective deconfliction.

b. The urban environment provides excellent cover and concealment for a wide variety of enemy air defense systems, creates difficulty in locating targets, and increases CD risks, which can reduce the effectiveness of SEAD operations. If enemy air defense systems are prevalent in the urban environment, planners must create a detailed and integrated SEAD plan to protect threatened aviation assets.

c. CAS and Army attack aviation procedures in the urban environment present unique challenges to aviators. The proximity of friendly forces, enemy forces, and civilian population in urban environments demand detailed integration of aviation fires.

(1) A large concentration of ground units in a dense urban area may limit airspace allotted to each aircraft, reducing the ability to maneuver or react to threats.

(2) Battle tracking may be particularly difficult. The use of phase lines, TRPs, and GRGs can aid in maintaining SA as the operation moves through an urban area. Additionally, communication between ground and air elements may be difficult due to interrupted LOS. (See Chapter 2, General Planning Considerations.)

(3) Many aircraft are capable of transmitting FMV. JTACs or FAC(A)s can use aircraft to reconnoiter and engage targets outside the area of immediate engagement using FMV to confirm targets.

(4) Urban canyons will present challenges for employing weapons requiring extended trajectory paths. Three-dimensional attack geometry and weapon flight profiles should be considered for each attack. Urban canyons may limit available attack headings for aircraft. However, JTACs or FAC(A)s working with aircrews should attempt to vary ingress and egress flight paths to mitigate the threat to the attacking aircraft. Additionally, the commander may prefer to use precision-guided munitions in urban operations to minimize the risk of CD and friendly fire. However, determining target elevation, due to vertical structures, may be difficult. See Chapter IV, Weapons Employment, for more details.

d. Air Interdiction. While there are no specific urban characteristics that drastically alter the conduct of air interdiction missions, there are unique urban planning issues that must be considered for successful execution. Unlike CAS missions, air interdiction missions may require aircrews to determine resolutions for PID, CD, and ROE independently.

(1) An urban environment can degrade the aircrew's ability to accurately assess PID, CD, and ROE due to man-made structures, urban canyons, environmental concerns, and the civilian populace.

(2) An urban environment may present aircrews with an abundance of targets listed in a commander's intent and targeting priority guidance. A thorough understanding of the commander's target priorities, will allow aircrews to provide efficient battlefield effects in accordance with the commander's intent.

5. Air Assault

Air assaults are operations to engage and destroy enemy forces or to seize and hold key terrain using assault forces moved by rotary-wing or tiltrotor aircraft.

a. Capabilities. Air assaults allow friendly forces to vertically maneuver against the enemy over extended distances and engage enemy forces at unexpected times and locations. Air assaults allow friendly forces to bypass enemy forces and obstacles that would prevent or disrupt ground movement. Air assaults are useful in urban environments where a ground assault would be slow and risky due to canalizing terrain or would provide the enemy early warning of friendly actions.

b. Specific Urban Considerations.

(1) Available LZs may be limited, which will restrict the number of friendly forces that can be inserted at one time. Additionally, the enemy may be able to easily identify potential LZs and emplace obstacles or defensive positions to prevent or disrupt an air assault.

(2) Structures within the range of the LZ can provide cover and concealment for enemy forces. Buildings and obstacles around LZs may require aircrews to perform a slow, deliberate approach to landing, which can increase aircraft vulnerability to ground fire. These buildings also provide high points of observation and areas from which to engage rotary-wing and tiltrotor aircraft from above.

(3) Loose debris and poorly constructed structures may create a hazard when impacted by rotor wash, which could damage aircraft and injure personnel. The hazard is greater with larger aircraft.

c. Mitigation and Employment Techniques.

(1) Units must complete a deliberate reconnaissance of LZs, which may be more difficult and require more time due to obstacles.

(2) If the ground force commander requires simultaneous infiltration of a large force, LZs outside dense urban terrain may be enlarged, allowing more aircraft to land simultaneously.

(3) Aircrews should avoid overflight of urban terrain to reduce the risk of ground-to-air fire and reduce the enemy's response time to the air assault.

(4) Use pre-assault fires in the objective area to prevent the enemy from placing effective fires onto the air assault force.

6. Air Movement

Air movement operations involve using aircraft to move troops, equipment, and supplies. The same planning sequence and phases used for air assault operations apply to air movement operations. Typically, units conduct air movement operations to secured LZs. In these operations, aircraft are not necessarily task-organized with other members of the combined arms team. Using fixed-wing assets to conduct air movement requires a suitable landing area within the urban environment (e.g., airfield under friendly control, and road surfaces that would support fixed-wing operations).

a. Capabilities.

(1) Utility and cargo aircraft provide the commander the ability to move time-sensitive, mission-critical personnel and cargo rapidly to sustain continuous offensive and defensive operations.

(2) Air movement is useful when conditions of the urban environment restrict ground movement or when time is critical.

b. Specific urban considerations and mitigation techniques for LZ selection are addressed in chapter 2.

7. MEDEVAC and Casualty Evacuation (CASEVAC)

MEDEVAC and CASEVAC operations move wounded, injured, or ill persons from the battlefield, or other areas, to treatment facilities. MEDEVAC is conducted using dedicated medical platforms, properly marked and protected by the Geneva Conventions, and uses specially trained medical personnel and equipment to provide en route care. CASEVAC is conducted using general-mission aircraft with no medical markings or protections, and manned by crews who may not have specialized medical training. Even when CASEVAC can move a person to treatment faster, the risk of not having en route care could outweigh the time saved. Medical personnel should advise the commander on whether to use MEDEVAC and CASEVAC, but the availability of assets and medical personnel will dictate the method a commander decides to use. In the urban environment, the specific nature of these missions have the same considerations as air assault and air movement. See JP 4-02, *Joint Health Services*, for more information.

a. Specific Urban Considerations.

(1) MEDEVAC and CASEVAC operations in the urban environment will be constrained to limited numbers of suitable landing areas. This restriction necessitates detailed planning with ground forces. MEDEVAC and CASEVAC from the point of injury often is impractical.

