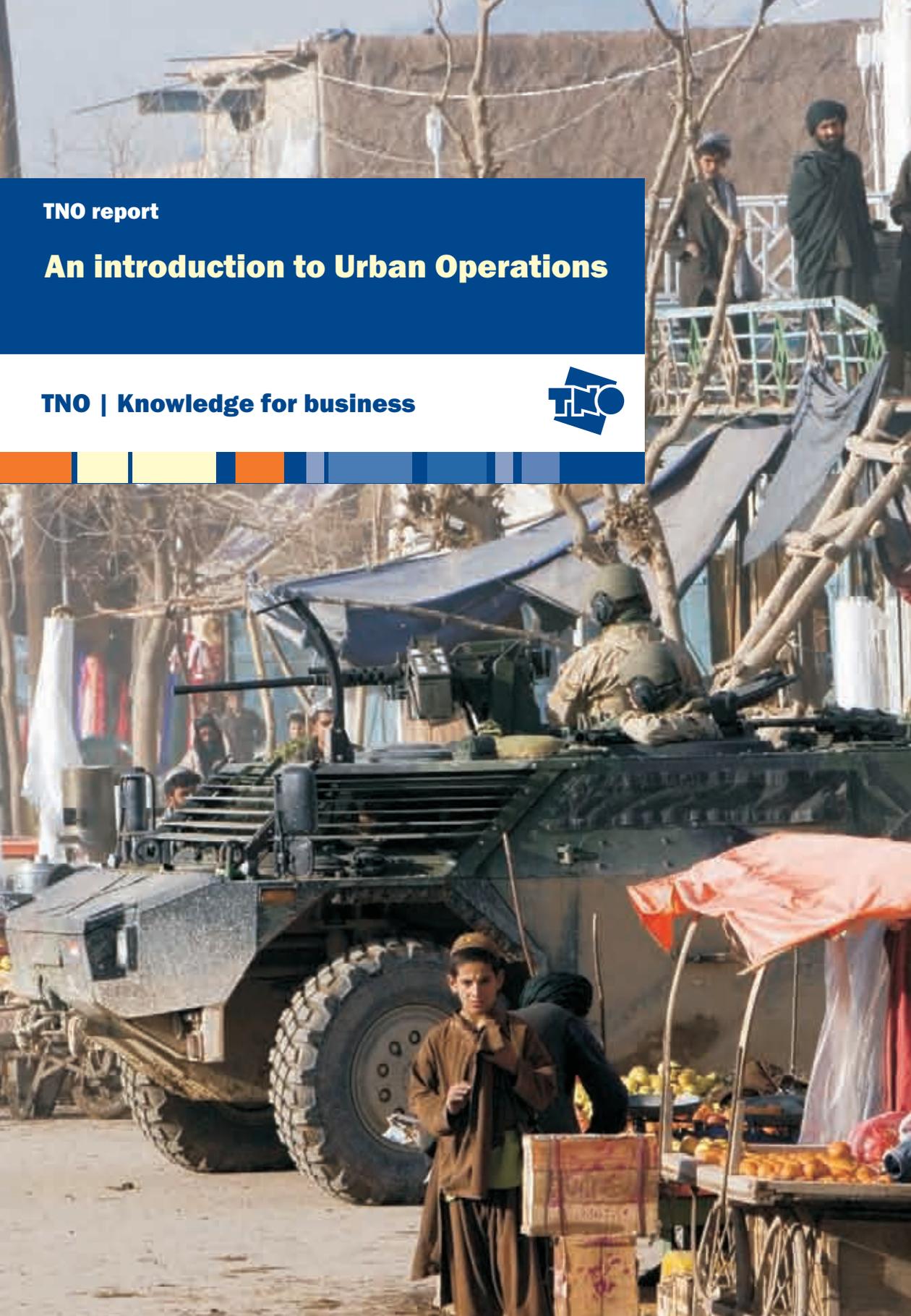


TNO report

# An introduction to Urban Operations

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TNO report

## An introduction to Urban Operations

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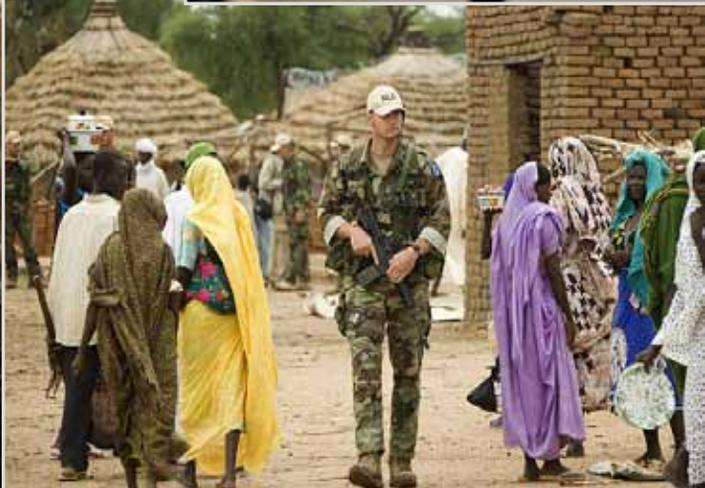


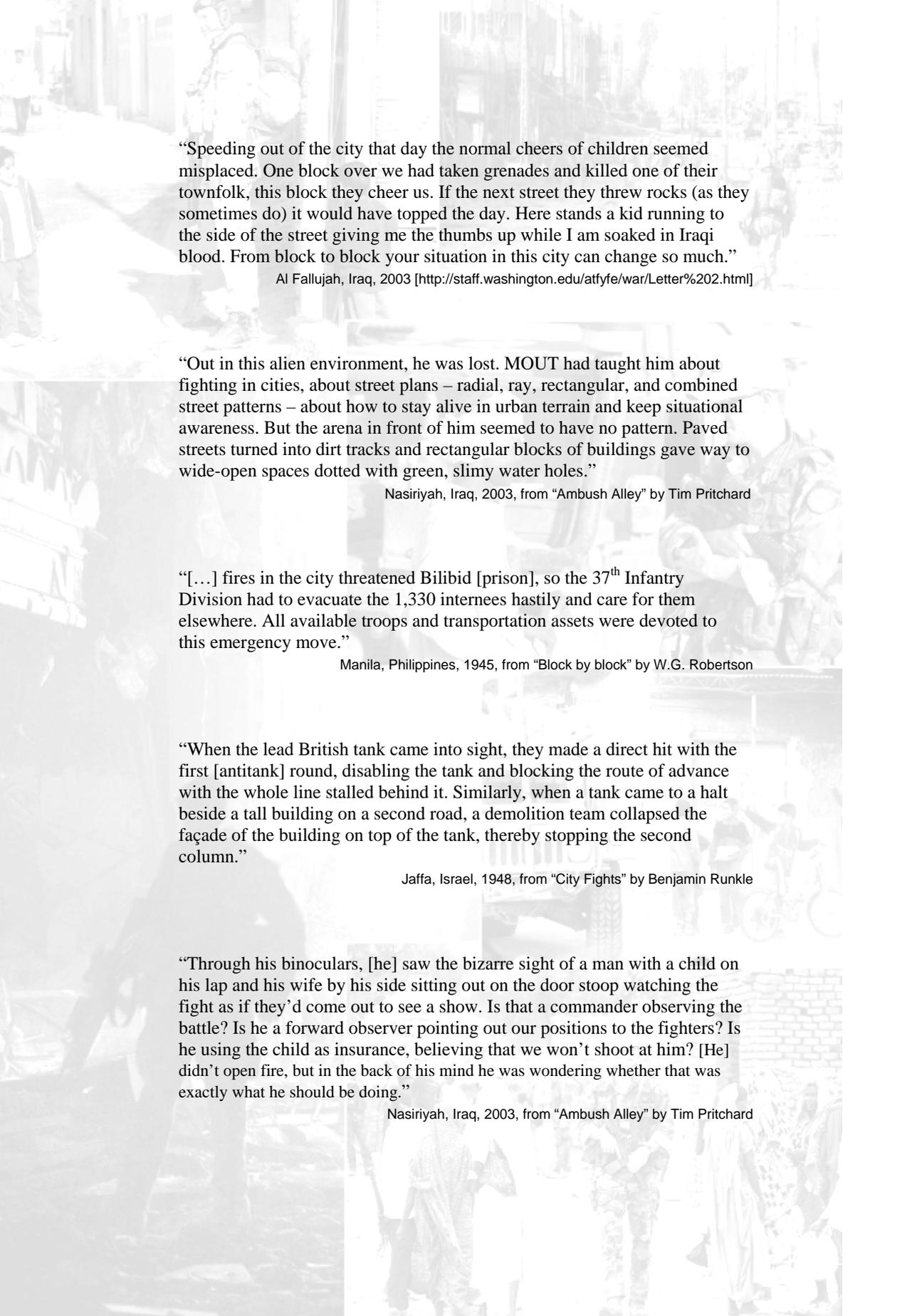
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“Speeding out of the city that day the normal cheers of children seemed misplaced. One block over we had taken grenades and killed one of their townfolk, this block they cheer us. If the next street they threw rocks (as they sometimes do) it would have topped the day. Here stands a kid running to the side of the street giving me the thumbs up while I am soaked in Iraqi blood. From block to block your situation in this city can change so much.”

Al Fallujah, Iraq, 2003 [<http://staff.washington.edu/atfyfe/war/Letter%202.html>]

“Out in this alien environment, he was lost. MOUT had taught him about fighting in cities, about street plans – radial, ray, rectangular, and combined street patterns – about how to stay alive in urban terrain and keep situational awareness. But the arena in front of him seemed to have no pattern. Paved streets turned into dirt tracks and rectangular blocks of buildings gave way to wide-open spaces dotted with green, slimy water holes.”

Nasiriyah, Iraq, 2003, from “Ambush Alley” by Tim Pritchard

“[...] fires in the city threatened Bilibid [prison], so the 37<sup>th</sup> Infantry Division had to evacuate the 1,330 internees hastily and care for them elsewhere. All available troops and transportation assets were devoted to this emergency move.”