(2) Noncombatant casualties are more likely to occur in the urban setting, so commanders must be prepared to use MEDEVAC and CASEVAC assets for noncombatant casualties. Evacuation priorities will dictate this requirement.

(3) Aircrews must understand the theater evacuation policy and medical rules of eligibility.

(4) Communication LOS Challenges. MEDEVAC and CASEVAC aircrews should be prepared to receive relayed communications from overhead aircraft, en route to an LZ.

b. Mitigation and Employment Techniques.

(1) When possible, MEDEVAC and CASEVAC crews should have a copy of the scheme of maneuver and operational graphics with marked patient collection points, ambulance exchange points, and potential LZs.

(2) Hoist-equipped aircraft can evacuate a casualty when landing is impractical, but extended hovering may put the aircraft at increased risk.

(3) Structures with flat roofs may be used as LZs, but aircrews should plan to execute an alternate extraction (i.e., one wheel, ramp, or light landing) if the roof cannot support the weight of the aircraft.

8. Personnel Recovery Operations

Personnel recovery in the urban environment presents multiple challenges. Evasion in the urban environment will be slow and difficult, depending on local populace support of friendly forces, enemy forces density, and urban density. Therefore, the isolated personnel (IP) may have to stay relatively fixed and the rescue force will have to recover

IP at their location. Visual acquisition by overhead aircraft will be difficult and increased time and effort to find the IP will be necessary. The urban environment can have significant sources of light and heat which may make crash site identification and IP observation difficult by overhead aircraft. Aircrew survival radios operate under low power and have LOS voice capability with GPS and satellite imbedded data capability. The vertical nature of the urban environment can limit the effectiveness of their functions.

a. The designated mission commander will determine whether to conduct an immediate or deliberate recovery. An immediate recovery is executed with the forces on hand and reduces the risk to the IP. A deliberate recovery is conducted with some level of preplanning and reduces the risk to the recovery force. The decision point should be identified in mission planning to reduce delays in execution. Factors to consider for making a recovery decision include:

(1) Number and condition of IPs.

(2) Surface, supersurface, and air threats.

(3) Fidelity of the IP's location.

(4) Proximity to friendly forces.

(5) Environmental factors.

b. As the number of aircraft and ground personnel increase, required planning and coordination increases. A recovery effort should be executed as soon as a suitable package can be assembled to increase the chances of a successful recovery and to mitigate risk.

c. Locating the IP in an urban environment can require a large force and multiple sensors due to the complexity of the urban environment.

d. If using an LZ, planners must consider the size of the LZ, the distance from the LZ to the IP's location, and threats.

e. Considerations for personnel recovery by ground forces:

(1) In a permissive environment, recovery of IP may be expedited by using friendly ground forces. However, in a contested or congested environment, recovery by ground forces may be significantly delayed.

(2) Ensure detailed coordination for fires and airspace control between the ground and airborne forces is complete and continuous until the end of the recovery mission. The urban environment exacerbates this requirement due to congested airspace and the density of ground forces (both friendly and enemy).

(3) Detailed frequency planning is required for effective communications. Consider ground force use of the combat search and rescue (CSAR) common frequency to begin this coordination in a time-critical environment. As a last resort, CSAR A and B frequencies may be used.

(4) Establish a geographical point at which the approaching ground force will establish communication with the on-scene commander and receive approval before proceeding into the recovery objective area.

f. Considerations for personnel recovery by air assets.

(1) The IP may lack communications.

(2) The IP's location may not be near suitable LZs.

(3) The on-scene commander must coordinate with the AO owner and designated airspace control element(s) to gain required fire support coordination measures and airspace coordinating measures, respectively.

(4) CD from the battle-space owner must be clearly passed and understood by the aircrew involved in the rescue.

(5) Until the IP is located, use all fires judiciously.

(6) Hoist-equipped aircraft can evacuate the IP when landing is impractical; however, extended hovering may put the aircraft at risk.

9. Humanitarian Assistance (HA) and Disaster Relief (DR)

HA and DR involve transporting life sustaining aid to displaced persons to alleviate suffering, and possibly rescuing or evacuating survivors from unsafe conditions.

a. Airspace Control. Normal air traffic services may be disrupted or degraded during HA and DR operations. Due to the high volume of rotary- and fixed-wing and tiltrotor aircraft involved, consider establishing flight following services, course rules, mandatory reporting areas, and frequency plans. Civilian SUAS may be operating without regard to ongoing operations and deconfliction plans. Additionally, during HA and DR, the military may not control the airspace over the operational area. In these situations, the military will have to coordinate with civil organizations for airspace access and control, potentially without the benefit of previous rehearsals or exercises. For example, over the continental United States, the Federal Aviation Administration will likely fulfill their normal role as the airspace controlling agency during HA and DR operations.

b. Local Authorities. Coordination with law enforcement, emergency medical services, and other local agencies should be considered to prioritize mission tasking and streamline communications. Imbedding liaison officers with aircrews or C2 elements enables real-time retasking of assets to maximize effectiveness.

c. Orientation. Natural disasters can flood roads, destroy landmarks, affect urban lighting, and otherwise alter the urban landscape. This can make orientation difficult for aviation and ground forces.

d. LZ Considerations.

(1) Maintaining security due to population size and distress levels.

(2) Damage of local infrastructure.

(3) Size and suitability of the LZ in the urban environment.

(4) Select alternate LZ if primary LZ is unavailable or fouled.

e. Domestic and Foreign Considerations.

(1) Defense Support of Civil Authorities (DSCA). DSCA is domestic support provided by Department of Defense forces, civilians, contractors, and component assets in response to request for assistance from civil authorities. For more information, refer to ATP 3-28.1/MCRP 3-30.6/NTTP 3-57.2/AFTTP 3-2.67/ CGTTP 3-57.1, *Multi-Service Tactics, Techniques, and Procedures for Defense Support of Civil Authorities (DSCA);* JP 3-28, *Defense Support of Civil Authorities*; or Department of Defense Directive 3025.18, *Defense Support of Civil Authorities*.

(2) Foreign HA. Department of Defense activities conducted outside the United States and its territories to directly relieve or reduce human suffering, disease, hunger, or privation falls under foreign HA. For more information see JP 3-29, *Foreign Humanitarian Assistance*.

10. Nonlethal Effects

Planners should consider using nonlethal effects to support operations in the urban environment. Determine the priority among denial, disruption, and exploitation operations to request support from appropriate liaison officers (e.g., the USMC SIGINT deconfliction officer, USAF non-kinetic duty officer, and the USA fires and effects coordination center). Planners should deconflict nonlethal effects with other operations.

a. Nonlethal effects planning considerations for the urban environment include:

(1) Desired geographic scope and target selection.

(2) Layering effects with other assets to deny, degrade, or exploit.

(3) Density and proximity of the civilian populace.

(4) Structural interference of signals.

(5) Method and frequencies used by friendly and enemy forces.

(6) Frequency spectrum saturation and interference.

(7) Integrated cyberspace effects.

(8) Integrated air defense system communication, sophistication, and doctrine.

These considerations can make the effectiveness of creating nonlethal effects unpredictable. Creation of nonlethal effects in an urban environment should attempt to minimize the negative effects within urban terrain. Aircrews may be required to employ nonlethal weapons at closer ranges than in nonurban environments.

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Chapter IV
WEAPONS EMPLOYMENT

1. Introduction

Considerations for aviation asset weapons employment during urban operations include target development, CD constraints, sensor management, and weapons delivery, marking, lasing, and sensor employment.

2. Target Development

a. The ability to identify and engage targets in an urban environment may be complicated due to the density and height of structures, the population, and the availability of cover and concealment. Aircrews must consider the secondary effects of striking dual-use targets and the impact to the civilian population (e.g., dams, bridges, and airfields).

b. Aircrews will have a limited engagement time from target identification to weapons employment because the enemy in an urban environment has the ability to quickly find cover and concealment and move to locations with a high CD concern.

3. Target Acquisition

a. Visual Acquisition.

(1) Daytime acquisition of urban targets can be hindered due to visual cue saturation and limited marking options.

(2) Nighttime acquisition increases marking options, but excessive light pollution can affect NVD capabilities.

b. Sensor-aided Acquisition.

(1) Planners and aircrews must consider the limitations of available sensors (e.g., IR, EO, and television (TV)) based on environmental factors, such as smoke, haze, and dust.

(2) The requirement for objective fidelity will drive the sensor employment altitude and standoff, which determines podium and urban canyon effects. These concepts will be covered in detail later in this chapter and are depicted in figures 14 and 16.

(3) IR systems may detect targets not visible using TV, EO, charge-coupled device, and direct-view optics systems. However, thermal crossover periods during sunrise and sunset will degrade IR systems by causing them to lose the contrast between two adjacent objects.

c. Ground Moving Target Indicator (GMTI) Radar.

(1) Proliferation of traffic on urban roads, highways, and intersections during daylight hours cause radar correlation and track difficulties.

(2) Vertical structure development can degrade radar acquisition due to masking and obstruction. When possible, align the radar sweep angle parallel to the direction of travel.

(3) A GMTI can be advantageous in areas or times of low traffic density (e.g., post-curfew hours or an evacuated population center) to conduct a large-area target search. Also, aircrews can use a GMTI in a focused area search for movement following lethal weapon employment in which the search area is obscured due to dust, debris, or haze (e.g., post-weapons engagement or after an IED explosion).

d. Tactical Data Links and Digital Data Sharing.

(1) Due to the proximity of fires to friendly forces in the urban environment, planners and operators must consider using all available tools to conduct battle tracking.

(2) Visual, EO, or IR constraints may drive an increased use of digital battlespace awareness tools (e.g., fully integrated data link, Link 16, hand-held tablets, variable message format). Using digital data sharing can increase target handover efficiency, identify sensor points of interest, and serve as a secondary communications option.

(3) The increase of electromagnetic interference in the urban environment can have detrimental effects on tactical data links and LOS communications. Consider using redundant communications via relay nodes or airborne controllers.

4. Marking Positions and Targets

a. When working in close proximity to friendly forces, positively identifying friendly positions and target locations is critical to preventing friendly fire incidents. Due to increased reliance on marking devices in the urban environment, all participants must understand the procedures for using the devices and their limitations.

b. Friendly Marking.

(1) Ensure marking methods are visible to air assets, compatible with fielded systems, and known by all personnel with friendly marking schemes and capabilities.

(2) Use radar and IR beacons to assist in identifying friendly ground forces in urban terrain. Standardized use of ground lighting, thermal contrast, and positional relationship of structures influence the effectiveness of these devices.

(3) Gated laser-intensifier tape, combat identification panels, and smoke present challenges and could be poor marking devices when used in the urban environment.

(4) Enemy tactics can reduce the effectiveness of visual markings. Consider using digital marking methods as an alternate means (e.g. Link 16 and blue force tracker).

(5) Friendly marking methods may compromise friendly locations.

c. Target Marking.

(1) Positive air-to-ground communications are essential to coordinate and authenticate markings.

(2) During high and low ambient-light conditions, significant urban shadowing from buildings can exist. Shadows may hide personnel and vehicular targets from ground forces and aircrews.

d. Nontraditional Marking. Ground forces may use unconventional methods (e.g., spray paint or bed sheets hung out of windows) to mark horizontal and vertical progress during building clearing operations.

5. Weapon Selection

a. The focus of weapons selection in an urban environment is to determine the correct type and quantity of lethal or nonlethal weapons required to achieve a desired effect on a target. Ground force commanders must articulate the desired effect for targets. Most lethal weapons are designed and built to create one or more of the following five effects:

(1) Blast. A blast destroys objects through sudden and violent overpressure due to the expansion of gases. This is not the primary effect against most tactical targets, but it is useful against buildings. The over pressure within the building may take down walls and have potentially lethal effects against personnel within the building.