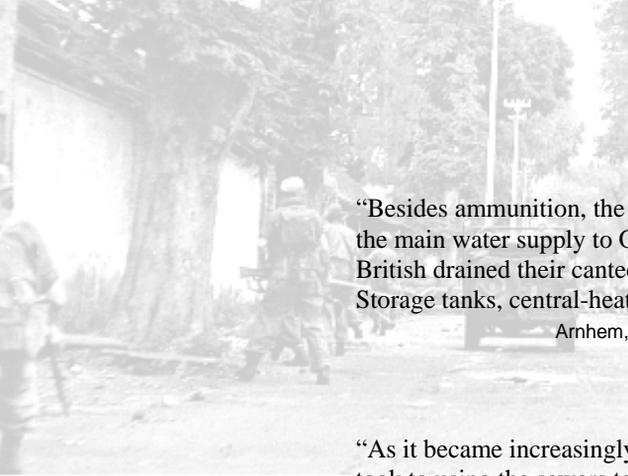
Manila, Philippines, 1945, from “Block by block” by W.G. Robertson

“When the lead British tank came into sight, they made a direct hit with the first [antitank] round, disabling the tank and blocking the route of advance with the whole line stalled behind it. Similarly, when a tank came to a halt beside a tall building on a second road, a demolition team collapsed the façade of the building on top of the tank, thereby stopping the second column.”

Jaffa, Israel, 1948, from “City Fights” by Benjamin Runkle

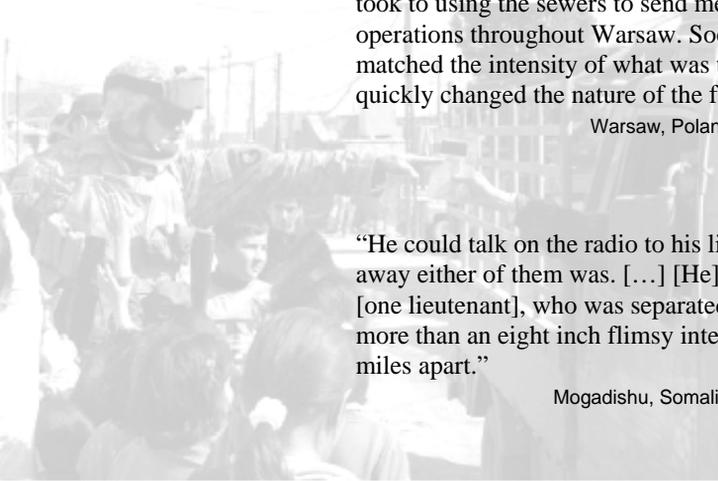
“Through his binoculars, [he] saw the bizarre sight of a man with a child on his lap and his wife by his side sitting out on the door stoop watching the fight as if they’d come out to see a show. Is that a commander observing the battle? Is he a forward observer pointing out our positions to the fighters? Is he using the child as insurance, believing that we won’t shoot at him? [He] didn’t open fire, but in the back of his mind he was wondering whether that was exactly what he should be doing.”

Nasiriyah, Iraq, 2003, from “Ambush Alley” by Tim Pritchard



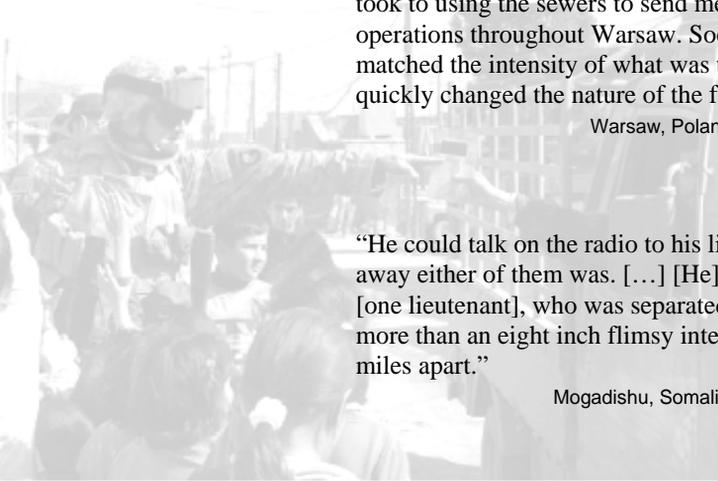
“Besides ammunition, the most pressing need was water. The Germans cut the main water supply to Oosterbeek on the first day of the battle, so as the British drained their canteens, the search for water became paramount. Storage tanks, central-heating systems, even fish bowls were drained.”

Arnhem, the Netherlands, 1944, from “City Fights” by LTC G.A. Lofaro



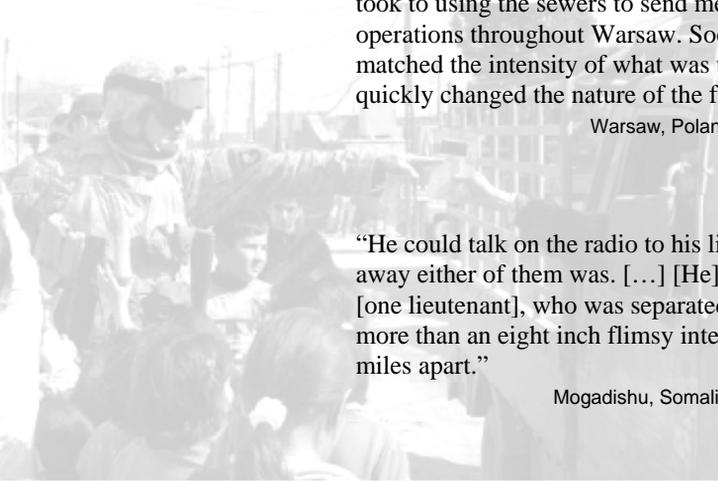
“As it became increasingly difficult to move above ground, the Poles soon took to using the sewers to send messages, more units, and conduct supply operations throughout Warsaw. Soon after, the struggle in the sewers matched the intensity of what was transpiring on the streets above and quickly changed the nature of the fighting.”

Warsaw, Poland, 1944, from “City Fights” by maj David M. Toczek



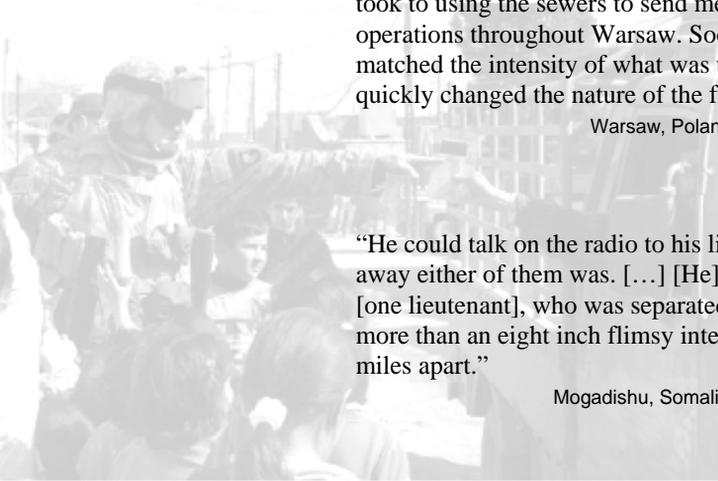
“He could talk on the radio to his lieutenants, but he wasn’t sure how far away either of them was. [...] [He] was no more than fifty yards away from [one lieutenant], who was separated from [the other lieutenant] by nothing more than an eight inch flimsy interior wall. They might as well have been miles apart.”

Mogadishu, Somalia, 1993, from “Black Hawk Down” by Mark Bowden



“Under fire, [the battalion commander] was still trying to get communications with his subordinate units. The radio operators in the [command vehicle] were still having difficulties receiving and sending radio messages. The two-story houses they were bumped up against were masking the VHF signals. Even in his Humvee, he couldn’t get a consistent signal among the labyrinth of houses.”

Nasiriyah, Iraq, 2003, from “Ambush Alley” by Tim Pritchard



“They knew the houses they were hiding in and where the most complex hiding spots were located. The spots that gave them the best geometry to fire on us without us seeing them. These guys were smart, well trained, and worst of all, willing to fight to the death. These were not the nickel and dimers we have been facing on the outskirts during the months leading up to this. They knew how to fight us in an urban environment. They didn’t challenge the tanks and armor and blended in the city without obvious signs to target. They would move house to house and fall back as we approached. They had weapons/ammo staged in every house. It was really complex.”

Al Fallujah, Iraq, 2004, from “A Tale of Three Cities” by Russell Glenn

# Acknowledgements

We thank the Netherlands Institute for Military History, The Hague, the Netherlands, for providing photographs with illustrative examples of different aspects of urban operations. The images are shown on the report cover page and the initial pages of Chapters 2 through 6.

The images shown on the initial page of Chapter 7 and the image shown on the right bottom side of the initial page of Chapter 6 are printed by courtesy of NATO.

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# Summary

## **Problem definition**

The nature of recent conflicts, where the population is targeted on the political, social, economical and physical front, and the current rate of urbanisation, have shifted the attention to urban operations, maybe more than in any other time in history. It is also fair to assume that the battlefield of tomorrow is dominated by the urban environment. An urban area is a terrain where man-made construction and the presence of non-combatants are the dominant features. Urban operations (UO) are defined as all operations planned and conducted across the range of military operations on, or against objectives within, an urban area. The combination of physical terrain, civilian population and urban systems fundamentally distinguishes urban operations from other types of operation. This environment, more than any other, strongly influences situational awareness, movement and the capabilities of (the systems of) the contending parties, who want to deny the urban environment to the opponent, yet want to preserve it for themselves and the population. This makes military operations in an urban environment, at any command level and level of force, more difficult than any other military operation.