(2) Fragmentation. The fragmentation effect is from high-velocity pieces of the munition casing that are propelled outward from the explosion. Normally, this provides the longest destructive reach from the point of detonation and is generally the most useful weapon effect.

(3) Armor Penetration. Armor-penetration weapons use shaped-charges or kinetic-energy penetration warheads to breach protective coverings, such as tank armor. Penetration generally results in subsequent effects of blast and incendiary inside the targeted vehicle or structure.

(4) Cratering. The cratering effect is achieved by delaying the fuse function until the weapon becomes buried in the target. Normally, cratering is intended for runways or critical transportation routes and may be used to delay or harass enemy forces. Cratering can significantly affect subsurface areas.

(5) Incendiary. Incendiary effects are created by intense heat, causing the surrounding material to burn or melt. Incendiary effects often are incorporated into attack plans as secondary effects.

b. Consider the following when choosing weapons in an urban environment:

(1) Hard, smooth, flat surfaces with 90-degree angles are characteristic of man-made targets. Weapons achieve maximum penetration from a perpendicular impact in all relative directions (e.g., azimuth and elevation).

(2) Due to aerial delivery parameters, munitions may strike an urban structure at an angle of less than 90 degrees and also may have an adverse azimuth angle. This can reduce the effects of munitions and increase the chance of ricochets.

(3) Direct-fire weapons may shorten the engagement time necessary for fleeting targets.

(4) Destroyed targets in an urban environment will cause various types of debris. Consider the debris effects on friendly, civilian, and enemy freedom of movement.

(5) Smoke, dust, and shadows mask targets, possibly making close-range targets indistinct. These effects, along with debris can inhibit the shooter's and observer's ability to observe round impact and conduct battle damage assessment, which may negatively affect the ability to reengage.

(6) Consider the effect of the weapon and the position of friendly, civilian, and enemy personnel in relation to the target.

(7) When attacking personnel inside structures, select weapons based on the desired effects on the target and consider the secondary effects (e.g., building collapse, fire, and unintended damage to infrastructure).

6. Collateral Damage

a. Engaging targets in an urban environment can be difficult due to CD concerns. Minimizing CD protects noncombatants and property, facilitates future operations, and reduces the costs of rebuilding. The presence and proximity of friendly ground forces and weapons effects are important considerations in weapons selection (e.g., using air burst vs. delay munitions) to include secondary munitions effects (e.g., burning fires and debris). CD involving personnel can vary depending on the environment. The following are specific considerations for weapons effects on CD in an urban environment:

(1) Blast effects create the highest concern for CD to surrounding structures.

(2) Fragmentation effects have the highest risk to personnel; however, they may cause less damage to surrounding structures.

(3) The most significant concern with armor penetration is CD behind the intended target. Nonexplosive rounds may penetrate structures in an urban environment due to an unreinforced building design.

(4) Cratering effects can prevent future use of the infrastructure.

(5) Incendiary effects can cause additional structural weakening and potential for building collapse. Dense urban environment may increase the opportunity for fire to spread beyond the target area.

b. Planners and aircrews should consider the following to reduce CD from secondary effects:

(1) Blast induced debris can be a significant hazard to noncombatant personnel. Many urban combat injuries result from glass shards and falling debris due to blast and overpressure.

(2) Although some delayed fuse munitions are ideal for urban engagements, unintentional structural weakening may occur.

(3) In addition to the effects of a deployable munition (e.g., flechette rockets, illumination rounds, and cluster bomb units), the delivery components can also cause CD.

(4) Nonexplosive rounds have a higher probability of ricochet than explosive rounds.

(5) Weapon effects mechanisms can be mitigated by delayed fusing, variable time fusing, shielding, delivery heading, and aim-point offset. However, mitigation may decrease the weapons' effectiveness.

7. Friendly Fire Potential and Avoidance

a. Organized, clear, and effective communication is the most critical element in preventing friendly fire incidents.

b. Close quarters, identification problems, inaccurate battle tracking, and unintentional secondary weapons effects increase the potential for friendly fire incidents during urban operations.

c. Friendly force trackers can be used for battle tracking to help identify the location of friendly forces. Forces involved in urban operations should understand the potential limitations with devices for friendly force tracking; specifically the reliability of friendly position marks due to obscuration, electromagnetic interference, and latency.

d. Not all marking devices are compatible with all friendly aviation assets and aircraft systems.

8. Lasing

a. Lasing techniques in the urban environment are susceptible to backscatter, obscurants, attenuation, beam divergence, spot jitter, refraction, podium effect, entrapment, and over and under spill.

b. It is critical that the individual lasing a target with a ground designator realizes the laser energy coming from the designator's aperture can be seen and tracked by a missile; in effect, making the ground designator platform a target. Due to the likely proximity of the laser designator to the target in urban environments, this is more of a concern than in rural environments.

c. Laser Designation of Reflective Surfaces.

(1) Angled engagements can reflect a compact spot to somewhere other than the intended target. There can be a high number of reflective surfaces in an urban environment. A missile can acquire the reflected laser energy and track to

an unintended location. Employ techniques to mitigate these concerns (see figure 15).

(2) A near perpendicular engagement against highly reflective targets (glass, mirrors, and polished metal) can return dangerously high levels of laser energy to the designator. Employment of a laser-guided missile (LGM) in an urban environment requires careful consideration of LOS geometry.

(3) It is possible laser energy can penetrate windows resulting in laser spot entrapment and failure of the LGM to track laser energy (see figure 15). To mitigate reflection, place the laser designator on a nonreflective surface adjacent to the desired aim point.

d. Buddy and Remote Lasing.

(1) Rotary- and fixed-wing platforms can complement each other during the targeting process. This becomes important due to the vertical structure of the urban environment and possibility of having an obstructed LOS. Buddy lase may enhance the lethality and survivability of both platforms. Rotary-wing aircraft provide laser designation capability, but should limit hover time in a hostile environment.