## **Work description**

This report provides novices as well as subject matter experts an integrated overview of currently available knowledge and doctrine for urban operations. The authors have collected information on UO characteristics and UO doctrine by means of a literature review and interviews with experts on (inter)national military doctrine and specific aspects of urban operations. The obtained information includes military doctrine publications of the Netherlands, international military publications (e.g. US Field Manuals and publications from NATO workgroups), and public information sources (e.g. literature on urban geography). The authors have integrated this information into a profound and systematic description of the characteristics of the urban area (illustrated with examples of military implications that result from each of the characteristics), and a brief overview of current (inter)national approaches of urban operations.

## **Results and conclusions**

The characteristics of the urban environment can be described from four points of view: (1) the physical terrain, (2) the civilian population, (3) the urban systems and (4) the urban threat.

In relation to physical terrain, three major elements influence urban operations: (1) the street patterns, (2) the multidimensional battlefield, and (3) the building constructions. The urban area can be segmented into multiple functional areas (e.g. the city centre, transportation areas, and a residential area), each having their own physical characteristics.

The civilian population represents the most complex aspect of urban operations. In order to prevent civilian losses, and win the 'hearts and minds' of the population, commanders must know the demographic structure of the population, and have a thorough understanding of the social characteristics of the population ('what is on the people's minds'), and the processes they are involved in ('what are they doing' and 'how do they manifest'). In order to be able to maintain public order, and in

particular to manage crowds and to prevent violent crowd behaviour, knowledge of crowd dynamics is essential to the military.

Each urban environment has an identifiable system of (urban) systems that constantly change and interact, and support the total functioning of an urban area. These systems represent the various roles the urban area plays, both for its inhabitants and for the surrounding area. The systems can be categorised into six main categories: (1) energy and (drink) water supply, (2) economy and commerce, (3) transportation and distribution, (4) communication and information, (5) culture, (6) administration and human services.

The urban threat includes military as well as non-military threats. Examples of non-military threats include fire, diseases, and the danger of (physical) collapse. The military threat can be divided into two categories: regular and irregular opponents. Regular opponents are military forces that have an organised hierarchical structure, plentiful military resources and are typically uniformly outfitted. Generally the members are motivated by a national cause, follow orders generated several levels above them and adhere to international rules of combat. Nowadays, irregular opponents represent the key military threat in urban terrain. Irregular opponents or insurgents differ from the regular threat in tactics and means as well as in motives. They are skilled at developing and adapting techniques to counter the technological and numerical supremacy and the trained procedures of regular armed forces, and they can fully interact with the other components of the urban battlefield: terrain, society, and urban systems. In particular, ideologically or religiously motivated insurgents are deeply committed to their cause and will fight ruthlessly and fanatically to accomplish their mission. Because of their beliefs, members are willing to conduct tactically unsound missions (i.e. suicide attacks) in promotion of the strategic cause and potential rewards. The urban population provides ample opportunities for suchlike missions.

The main operational capabilities required for urban operations are capabilities to perform (1) effect-based operations, (2) joint, combined and interagency operations, (3) counter-insurgency operations, (4) information operations, and (5) public order management. All nations consider urban operations as a very important theme, yet only at the lower tactical levels up to date and specific urban operations doctrine is available. The higher military levels, that have to shape the conditions for the subordinate units, lack clear doctrinal guidelines to deal with the urban complexity. Last but not least, it is fully recognised that joint, combined and interagency aspects are inextricably bound up with Urban operations, but doctrine how to successfully implement this still has to take shape.

### **Applicability**

Within the research programme 'Urban Operations', TNO supports the Netherlands defence organisation in order to enable them to conscientiously embed urban operations in their doctrine and to better prepare the forces to conduct urban operations. By clearly describing the characteristics of urban operations, this report provides the context for both military personnel and scientific researchers, to be used in projects related to urban operations, which naturally is much broader than only the current research programme 'Urban Operations' itself.

## Abbreviations

AIED	Aerial Improvised Explosive Device
ATGM	Anti-Tank Guided Missile
C2	Command and Control
C3	Command, Control and Communication
C4I	Command, Control, Communication, Computers, and Intelligence
CBRN	Chemical, Biological, Radiological and Nuclear
CD&E	Concept Development and Experimentation
CIMIC	Civil and Military Co-operation
CJUO	Combined Joint Urban Operations
CNN	Cable News Network
CNO	Computer Network Operations
COIN	Counterinsurgency
CWIED	Command Wire IED
DIME	Diplomatic, Information, Military and Economic
EA	Electronic Attack
EBAO	Effect Based Approach to Operations
EFP	Explosively Formed Penetrator
EP	Electronic Protection
ES	Electronic Support
EW	Electronic Warfare
FIBUA	Fighting in Built-Up Areas
HBIED	House Borne Improvised Explosive Device
HIV	Human Immunodeficiency Virus
IDP	Internally Displaced Person
IED	Improvised Explosive Device
IO	Information Operations
	International Organisation
	Intergovernmental Organisation
IPB	Intelligence Preparation of the Battlespace
IWARS	Infantry Warrior Simulation
JP	Joint Publication
JUW	Joint Urban Warrior
MANPADS	Man-Portable Air Defence Systems
MILDEC	Military Deception
MOUT	Military Operations in Urban Terrain
NATO	North Atlantic Treaty Organisation
NGO	Non-Governmental Organisation
OBUA	Operations in Built-Up Areas
OPSEC	Operations Security
OSCE	Organisation for Security and Co-operation in Europe
PA	Public Affairs
PBIED	Person Borne Improvised Explosive Device
PfP	Partnership for Peace
PMESII	Political, Military, Economic, Social, Infrastructure and Information
POM	Public Order Management
PPIED	Pressure Plate Improvised Explosive Device

PsyOps	Psychological Operations
RCIED	Radio Controlled Improvised Explosive Device
	Remotely Controlled Improvised Explosive Device
RDD	Radiological Dispersal Device
RNLA	Royal Netherlands Army
RNLAF	Royal Netherlands Airforce
RNLN	Royal Netherlands Navy
ROE	Rules Of Engagement
RPG	Rocket-Propelled Grenade
RTO	Research and Technology Organisation
SAS	Studies, Analysis and Simulation Panel
SPBIED	Suicide Person Borne Improvised Explosive Device
SVBIED	Suicide Vehicle Borne Improvised Explosive Device
TNO	Netherlands Organisation for Applied Scientific Research
TTP	Techniques, Tactics and Procedures
UK	United Kingdom
UO	Urban Operations
US(A)	United States (of America)
USECT	Understand, Shape, Engage, Consolidate, and Transition
USJFCOM	US Joint Forces Command
USMC	US Marine Corps
VBIED	Vehicle Borne Improvised Explosive Device

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### **Appendices**

- A Improving the Urban Operation Capabilities
- B Suggested Literature
- C A Historic Perspective to Urban Operations
- D NATO Programs related to Urban Operations

# 1 Introduction

*“The growth of cities will be the single largest influence on development in the 21st century.” [4]*

This statement is proving more accurate by the day. Until now mankind has lived and worked primarily in rural areas, but the world is about to leave its rural past behind. In 2008, the world reaches an invisible but momentous milestone: for the first time in history, more than half its human population, 3.3 billion people, will be living in urban areas. By 2030, this is expected to swell to almost 5 billion. While the world’s urban population grew very rapidly (from 220 million to 2.8 billion) over the 20th century, the next few decades will see an unprecedented scale of urban growth in the developing world. This will be particularly notable in Africa and Asia where the urban population will double between 2000 and 2030. That is, the accumulated urban growth of these two continents during the whole span of history will be duplicated in a single generation. By 2030, the towns and cities of the developing world will make up 81 percent of urban humanity.

Given this development it is likely that urban areas will become focal points for unrest and conflicts. Therefore, one can fairly assume that in the future these areas will be the most dominant environment in which military forces have to operate. Though urban operations are not new -throughout its history the military has fought an enemy in urban areas- the overwhelming physical and psychological complexity and size of 21st-century urban areas have begun to exert a much greater influence on military operations than ever before.

## 1.1 Definition of Urban Operations

The military term for urban warfare is *Urban Operations*<sup>1</sup>, abbreviated as **UO**:

*Urban operations are defined as all operations planned and conducted across the range of military operations on, or against objectives within, a terrain, where man-made construction and the presence of non-combatants are the dominant features.*

This definition is largely taken from [6]. This publication mentions three important additional characteristics of urban operations:

- 1 Although at times one military service (land, naval or air force) or functional component may predominate, urban operations inherently require a joint, combined, or even interagency approach. In *joint* operations, military forces of

---

<sup>1</sup> There exist multiple alternative terms for the term UO. The former US military term was **MOUT**, an abbreviation for *Military Operations in Urban Terrain*. MOUT has been replaced by UO in order to encompass the above-mentioned three important additional characteristics of the military presence in urban terrain (yet, the term MOUT-site is still in use). Elaborating on the physical complexity of the urban environment, also the term MOUT/RT (Restrictive Terrain) has been used, to indicate that operations in for example jungles and caves strongly resemble operations in urban terrain. The British military term is **FIBUA** (Fighting in Built-Up Areas), although it also has been called **OBUA** (Operations in Built-Up Areas). And, frivolously, **FISH and CHIPS** (Fighting in Someone’s House and Causing Havoc in People’s Streets). The term **FOFO** (Fighting in Fortified Objectives) refers to clearing enemy personnel from narrow and entrenched places like bunkers, trenches and strongholds, the dismantling of mines and wires and the securing of footholds in enemy areas.

two or more military services work together to accomplish the mission. In *combined* operations, forces of two or more nations work together to accomplish the mission. In *interagency* operations, military units cooperate with (are supported by or are supporting) non-military agencies in order to accomplish the mission. Non-military agencies can include national agencies (i.e. governmental, state, and/or local agencies) as well as international agencies.

- 2 Urban operations can include any type of military operation, ranging from humanitarian assistance to high-intensity combat. Different types of operations can be performed singly or in combination and in close proximity. A current doctrine publication of the Netherlands provides an overview of the different types of military operations [3]. However, more recent insights and experiences show that operations as a whole are difficult to categorise as a specific type, but that one operation can (simultaneously) have different aspects across the whole spectrum. These insights and experiences are expressed in the fundamental principle “operations are operations”. This concept is already commonly adopted, and will be the basic principle in the next version of the doctrine.
- 3 Urban operations require the synchronisation and integration of all instruments of (inter)national power (diplomatic, economic, military, and informational) to achieve strategic, operational and tactical objectives.