(2) When designating with a ground-based laser within an urban canyon, use caution if LOS geometry only allows the weapon to receive laser energy within the safety zone. Aircrews should consider employing buddy lasing for LGMs when urban obstructions preclude the attacking aircraft from maintaining LOS with the target through ordnance impact. See JP 3-09.3 for more information.

(3) When employing buddy lasing, the terrain may restrict the attack axis due to the designator's position.

(a) When lasing for medium-to-high altitude attack aircraft, pick a desired point of impact on top of a vertically developed structure. 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.

(b) When lasing for low-altitude attack aircraft, designators should lase a vertical surface, not the top of the target, to avoid creating a podium effect (as illustrated in figure 14). Designators should deconflict the gun and laser-to-target lines to mitigate podium effects prior to the engagement.

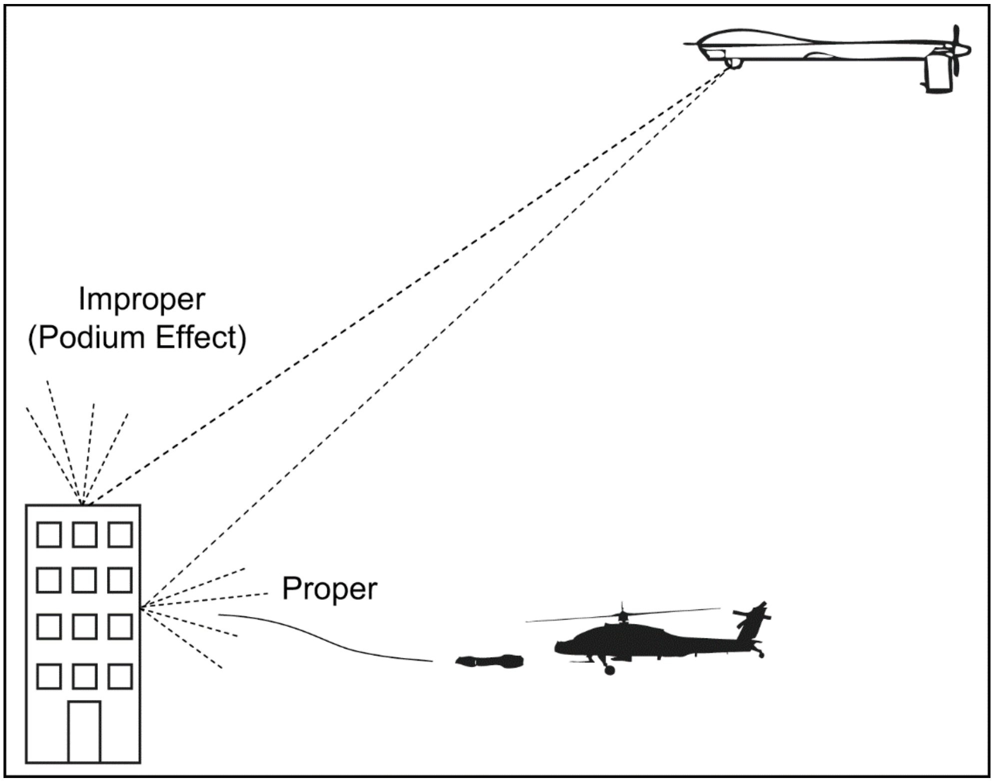

Figure 14. Podium Effect

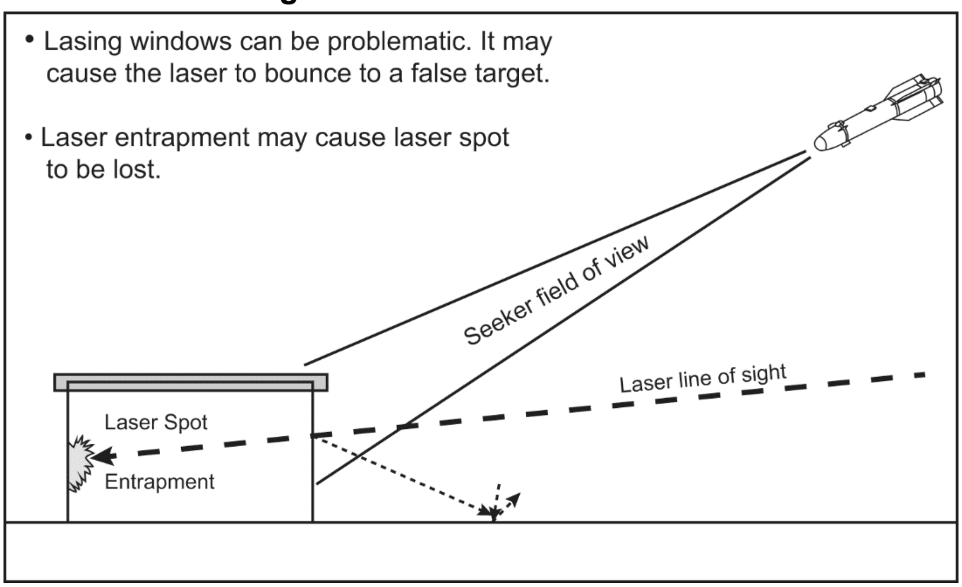

Figure 15. Laser Designation Reflection Considerations

9. General Weapons Delivery

a. Urban terrain introduces unique challenges to aircrews and ground personnel due to urban canyons. Urban canyons can shield a target set with 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 and subterranean entry points making them only visible along the street axis or from high angles.

c. Subsurface targets will present significant challenges to weapon delivery.

d. Targeting a specific side or story of a building can limit the engagement heading.

e. Factors, such as threats or weather, may force the aircraft to deliver from a low altitude. Planners and aircrews must consider obstacle clearance along the munition's flight path.

f. Achieving LOS with an objective at surface level is easier when commencing the attack run along the axis of an urban canyon as illustrated in figure 16.