## 1.2 Definition of an Urban Area

In this report, an *urban area* is defined as follows (definition largely taken from [6]):

*An urban area is a terrain where man-made construction and the presence of non-combatants are the dominant features.*

Urban areas are frequently classified according to their population size, from villages of fewer than 3,000 inhabitants to large cities ranging in population from 100,000 to over 20,000,000. Table 1 shows an example size-classification of urban areas. Note that a lot of different size-classifications exist in literature.

Table 1 Example size-classification of urban areas [5].

Category	Population size
Village	3000 or less
Town	over 3000 to 100000
City	over 100000 to 1 million
Metropolis	over 1 million to 10 million
Megalopolis	over 10 million

In this report, *small urban areas* will be discerned from *large urban areas* (Figure 1)<sup>2</sup>. Large urban areas, i.e. city, metropolis and megalopolis in Figure 1, have a significant influence beyond their boundaries on the region or even the nation in which they exist. Small urban areas, i.e. villages and towns in Figure 1, do not have such significant influence. Generally, large urban areas are segmented

<sup>2</sup> Urban areas vary in ways other than size: an urban area may be the only urban area in a region, or one of many; its physical layout may be orderly or chaotic; it may be modern or built around an ancient core; it may contain towering buildings or none over three stories.

into multiple functional areas, e.g. residential areas and industrial areas. Small urban areas are not segmented; here the entire area consists of a mixture of residences, shops, local industry, civil services, etc.

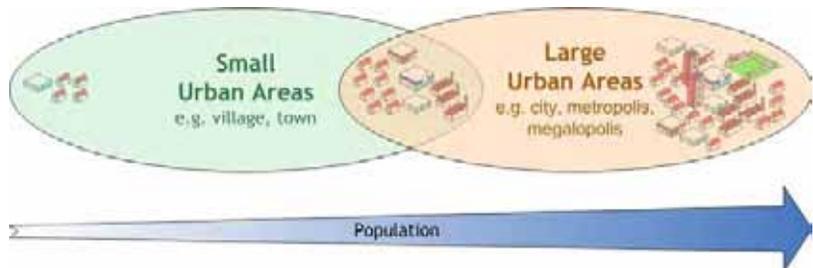


Figure 1 The difference between small urban areas and large urban areas<sup>3</sup>.

### 1.3 Military Challenges

Military planners of urban operations face distinct challenges in the characteristics of the urban area. As these characteristics interact, they make each urban area a complex and dynamic system of systems, with a unique physical, political, economic, social, and cultural identity. This is true for small urban areas as well as for large urban areas.

All urban areas share three main characteristics, an urban triad generally so interlaced as to be virtually inseparable:

- 1 *Physical terrain:* A complex man-made physical terrain is superimposed on existing natural terrain and consists of structures and facilities of various types.
- 2 *Population:* A population of significant size and density inhabits, works in, and uses the man-made and natural terrain.
- 3 *Urban systems:* Urban systems are those systems that support urban inhabitants and their economy. Each system provides its own human services for the urban area and often beyond, perhaps for the entire nation.

The urban systems form the essential link between the physical terrain and the urban population. Each system occupies some part(s) of the physical terrain. Each system encompasses (i.e. employs, services, influences, etc.) some of the inhabitants. It is this combination of complex physical terrain, urban population and urban systems that fundamentally distinguishes Urban operations from other types of operation. This environment, more than others, strongly influences e.g. situational awareness, movement and the capabilities of (the systems of) the contending parties, who want to deny the urban environment to the opponent, yet want to preserve it for themselves and the population. In this environment, the

<sup>3</sup> Figure 1 shows an overlap between small and large urban areas. This is because of two reasons. Firstly, urban areas originate and further develop by the process of urbanization. This implies that a small urban area can gradually turn into a large urban area. Secondly, the distinction between small urban areas (e.g. village, town) and large urban areas (e.g. city, metropolis and megalopolis) is not clearly amenable to a single definition that applies to all countries of the world, or even to the countries within a region.

effects of military interactions are hard to predict. Because of the strong link between physical terrain, population and urban systems, a distinct change within one component of the urban triad (e.g. a military interaction within an urban system) will never influence that triad component only; the change will almost certainly influence the other triad components (the physical terrain and the population) as well. Even worse, the interrelationship between physical terrain, population and urban systems is generally very complex and therefore impossible to unravel (Figure 2). This makes military operations in an urban environment, at any command level and level of force, more difficult than any other military operation.

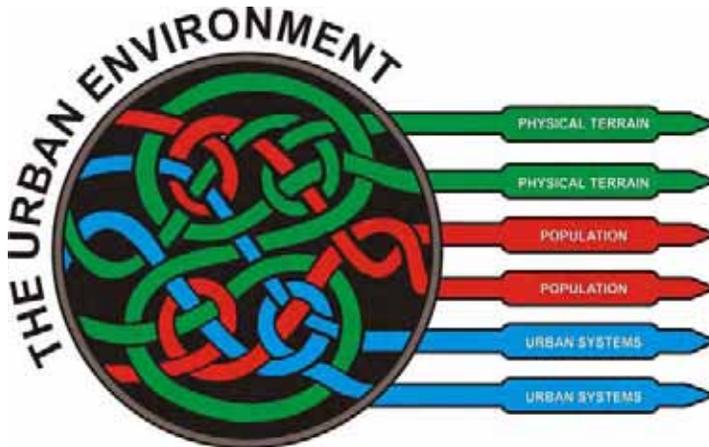


Figure 2 The complexity and interdependency of interactions within the urban environment.

#### 1.4 Why are Urban Operations inevitable?

If urban operations are so complex and demanding, why not try to avoid them? That indeed has been the doctrinal starting point for many armed forces since the earliest time of describing concepts of war fighting (e.g. Greek military historians, the Chinese general Sun Tzu, ca. 500 B.C.). Yet throughout history military operations have taken place against and in cities, because the gains of operating successfully in urban areas were assessed to outweigh the risks and losses, or the forces were left no other choice.<sup>4</sup>

Strategically, a city can contain the centre of leadership, economy and culture. Capturing or controlling such a city destroys the opponent's capability to govern, his ability to sustain hostilities and his morale. For example, in the end, the battle of Stalingrad had no military value (anymore) to Hitler, but it became purely a matter of prestige and morale.

At the operational level, a city can have a dominating geographical location and can contain vital resources (e.g. factories, logistic supplies). Also, the opponent can entrench himself in a city, using the characteristics of the urban environment to resist the advantages of the attacking force.

<sup>4</sup> Appendix C provides a short historic perspective to urban operations.

Bypassing a city is an option, but it means that the attacker must tolerate an enemy stronghold in its area of operation, tying up forces to contain this threat and possibly lengthening the duration of the campaign.

In counter-insurgency operations influencing the attitudes and actions of the population is key to success, more so than physically engaging the opponent. Since many modern crises will have these characteristics and the majority of the population lives in cities, the urban environment is inevitably (part of) the operational area of our armed forces.

## **1.5 Report Objectives**

Within the research programme 'Urban Operations', TNO supports the Netherlands defence organisation in order to enable them to conscientiously embed urban operations in their doctrine and to better prepare the forces to conduct urban operations. This report provides novices as well as subject matter experts an integrated overview of currently available knowledge and doctrine for urban operations. As such, it provides the context for both military personnel and scientific researchers, to be used in projects related to urban operations, which naturally is much broader than only the current research programme 'Urban Operations' itself.

The report describes the characteristics of the urban operation area from four points of view: (1) the physical terrain, (2) the civilian population, (3) the urban systems and (4) the urban threat. For each of the characteristics, examples of military implications are provided in order to emphasise their importance. Note that each individual urban area and each individual urban operation is unique in itself. It is virtually impossible to provide a general description of urban operations that is complete and valid under all circumstances, without becoming too abstract. Therefore, this report identifies the elemental characteristics that can play a role in urban operations. It is up to the military personnel and scientific researchers to determine to what extent the provided characteristics apply to their specific project. The mentioned examples of military implications can assist in these decisions.

In addition, the report provides an overview of the key operational capabilities required in urban operations, and briefly summarises current (inter)national urban operations doctrine. The goal of this investigation is to identify which aspects of urban operations have (not yet) been addressed in (inter)national doctrine.

## **1.6 Scope**

Through the ages, urban geographers have studied the spatial distribution of urban areas in two ways. Urban geography [1] studies the inner structure of the urban area, including the complex patterns of movement, flows and linkages within and between its (functional) areas. Similarly, urban geography studies the spatial distribution of the urbanised region, i.e. a region consisting of multiple urban areas, and the linkages between its underlying urban areas. Urban geographers have found large differences between distinct urban areas and regions. Not only differences among the continents; within continents, and even within countries, substantial differences exist between urban regions and the inner structure of their underlying urban areas.

A similar observation counts for the characteristics of the urban population and the urban systems. Obviously, around the world large differences exist between the historical backgrounds, attitudes, culture and activities of people living in urban areas.

Given the described worldwide differences between urban areas, in this report, the characteristics of urban areas are not ordered by geographical location. Instead, the report describes the main factors that shape an urban area and its inhabitants. Examples of small and large urban areas across the world (this includes urban areas inside as well as outside Europe) illustrate the global differences among urban areas in relation to these shaping factors. For each shaping factor, examples of military implications illustrate why this factor is important in relation to urban operations.

In preparation for an operation, commanders have to gather information regarding the specific operational circumstances and constraints in relation to each of the described shaping factors. By means of this information, the urban operation can be planned. During the operation execution, commanders continuously need to keep an eye on the shaping factors, such that when operational circumstances are changing, appropriate measures can be taken on time.

## **1.7 Work Approach**

The authors have collected information on UO characteristics and UO doctrine by means of (1) a literature review and (2) a number of interviews with experts on (inter)national military doctrine and specific aspects of urban operations. The obtained information includes military publications (e.g. doctrine publications) of the Netherlands, international military publications (e.g. US Field Manuals and publications from NATO workgroups on urban operations), and public information sources (e.g. literature on urban geography). The authors have first integrated citations from the collected written material into an easily readable text, which profoundly and systematically describes the characteristics of the urban area. Subsequently, they included expert opinions and their own perspectives, by providing examples of military implications that result from each of the characteristics. Finally, they wrote a brief overview of current (inter)national approaches of urban operations (urban operations doctrine).

## **1.8 Report Outline**

Chapter 2 discusses the physical structure of the urban area. Chapter 3 describes the civilian population, whereas Chapter 4 describes the urban area as a system of (urban) systems.

Chapter 5 describes the characteristics of the urban threat, military as well as non-military.

Chapters 6 and 7 of this report provide an overview of (inter)national approaches of urban operations.

The appendices provide overviews of current (inter)national research and investigation on urban operations (Appendices A and D), a historic perspective to urban operations (Appendix B), and a shortlist of urban operations literature

(Appendix C). The literature shortlist is particularly meant for readers who are new with the subject and want to become quickly familiar by reading the most relevant publications.

## 1.9 Source Indication

For the purpose of readability, the authors have not bookmarked every citation with a distinct literature reference. Instead, a list of included publications is available at the end of each chapter.

## 1.10 References

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- [5] United States Headquarters Department of Army (July 27, 2006). *The Infantry Rifle Company*. Field Manual 3-21.10.
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## 2 The Physical Terrain

This chapter describes the physical elements that characterise the urban area. The provided characteristics influence the way the military operation is performed. Therefore it is essential to take these elements into consideration during the military planning and execution phase. The characteristics are used in a few descriptive examples of urban areas in order to conceptualise the likely nature of the current and future urban environment, and the military implications of operating in such an environment.

The definition of small and large urban areas in §1.2 provides the point of departure for this chapter. §2.1 describes the common characteristics of small and large urban areas. Subsequently, §2.2 and §2.3 provide specific characteristics and military implications for small urban areas and (the functional areas within) large urban areas, respectively. Finally, §2.4 describes the military implications of the cities of the future.

### 2.1 Common Physical Characteristics

Urban areas are man-made environments, often with certain distinct nature elements (e.g. mountains, rivers) still present. The overall geometry of the area can be characterised by a composition of angular forms (forms which occur only rarely in non-urban terrain). When focusing on the physical form, there are three major elements that influence urban operations: (1) the street patterns, (2) the spatial dimensions, and (3) the building features.

#### 2.1.1 Street Patterns

Street patterns are determined by the layout of the streets, roads, highways, and other thoroughfares. They evolve from influences of natural terrain, the original designer's personal prejudices, and the changing needs of the inhabitants. Military units must consider the lay out of the streets, because they greatly affect manoeuvre, command and control, as well as combat service support. Urban areas can display any of the three basic street patterns and their combinations: radial, grid and irregular (Figure 3).

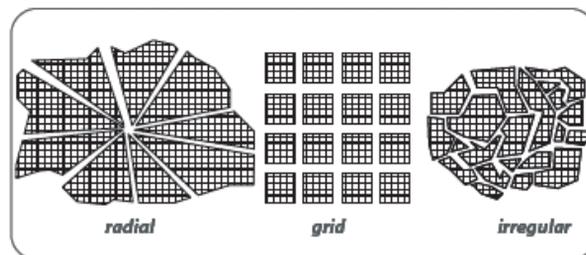


Figure 3 Three basic street patterns [2].

**Radial pattern**

Societies of highly concentrated religious or secular power often construct urban areas with a radial design with all primary thoroughfares radiating out from the centre of power, e.g. a temple or castle. Terrain permitting, these streets may extend outward in a complete circle or may form a semicircle or arc when a focal point abuts a natural barrier such as a coastline or mountain. To increase mobility and traffic flow, societies often add concentric loops or rings to larger radial patterns.

**Grid pattern**

The most adaptable and universal form for urban areas is the grid pattern (lines of streets at right angles to one another forming blocks similar to the pattern of a chessboard). A grid pattern can fill in and eventually take over an original radial pattern.

**Irregular pattern**

Most urban areas, regardless of the original intent, plan, or vision, emerge from successive plans overlaid on one another. Some areas are well planned to fit with previous plans and others areas are a haphazard response to explosive urban growth. The results may mix different patterns, blend patterns in symmetric combinations, or have no discernible geometric pattern (the irregular pattern). Irregular patterns can be specifically designed for aesthetic reasons (as in many suburban housing developments). They are sometimes used to conform to marked terrain relief.

**Military implications**

Each pattern has its distinctive influence on the urban operation. A grid pattern for one provides good situational awareness in urban operations and often appears to ease the assignment of boundaries for subordinates units. Radial design however can result in congestion of own troops, as an effect of bad planning. In case of irregular street patterns, the natural terrain may exert greater influence over operations. Loss of momentum and increased potential for ambush or fratricide are possible risks. Besides, the irregular pattern can make movement and manoeuvre less predictable. Especially in close orderly block and high rise areas, the configuration of streets can even cause wind canalisation, resulting in unpredictable wind direction. This complicates for instance putting up a smoke screen to provide cover.

Irrespective of street patterns, urban areas restrict observation, fire sectors, fire distances, navigation and manoeuvrability. To determine ones position and objectives within an urban environment, accurate maps or recent aerial photographs are essential. Numerous examples exist where forces lost their way in a city and had to pay dearly in terms of casualties. Street nameplates and direction signs within an urban environment are helpful, but often they are not comprehensible due to the language differences or they can be replaced to confuse outside parties. Without a doubt, he who knows the layout of the urban area has a large advantage.

**2.1.2 Spatial Dimensions**

Understanding the physical characteristics of urban areas requires a different way of thinking about terrain. It requires the comprehension of the multidimensional nature of urban terrain, its general forms and functions, and size. The total size of the surfaces and spaces of an urban area is usually many times that of a similarly sized piece of natural terrain because of the complex blend of horizontal, vertical,

interior, exterior, and subterranean forms superimposed on the natural landscape. Like other terrain, urban areas consist of airspace and surface areas. But in addition to those are 'supersurface' and 'subsurface' areas.

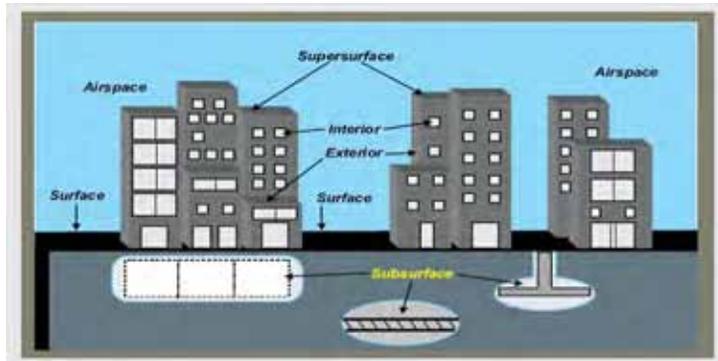


Figure 4 The spatial dimensions of an urban area [2].

Urban terrain has four spatial dimensions (Figure 4).

- 1 *Airspace*: the area above the ground;
- 2 *Surface areas*: exterior ground level areas of e.g. streets, roads, parks and fields;
- 3 *Supersurface areas*: roofs and upper floors of buildings, stadiums, towers, etc.;
- 4 *Subsurface areas*: areas below ground level (e.g. sewer and drainage systems, subway tunnels, utility corridors).

From a military point of view, considerations of *exterior space* (what is on or outside supersurface areas) and *interior space* what is inside supersurface and subsurface areas) are equally important. Examples of important considerations related to the multidimensional battlefield are:

- The buildings can provide a good cover and concealment. Also, the high-density building limits the fields of observation and fire.
- Conventional lateral boundaries will often not apply as one party can control some stories of the same building while opposing forces control others.
- The so-called *urban canyons*, caused by streets cutting through dense blocks of high-rise structures, significantly restrict line of sight, which in turn affects many aspects of military employment, from radio communications to weapons trajectory.

Given the four main dimensions in an urban area, each dimension enlarges the urban battle space and therefore complicates the planning and execution of military activities. The subsequent paragraphs provide specific examples of operational consequences resulting from each of the four dimensions of the urban area.

### **Airspace**

As in all other environments, aircraft (fixed and rotary wing as well as unmanned aerial vehicles) and aerial munitions (including munitions from ground-based weapon systems) use the airspace as rapid avenues of approach in urbanised areas. Forces can use aviation assets for observation and reconnaissance, command and control, aerial attack, or high-speed insertion and extraction of personnel, supplies, and equipment. Some surface obstacles in an urban area, such as rubble, do not

affect flight (though they may prevent the take-off and landing of aircraft). Buildings of varying height and the increased density of towers, traffic and advertisement signs, power lines, and other urban constructions, however, create obstacles to flight and the trajectory of many munitions. Similarly, these obstacles can restrict a pilot's line of sight as well as physically limit low-altitude manoeuvrability in the urban airspace. The excellent cover and concealment afforded to gunners in an urban area increases aviation vulnerability to small arms (including rocket propelled grenades) and man-portable air defence systems (MANPADS), particularly when supporting ground forces are not available. The potential for a high volume of air traffic (military and civilian) over and within urban airspace may become another significant hazard and necessitates increased airspace command and control measures.

The strengths and weaknesses of the use of helicopters in an urban environment are clearly demonstrated by the operation to capture a local warlord in Mogadishu, Somalia, October 1993, well known as "Black Hawk down". Helicopters were used to insert US Special Forces assault teams in the centre of the city. This method of troop insertion assured a reasonable amount of surprise (though the presence of the helicopters had been detected by the adversaries in a very early stage). The risks involved became apparent when two Black Hawk helicopters were shot down by RPGs, fired from the streets and buildings below. The ensuing attempts to rescue the crew members heavily impacted the planned operation, claiming more victims. The deployment of AH-6 Little Bird attack helicopters provided the trapped US forces the means to keep the advancing adversaries temporarily and locally at bay.