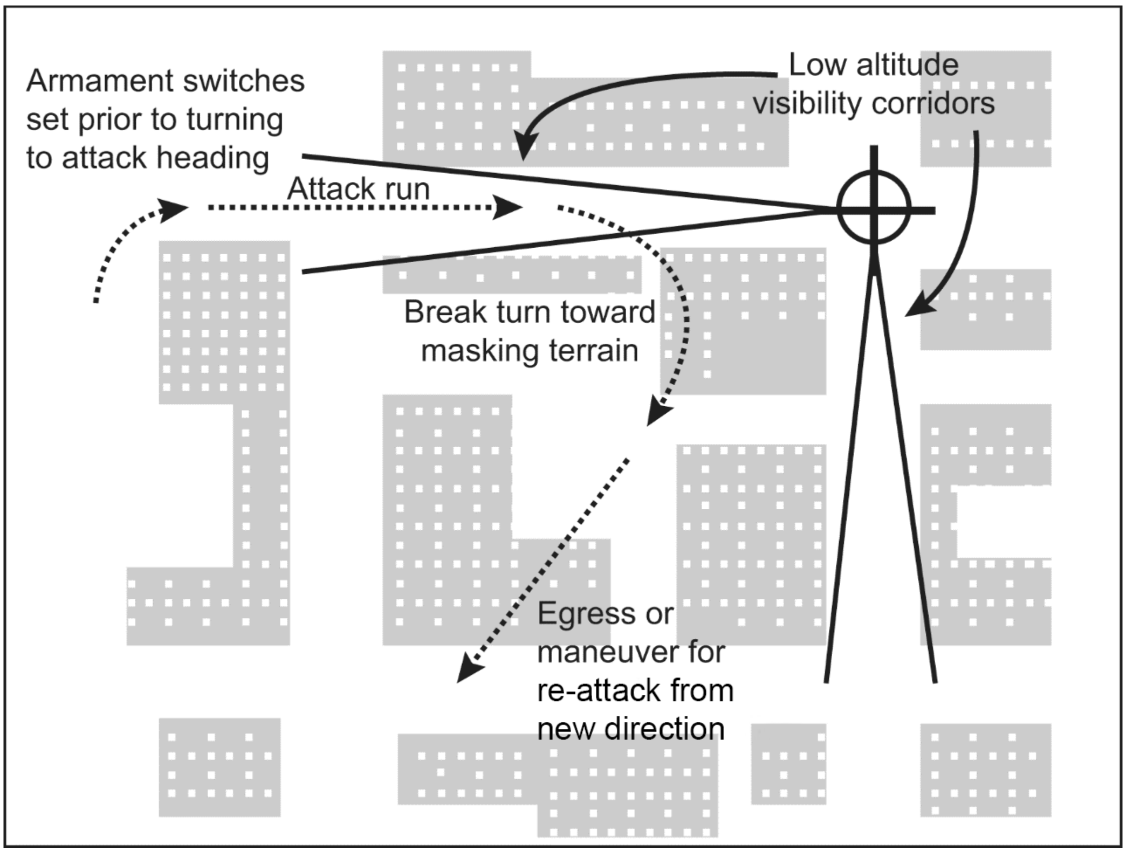

Figure 16. Attack Along an Urban Canyon

g. A look-down into areas surrounded by tall structures is required if roadways do not create an adequate avenue of observation, as illustrated in figure 17.

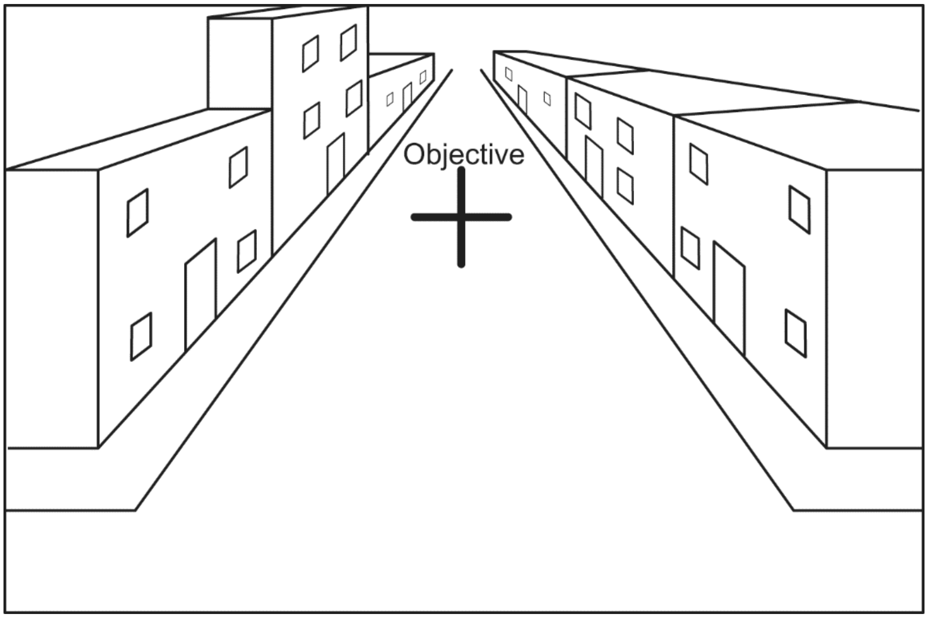

Figure 17. A View Along a Street (A Low Angle is Possible)

h. Fixed- and rotary-wing aircraft may experience significantly reduced ordnance employment ranges in urban areas compared to rural areas. Reasons for this include the following:

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

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

(3) High-angle deliveries may provide better look-down angles and visibility into a target area and a better ballistic trajectory when delivering ordnance near tall structures, as shown in figures 18 and 19.