### **Surface areas**

Surface areas apply to exterior ground-level areas, such as parking lots, airfields, highways, streets, sidewalks, fields, and parks. They often provide primary avenues of approach and the means for rapid advance. However, buildings and other structures often canalise forces moving along them. As such, obstacles (natural as well as man-made) on urban surface areas usually have more effect than those in open terrain since bypass often requires entering and transiting buildings or radical changes to selected routes. Where urban areas border the ocean or sea, large lakes, and major rivers, the surface of these bodies of water may provide key friendly and threat avenues of approach or essential lines of communication (LOCs) — a significant consideration for commanders. As such, amphibious, river-crossing, and river operations may be integral parts of the overall urban operation.

### **Supersurface areas**

These areas include the external roofs or tops of buildings, stadiums, towers, or other vertical structures. They can provide cover and concealment; limit or enhance observation and fields of fire; and restrict, canalise, or block movement.

However, forces can move within and between supersurface areas creating additional, though normally secondary, avenues of approach. Rooftops may offer ideal locations for landing helicopters for small-scale air assaults and aerial resupply. Some rooftops are designed as helipads. First, however, engineers must analyze buildings for their structural integrity and obstacles. Such obstacles include electrical wires, antennas, and enemy-emplaced mines (although personnel may be inserted by jumping, rappelling, or fast roping from a hovering helicopter and extracted by hoist mechanisms). Roofs and other supersurface areas may also provide useful observation points and battle positions; they may serve as excellent

locations for snipers, lightweight, handheld antitank weapons, MANPADS and communications retransmission sites. They enable attacks against the weakest points of armoured vehicles (top-down) and unsuspecting aircraft. Overall, elevated firing positions reduce the value of any cover in surrounding open areas and permit engagement at close range with less risk of immediate close assault. This area (and the subsurface area) requires commanders to think, plan, and execute ground operations (incl. logistic operations) vertically as well as horizontally. In this latter regard, UO share strong similarities with mountain operations.

### **Subsurface areas**

Underground systems can come in many different forms and in different types of urban areas. Many towns have sewage systems or passages for electric or telephone cables which are frequently large enough to permit passage of personnel and/or supplies. Some cities have underground railways or rivers. A lot of houses have cellars, usually self-contained, which differ with the type of building.

Two types of underground networks that are designed to interconnect and can bear significant traffic are sewers and subways. All sewers generally follow street patterns and flow in a slightly downward slope that may increase as the sewer progresses. Sewers are separated into three types:

- *Sanitary systems*: carry human waste, usually too small to permit entry;
- *Storm sewers*: function to remove rainfall from the streets, usually large enough for people and small vehicles to enter. They are usually dry when there has been no recent precipitation;
- *Combined systems*: found in older cities, merging the two functions creating a large sewer that remains partially full at all times. They are usually large enough for people and small vehicles to manoeuvre.

Most large cities have extensive subway systems of various sizes. Subways are usually built under major roadways and may have potentially hazardous electrified rails and power leads. They often have underground stations that connect to subterranean malls or storage areas. Utility and maintenance tunnels are often found near subways. Older cities may have extensive catacombs below street level and underneath buildings. When thoroughly reconnoitred and controlled, they offer excellent covered and concealed lines of communications for moving supplies and evacuating casualties. They may also provide sites to cache and stockpile supplies.

It is important to be aware of the tactical implications of underground systems. Both attacker and defender can use subsurface areas to gain surprise and manoeuvre against the rear, flanks or even the centre of a threat and to conduct ambushes. However, these areas are often the most restrictive and easiest to defend or block, but are also extremely vulnerable. During World War II in Warsaw the Germans knew that Polish fighters and civilians were hiding in bunkers and sewage systems. By using explosives and incendiary weapons thousands of people were killed. Another tactic was drowning the people by filling the bunkers with water.

Underground systems may have natural and/or combat-related disadvantages in conducting subterranean activities. An example of natural disadvantages is the excellent breeding environment in underground areas for disease and rodents. An example of combat-related disadvantages is the increase of possible ricochet of walls and along sides of tunnels.

Underground systems provide an additional dimension to urban operations. Their effectiveness depends upon superior knowledge of their existence and overall design.

### 2.1.3 *Building Features*

The features of the buildings that occupy urban terrain are of key importance to urban operations. Knowledge of the construction method and material, building size and shape is essential because these features may influence lines of sight, fields of fire, possibilities for manoeuvre, locations for deployment of weapons of various types and observation points. But most of all, the building features have a significant impact on the effectiveness of weapons and munitions.

#### **Construction method**

A major change in building construction method, taking place in cities throughout the world during the last eighty years, has been the conversion from *frameless* to *framed* buildings. Frameless buildings, or mass-construction buildings, have outside walls that support the building's weight and contents. Additional support, especially in wide buildings, comes from using load-bearing interior walls, strong points (called pilasters) on the exterior walls, cast-iron interior columns, and arches or braces over the windows and doors. Modern types of frameless buildings are wall and slab structures, such as modern apartments and hotels, and 'tilt-up' structures commonly used for industry or storage.

Frameless buildings are constructed in many ways (Figure 5):

- The walls can be built in place using brick, block, or poured-in-place concrete;
- The walls can be prefabricated and "tilt-up" or consist of reinforced-concrete panels;
- The walls can be prefabricated and assembled like boxes.

Framed buildings are supported by a skeleton of columns and beams and are usually taller than frameless buildings (Figure 6). The exterior walls are not load-bearing, and are referred to as either heavy-clad or light-clad. Another type of framed building often found in cities is the garage, which has no cladding. Heavy-clad buildings were common when framed buildings were first introduced. Their walls are made of brick and block that are sometimes almost as thick as frameless brick walls, although not as protective. Light-clad buildings are more modern and might be constructed mostly of glass. Most framed buildings built since World War II are light-clad buildings.

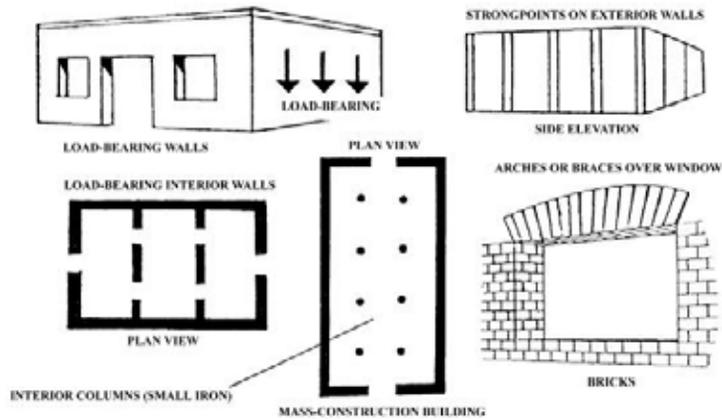


Figure 5 Frameless buildings [12].

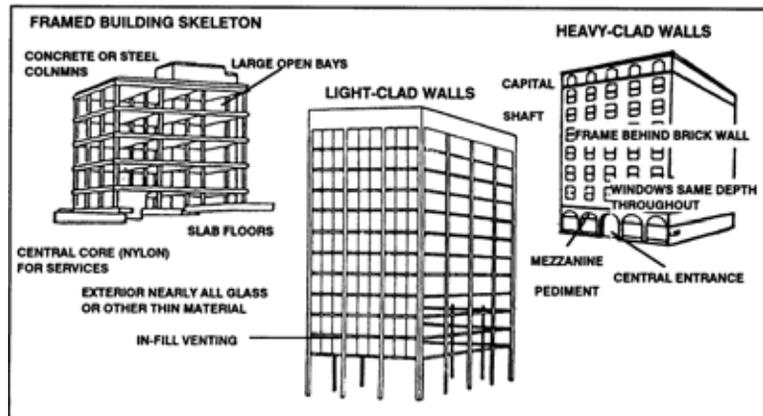


Figure 6 Framed buildings [12].

The construction type can have an enormous impact on military activities. Frameless buildings, with their high proportion of walls to windows, offer more substantial cover than framed buildings having both a higher proportion of wall to window space and thicker (load-bearing) walls than the curtain walls of framed buildings. However, interior walls of the older, heavy-clad, framed buildings are stronger than those of the new, light-clad, framed buildings. Cover within these light-clad framed buildings is very slight except in and behind their stair and elevator modules which are usually constructed of reinforced concrete.

The concrete walls of frameless constructions are often difficult to breach and when using too much explosives, (parts of) the building may collapse. Therefore the best way to enter is to breach a door or window. Heavy- and light-clad buildings are relatively easy to breach with explosive or ballistic breaching techniques.

### Construction material

Traditionally, the basic types of building materials used for construction were mud, stone and brush. Mud was used for filling the spaces between firmer materials and acted as a concrete and insulation. In the Western World nowadays the main building materials used in the construction of buildings are cement, bricks and tiles. However, in the history of building a myriad of materials have been used, ranging from mud to metal, from plastic to grass. Other examples of construction material include sand, thatch, fabric, stone, ceramics and glass.

It is essential to have knowledge on the construction material of the buildings present in the urban area one must operate in while they affect military activities. For instance, the kinetic impact (of bullets) on a house that is constructed using reeds and sticks, such as the thatched house in Figure 7, is very different than the impact on a concrete building, as shown in Figure 8. Bullets can easily penetrate the walls of the first house; this can lead to fratricide or unnecessary collateral damage (e.g. civilian casualties, damage to infrastructure). Concrete buildings however, are much more protected against gunfire and won't easily catch fire when grenades are being used.



Figure 7 Thatched house.



Figure 8 Concrete house.

### Building size

The size of a building refers to its length, width and height. The latter is especially valuable and an interesting fact for military operating in urban terrain. The height of a building provides an indication of the size of the floor surface area, considering each floor is another replication of ground surface area. Moreover, height is a rough indication of type of construction, considering the practical limit of five stories for frameless buildings and the virtual lack of limit to the height of framed buildings. Generally, there are very few mass constructions taller than five stories and few framed structures shorter than three stories.

A single building can be a complex battlefield on its own. During the battle of Stalingrad in the beginning of 1943, it was observed that a four storey warehouse was occupied by Germans on the lower floor, Russians on the floor above them, while Germans also occupied the topmost floor. Adding to the confusion was the fact that because of the intense fighting, the uniforms were impregnated by a dun-coloured dust, making it difficult to distinguish the troops from each other.

To defend or occupy a large building can require vast amounts of troops. Notable is the assault on the Reichstag building in Berlin in April 1945 by the Russians. Some 5000 highly motivated Germans occupied the huge building, which was attacked by nine Russian battalions. The fighting lasted 48 hours before the surviving Germans surrendered. Half of the Germans died in the assault, while also the Russians lost 2200 soldiers.

**Building shape**

Buildings can come in many different shapes. These shapes can be identified as: square, rectangular, T-shaped, L-shaped, U-shaped, H-shaped, X-shaped, and irregular. The table below gives more insight in the different building shapes. The more complex the shape is, the more difficult it is to co-ordinate the activities within the buildings, which increases the risk of fratricide (i.e. blue on blue, friendly fire).

Table 2 Construction shapes [3].

Shape	Description
<b>Square</b>	Designed so that all four sides are of equal size. Such designs are normally found in inner-city construction, smaller family dwellings, and in utility company maintenance buildings.
<b>Rectangular</b>	Designed such that opposite sides are of equal size. The most commonly used shape in building construction.
<b>T-shaped</b>	A modification of a square or rectangle with a wing extending from the centre of the front or back of the building.
<b>L-shaped</b>	A modification of a square or rectangle with a wing extending from one end or the other of the front or back of the building. A common design for family dwellings.
<b>U-shaped</b>	A modification of a rectangle with a wing extending from each end of the front or back of the building. A modification of a U-shape is the multiple U, with more than two wings extending from the front or back. The U-shape is common to larger official buildings and hospitals.
<b>H-shaped</b>	A modification of a rectangle with a wing extending from each end to the front and back. A modification of the H-shaped is the multiple H. The multiple H has more than two wings extending to the front and back.
<b>X-shaped</b>	A centre common area with T-shaped wings extending from the centre of each side. X-shaped designs are found in some apartment complexes.
<b>Irregular</b>	Buildings that do not fit traditional designs such as the Pentagon, religious structures, sports arenas, and permanent fortifications.

**The qala as a significant building type**

A typical example of a building architecture that is encountered in the current theatre of operation is the *qala* (Figure 9). A qala houses one Islamite family. The residence area varies from 20 meter × 20 meter until 100 meter × 100 meter, depending on the family size and the family belongings. The area includes at least one room for living. For protection and for privacy reasons, the entire area is fenced by a wall. Inside this wall, an open space can house a well, a vegetable garden, cattle and/or an outdoor kitchen.



Figure 9 A qala.

The fence wall is made of self-made large stones and filled up with pebble stone, straw, sand, wood and/or animal droppings. Loam is spread out across the wall. The sun hardens the loam. As a result, the fence wall becomes rock-hard. The height of the fence wall ranges from 2 meters until 5 meters. The wall thickness ranges from 20 to 80 centimetres. The qala entrance is frequently covered by means of a simple metal door (e.g. made of corrugated iron). Windows are covered by cloth or stay open night and day.

An urban area may consist of a large number of qalas (Figure 10). Neighbouring families may separate their residences by a common fence wall. Small paths in between the qalas can provide a path towards a main street, farmland or a river.



Figure 10 An urban area consisting of multiple qalas.

Although of simple structure and built from very basic material, qalas are a military challenge. Firstly, the high surrounding walls provide excellent cover from sight. The opponent, and especially the insurgent who has support from the local

population, can easily disappear from view by entering a qala (although without preparation, his escape routes might be very limited). A series of qalas shows ground troops nothing but a row of blind walls, without knowing what is behind them. Aerial observation is a good solution to overcome this challenge. Secondly, the qala wall provides good cover against small and medium calibre munitions. When attacked from a qala or when the wall has to be breached, anti-tank grenades or missiles have to be used. Knocking down a wall should only be tried with bulldozers or the heaviest armoured vehicles like tanks. However, the narrow streets limit the movement of these vehicles.

## 2.2 Physical Characteristics of Small Urban Areas (Villages, Towns)

Whereas large urban areas (cities, metropolis, megapolis) are segmented into multiple functional areas (see §1.2), small urban areas (villages, towns) are not. A small urban area can be considered an area with inseparable commerce, residential houses, industry, support facilities, etc.

Small urban areas are usually found in a rural setting. These urban areas are usually involved in only one economic activity like fishing, mining, or farming. Small urban areas provide basic goods and services for the settlement's inhabitants and for people in a small hinterland around the settlement.

Small urban areas typically have a limited geographical footprint and consist of a small number of streets. The centre typically consists of a main street with some shops, restaurants, cafes and offices. Often, the main square dominates the centre. Small urban areas are more spacious than large urban areas. They often include detached houses, including farms. Generally, a small urban area contains low-rise buildings only.

Due to urban growth, the variety of functions and services provided in a small urban area can gradually increase. New functions may grow around specialised economic activities, and can include local self-government. The newly provided services require a large threshold of population to survive, i.e. people need to be willing to travel longer distances to get to these services, as they are more important or rarer.

### **Military implications**

The following examples illustrate the military implications of small urban areas:

- Small urban areas are often on chokepoints in valleys, dominating the only high-speed avenue of approach through the terrain. If the buildings in a small urban area are well constructed and provide good protection against direct as well as indirect fires, a very effective defence can be established by placing a company within the settlement, while controlling close and dominant terrain with other battalion elements.
- Strip areas (e.g. Figure 11) consist of a small row of houses, stores and factories built along roads or down valleys between distinct small urban areas. They afford the defender the same advantages as a small urban area. If visibility is good and enough effective fields of fire are available, a security force only will need to occupy a few strong positions spread out within the strip.
- For large-sized military units, operating in small urban areas is less complex than operating in large urban areas. This is because the area can be cordoned off (more easily). In addition, the area can more easily be by-passed. Finally, the

small number of buildings and the relatively low building density makes search operations within small urban areas less complex. In all, the situational awareness in small urban areas is better than in large urban areas, which makes it easier for the higher echelons to create the proper conditions for the small-sized military units which have to conduct the operations.

- For small-sized military units, operating in small urban areas is similar to operating in large urban areas. This is because techniques, tactics and procedures (TTPs) are equal for both types of areas.



Figure 11 An example strip area.

## 2.3 Physical Characteristics of Large Urban Areas (Cities, Metropolis, Megapolis)

### 2.3.1 Introduction

#### **Functional decomposition of a large urban area**

Sociologists, economists and geographers have developed several models explaining the physical structure of large urban areas. A model of urban spatial structure was proposed in 1939 by an economist named Homer Hoyt. His so-called sector model proposed that a large urban area consists of sectors, or functional areas. Certain areas of an urban area are more attractive for various activities, either by chance or for geographical and environmental reasons. As the urban area grows and these activities flourish and expand outward, they become a clearly distinguishable sector of the urban area.

The sector model is only one way to visualise the development of urban design, taking into account that this theory is primarily based on the developed world. However, the sector model provides a valuable framework to consider the different functional areas that each has its own specific influence on the urban operation.

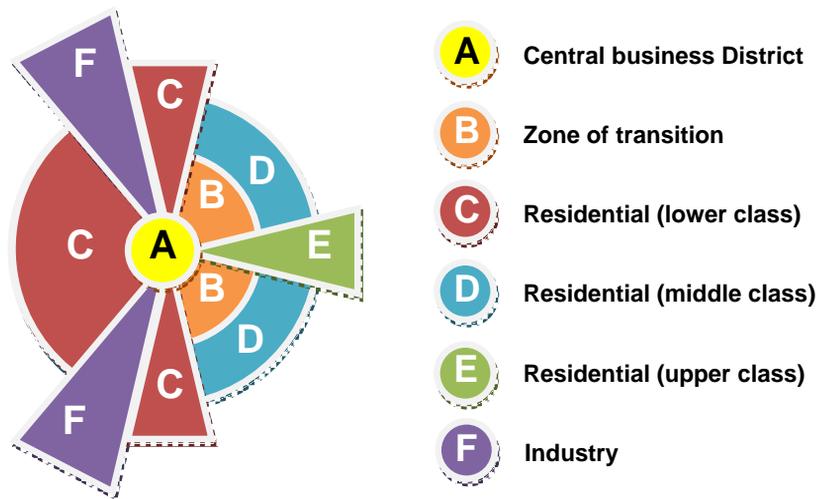


Figure 12 Hoyt Sector model [6].

### Geometrical decomposition of a large urban area

The geometrical decomposition of a large urban area can be defined by the relative positions of functional areas, main transportation lines (such as highways, railroads and canals), and nature areas. We can distinguish four types of geometrical decompositions (Figure 13):

- 1 *Satellite*: A central hub is surrounded by smaller, dependent urban areas. The nature area throughout the urban area is relatively homogeneous;
- 2 *Network pattern*: A network pattern interlocks primary hubs of subordinate satellite patterns. The nature may vary more than in a single satellite array;
- 3 *Linear*: Potentially a sub element of the previous two patterns. The linear pattern can form one ray of a satellite pattern, or can be found along connecting links between the hubs of a network;
- 4 *Segment pattern*: When dominant nature (such as a river) and/or man-made features (canals, major highways, or railways) divide an urban area, a segmented pattern will result.

### Outline of this section

The description of physical characteristics of large urban areas in this section is based on the assumption that distinct areas within a large urban area can be formed based on their function as well as on their location. Sections §2.3.2 through §2.3.7 describe the distinct characteristics of specific functional areas, which are a variation on the functional areas from Hoyt's sector model.

- 1 City centre;
- 2 Industrial area;
- 3 Residential area;
- 4 Transportation terminal;
- 5 Slums and refugee camps;
- 6 Recreational area.