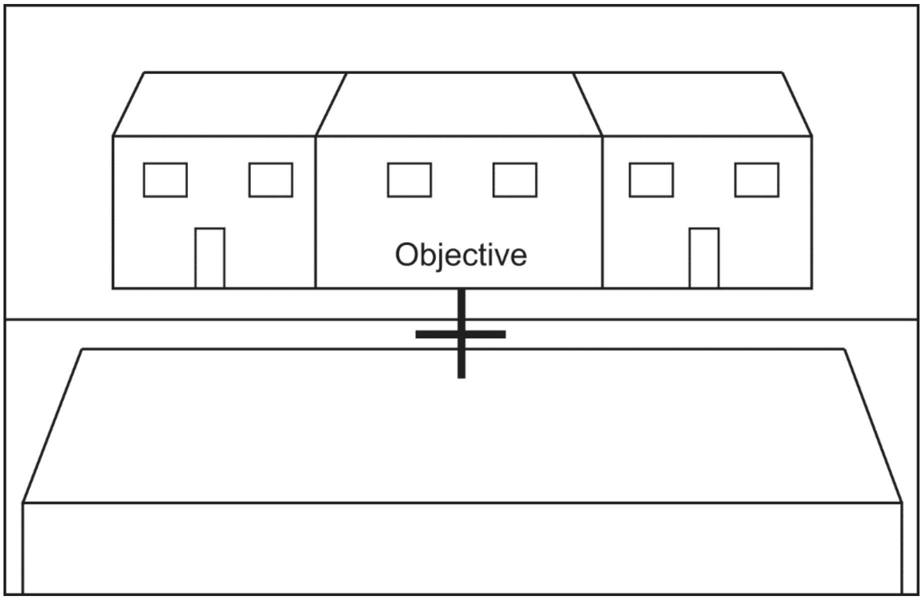

Figure 18. Look-Down View (A High Angle is Required)

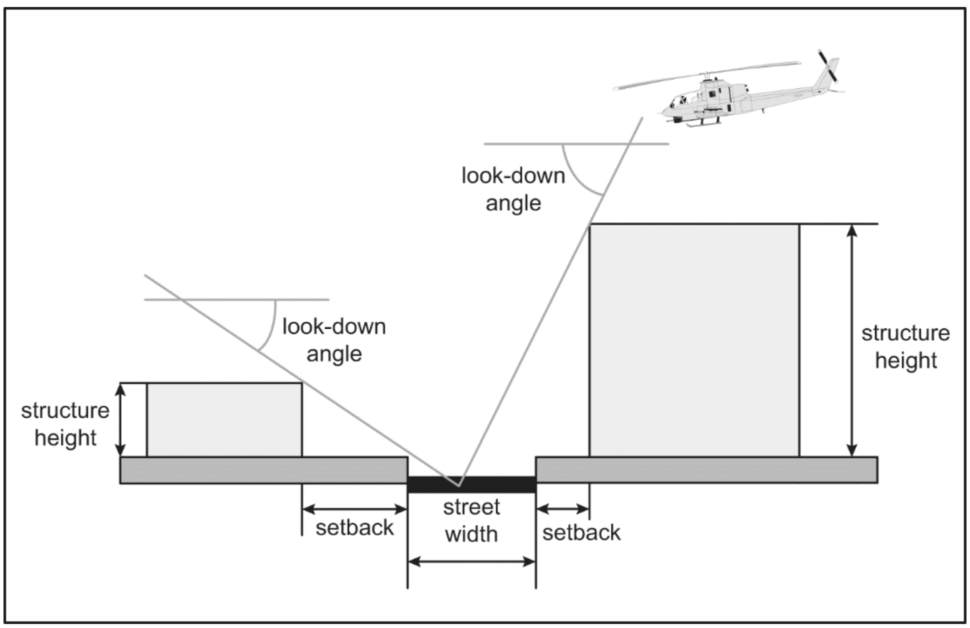

Figure 19. Look-Down Angle

i. Confined spaces and unpredictable routes make moving vehicles difficult to target. Since urban operations inherently generate close-quarters engagements, an aircraft may not have time to achieve a firing solution on a moving vehicle. Ground forces must pass fire mission requests to an aircraft as early as possible for the best firing solution.

j. Post-launch aborts may not be possible in the urban environment where the chance for CD is increased due to population density. See JP 3-09.3 for further discussion on post-launch aborts.

10. Rotary-wing Attack Techniques

a. Running and diving fire are the preferred engagement techniques in urban terrain due to increased weapons accuracy and reduced ability for the enemy to achieve effective fires.

b. Hovering in urban environments exposes aircraft to small-arms fire while in a low-energy state. Only plan or execute hovering fire if it is essential to the mission and adequate overwatch fires are available.

c. Attack rotary-wing aircraft in direct support of ground forces maximize aviation reconnaissance, security, and attack capabilities to the supported force.

d. Manned-unmanned teaming compatible aircraft should consider the use of unmanned systems for reconnaissance of the objective area to increase SA, which will facilitate:

(1) Increased standoff due to positive target identification.

(2) Expedited engagement of previously identified targets.

(3) Remote engagements to maintain the increased standoff.

e. Aerial Sniper Platform in the Urban Environment.

(1) An urban conflict may require employing extremely low-yield, precision fires. In this case, employing snipers from rotary-wing aircraft offers the commander great operational flexibility in a CD-sensitive environment.

(2) 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.

11. Indirect Fires and Standoff Munitions

a. Indirect fires, such as artillery, mortars, 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, provide pre-assault fires for LZ occupation, or to draw attention from the primary attack.

(1) 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 NVDs when used at ground level.

(2) IR illumination rounds are especially effective in urban areas devoid of artificial light sources. JIPOE will determine the effectiveness of overt vs. covert illumination rounds.

(3) Ground forces 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 which could negatively impact NVD operations.

(4) 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, JTACs, observers, and fire support coordinators. Aircraft and indirect fire separation techniques provide protection from friendly SEAD fires.

b. Standoff Weapons.

(1) These weapons are designed for long-range employment and require coordination between JTACs and aircrews to identify precise target location, impact angle, and fusing options.

(2) Ranges vary between weapon types, and consideration must be given to terrain, obstructions, routing, and environmental factors when selecting standoff weapons in the urban environment.

(3) Standoff Considerations.

(a) Minimize target location error when target is in proximity to collateral objects.

(b) The lack of visibility with the target area may increase friendly or civilian casualty potential.

(c) GPS jamming, spoofing, or loss can create large targeting accuracy errors. Requesting GPS planning products and encrypting GPS receivers can mitigate degradation issues.

Appendix A
URBAN CAMOUFLAGE, CONCEALMENT, AND DECEPTION

1. Camouflage

a. Traditional camouflage systems are optimized to blend 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 multispectral nets, or improvised camouflage of cardboard, tarps, sheets, and building debris.

c. Enemy forces may attempt to exploit United States (US) forces' ROE and friendly fire reduction techniques by deliberately employing methods of blending with friendly or neutral forces. Some enemy forces use uniforms nearly indistinguishable from US uniforms and equipment.

d. Other nations may use military transport trucks with a commercial product logo and advertising depicted on its sides with an additional false skin applied to the cab, externally transforming a military vehicle into an apparent commercial truck.

e. The enemy may also use civilian equipment for military purposes. A common example is the technical, a civilian pickup truck used as a mobile weapon's platform. Additionally, civilian vehicles are often used for hauling small arms or vehicle-borne improvised explosive devices. The volume of civilian traffic present in urban environments will provide challenges to positively identifying threat vehicles within the normal patterns of life.

f. Advanced camouflage techniques allow for changing the thermal signature of a target. This may include thermal blankets, cooling devices, and energy reflective materials. Another consideration is enemy forces using fires in proximity to their locations to cause thermal washout effects.

g. The use of structures to mask firing locations (loopholes) create challenges in identifying the actual point of origin and weaponeering considerations for attack.

2. Deception and Decoys

Decoys are designed to force the shooter to waste time, combat power, and ammunition on invalid 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, electromagnetic, or radar signature to misdirect fire to areas of the friendly force choosing to dissipate probability of kill against friendly targets.

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GLOSSARY

PART I – ABBREVIATIONS AND ACRONYMS

A, B

ADA	air defense artillery
ADGR	air-delivered ground refueling
AFTTP	Air Force tactics, techniques, and procedures
AGL	above ground level
ALSA	Air Land Sea Application (Center)
AO	area of operations
ASCOPE	areas, structures, capabilities, organizations, people, and events
ATP	Army techniques publication
AWACS	Airborne Warning and Control System

C

C2	command and control
CAS	close air support
CASEVAC	casualty evacuation
CD	collateral damage
CRC	control and reporting center
CSAR	combat search and rescue

D

DR	disaster relief
DSCA	defense support of civil authorities
DZ	drop zone

E

EO	electro-optical

F

FAC(A)	forward air controller (airborne)
FARP	forward arming and refueling point
FMV	full-motion video
FPASS	force protection airborne surveillance system

G

GMTI	ground moving target indicator
GPS	Global Positioning System

GRG	gridded reference graphic
	H
HA	humanitarian assistance
HIRTA	high-intensity radio transmission area
	I
IED	improvised explosive device
IP	isolated personnel
IR	infrared
ISR	intelligence, surveillance, and reconnaissance
	J, K
JIPOE	joint intelligence preparation of the operational environment
JP	joint publication
JTAC	joint terminal attack controller
	L
LGM	laser-guided missile
LOS	line of sight
LZ	landing zone
	M
MANPADS	man-portable air defense system
MCRP	Marine Corps reference publication
MEDEVAC	medical evacuation
MGRS	military grid reference system
MSL	mean sea level
MTTP	multi-Service tactics, techniques, and procedures
	N, O
NTTP	Navy tactics, techniques, and procedures
NVD	night vision device
NWDC	Navy Warfare Development Center
	P, Q
PID	positive identification
	R
ROE	rules of engagement
RPA	remotely-piloted aircraft
RPG	rocket-propelled grenade
	S
SA	situational awareness

SAM	surface-to-air missile
SEAD	suppression of enemy air defenses
SIGINT	signals intelligence
SUAS	small unmanned aircraft system

T

TAOC	tactical air operations center
TECOM	Training and Education Command
TRP	target reference point
TV	television

U, V, W, X, Y, Z

UA	unmanned aircraft
UAS	unmanned aircraft system
US	United States
USMC	United States Marine Corps

PART II – TERMS AND DEFINITIONS

airspace control plan—The document approved by the joint force commander that provides specific planning guidance and procedures for the airspace control system for the joint force operational area. Also called ACP. (DOD Dictionary. Source: (JP 3-52)

airspace control order—An order implementing the airspace control plan that provides the details of the approved requests for airspace coordinating measures. Also called ACO. (DOD Dictionary. 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. Also called ATO. (DOD Dictionary. Source: JP 3-30).

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

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

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. Also called C2. (DOD Dictionary. Source: JP 1).

direct fire—Fire delivered on a target using the target itself as a point of aim for either the weapon or the director. (DOD Dictionary. Source: JP 3-09.3).

drop zone—A specific area upon which airborne troops, equipment, or supplies are airdropped. Also called DZ. (DOD Dictionary. Source: JP 3-17).

fire support—Fires that directly support land, maritime, amphibious, space, cyberspace, and special operations forces to engage enemy forces, combat formations, and facilities in pursuit of tactical and operational objectives. (DOD Dictionary. Source: JP 3-09).

night vision device—Any electro-optical device used to detect visible and infrared energy and provide a visible image. Also called NVD. (DOD Dictionary. 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. (DOD Dictionary. 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. (DOD Dictionary. Source: JP 3-84).

supersurface—Areas above ground level that consist of man-made structures (e.g., buildings, towers, power lines). (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 that performs a function for the threat considered for possible engagement or other action. (DOD Dictionary. Source: JP 3-60).

target reference point—A predetermined point of reference, normally a permanent structure or terrain feature that can be used when describing a target location. Also called TRP. (DOD Dictionary. Source: JP 3-09.3).

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***ATP 3-06.1**
MCRP 3-20.4
NTTP 3-01.04
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By Order of the Secretary of the Army **22 FEB 2022**

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