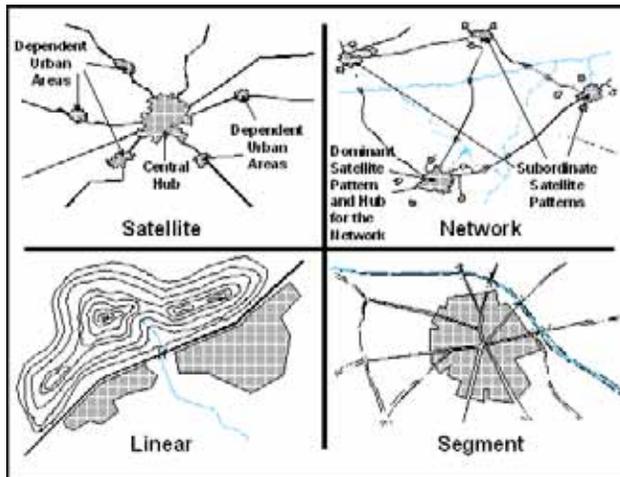


Figure 13 Urban patterns [12].

The provided descriptions of functional areas are meant to help commanders in determining the potential advantages and disadvantages (threats and difficulties) of distinct functional areas when accomplishing an operation within a large urban area. Note that commanders must also take into account the mutual positions of the functional areas. E.g. due to the large city growth (especially in megacities), an airport may be located among other functional areas, instead of along the city border. As a result, it becomes more difficult to use this airport as a point of debarkation or logistical hub. This is because the surrounding functional areas provide ample firing positions for firing at incoming or departing planes and helicopters.

### 2.3.2 City Centre

The basic assumption is that every city contains a *city centre*. The city centre is the social and economic heart of the urban area in which a combination of several functions is present, such as residence, business, industry and transportation.

Throughout the world there are many types of city centres possible, each with its own combination of certain physical characteristics. These different types must be taken into consideration while they affect the way an operation can be performed. Three main types of city centres are presented in this chapter: the historical or *medieval* city centre, the *modern* city centre and the *high-tech* city centre. Note that these three types do not cover *all* possible types of city centres. Besides these three main types several other combinations of the characteristics are possible.

#### 2.3.2.1 Medieval City Centre

A *medieval* city centre can be characterised by its compactness. The multi-storey houses are positioned together, the density of people is very high and there is little if any yard space. Transportation had little influence on the layout of the streets which resulted in a very irregular street pattern. Narrow, practically impassable streets are jumbled together, often seemingly without a structural plan. City centres with medieval origin are frequently built around a central, main castle, cathedral or church located upon a hill.

### Example 1: Perugia

The historical city centre of Perugia, the capital city of the region of Umbria in central Italy, is a classical example of a medieval city centre. It can be characterised by its incredible network of narrow, cobbled streets and twisting alleyways. The city centre is located on a hill which is accessible through stairs all around the hill. There are just a few main streets that are primarily for pedestrians. This complex design of the centre is an enormous restriction to freedom of movement of the military troops. Moreover, fields of fire and observation are severely limited; the narrow streets negate the advantages of a tank's long-range firepower, can limit the turret's ability to traverse and do not allow for minimum effective range of anti-tank guided missiles (ATGM).



Figure 14 Perugia city centre.

### Example 2: the medina

Another example of a medieval city centre is the traditional city centre of the Middle East, often referred to as *medina*. The medina needs an individual analysis, while its urban design is most different from cities in other world regions. There are strong design and artistic correlations of the medina across the Islamic world from North Africa to southwest Asia (Pakistan).

The medina is the heart of the Middle Eastern city and of great importance in understanding the social and physical structures of urban life, even though in some cases only three percent of the modern Middle Eastern urban population lives in the old city.

Figure 15 shows the urban design of the medina, which is surrounded by high walls. As in most city centres several functionalities are present. The floor plan shows several scattered mosques, which are the centres of urban cultural, political and social activity. Located in close vicinity of the mosques are the marketplaces, bazaars or *suqs*. These suqs are typically characterised by narrow alleys with shops that appear to be carved into the walls of the market streets and alleys, as shown in Figure 16. Often tarps spanning the streets provide protection from the weather.

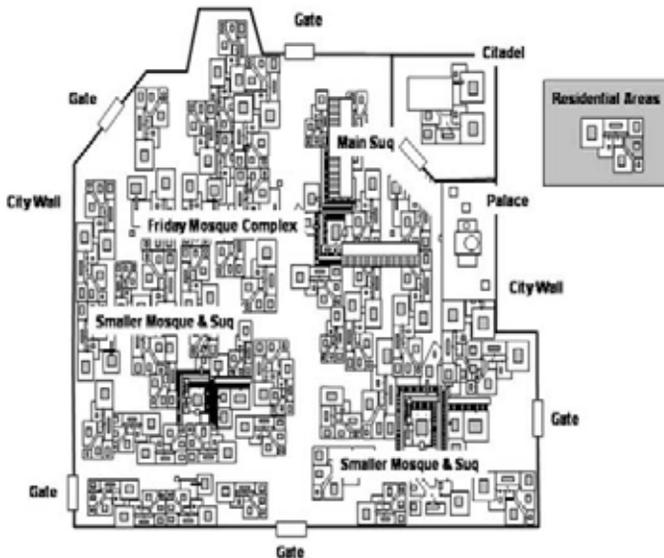


Figure 15 Main components of the traditional old city centre of the Middle East (medina) [4].



Figure 16 Suq in Iraq [4].

The residential buildings are another important component of the medina, visibly influenced by Islam. The inwardly focused building styles and privacy-enhancing door designs reflect the religious desire for privacy. This is sometimes reinforced by fences surrounding the house, marking its territory. The courtyard homes also accommodate the inclusiveness of a large family.

Other physical characteristics that influence military activities are:

- Narrow streets, with buildings spaced closely together;
- Irregular street patterns of winding alleys and cul-de-sacs;
- The houses are representing a social status or image;
- The houses are characterised by the exterior walls, flat roofs and the absence of windows;
- Simple water, sewer and electricity systems.

The traditional city core, though relatively small physically is often the centre of the urban population's religious and, by association, political focus. Many of the important mosques and associated facilities are located here. The quarters' and residences' unique designs may pose significant challenges to military operations that must be accounted for by commanders and their staffs. The community is close-knit, making intelligence activities more difficult. Its street construction and patterns make many parts impenetrable to vehicles. House styles (like the courtyard home) are more secure from rapid seizure or search, and the winding streets and alleys without patterns decrease the situational awareness and make navigation tasks difficult. Tactical operations in the area, therefore, require specific TTPs, additional planning, and careful execution.

### 2.3.2.2 *Modern City Centre*

Since the middle of the 19<sup>th</sup> century the development of urban areas has largely been characterised by massive projects of transport infrastructure, mainly as a result of the industrial revolution. The city centres that originated were aimed at increasing mobility and accessibility and therefore have characteristics very different from those of their predecessors. The design of this *modern* city centre, characterised by a grid pattern, is very spatial, with wide streets, open areas (parks, parking lots), large built-up areas and low to medium-rise buildings that are spaced apart, which is the reason why the density of people is relatively low.

#### **Example: Washington D.C.**

An example of a modern city centre is Washington D.C., the capital city of the United States of America. Washington D.C. can be characterised by a grid street pattern overlaid by broad radial avenues, converging on the Capitol and Executive Mansion, forming numerous squares, circles, and triangles that make interesting spaces for pocket parks. There is quite some space between the individual buildings, which are low to medium rise.



Figure 17 Washington D.C. City centre.

#### **Military implications**

The spatial and orderly layout of the modern city centre improves freedom of movement and increases the number of avenues of approach. The wide streets may allow high-speed movement of tracked and wheeled vehicles. Unlike the medieval

type, the modern city centre provides sufficient manoeuvre space for the deployment of heavy direct-fire weapons. Moreover, the situational awareness for infantry is better compared to the medieval city centre. Together with increased field of fire, this multiplies the opportunities for fire support. Considering air support, the modern city centre provides a better overview from the air. However, besides these advantages, some disadvantages can also be identified. For instance, large fields of fire offer less cover and thereby increase the vulnerability of own troops.

### 2.3.2.3 *High Tech City Centre*

The spatial and stretched urban design of the modern city centre could not anticipate the ongoing growth of some urban areas. Mostly in the developed parts of the world, another type of city centre was created to cope with the high density of people: the *high tech* city centre. This type of city centre is among other things characterised by building upward; these ‘vertical’ city centres are dominated by skyscrapers and a highly technological environment.

In high tech city centres a combination of grid and radial street pattern can be found, with (underground) superhighways and train systems that go both around and through the city. The high-rise buildings (apartment buildings, offices) such as skyscrapers are closely spaced and the density of people is very high.

#### **Example: Shanghai**

Examples of a high tech city centre are New York, Tokyo and Shanghai. The latter will be addressed here. Situated on the banks of the Yangtze River Delta in East China, Shanghai is the largest city of China and the seventh largest in the world. Widely regarded as the citadel of China’s modern economy, the city also serves as one of the nation’s most important cultural, commercial, financial, industrial and communications centres.



Figure 18 Shanghai city centre.

Downtown Shanghai is dominated by a dense cluster of high-rise buildings, such as skyscrapers, which results in an excessive high density of people. Subways and underground parking garages make optimal use of the extra dimension.

The city-grid and street pattern in the old city centre of Shanghai is comparatively regular and standardised, with a recognisable pattern of gridiron constructions (e.g. fly-overs). Two series of roughly paralleling streets connect to each other in a cross-intersection, forming square-shaped urban blocks. This pattern of urban streets has the benefit of being strongly connected, openly accessible and readily expandable. It offers a wide variety of possible routes of movement through the urban blocks and accessing nodes in and out. The open type of cross-intersection allows fluent circulation through blocks, thus causing fewer traffic jams.

### **Military implications**

On the one hand the accessible roads make it easy to use military vehicles in a high tech city centre. However, the remaining characteristics of the environment make it very difficult to execute military activities. The situational awareness is extremely limited; standing on the ground, the visual sight is blocked by the high-rise buildings. The radio communication depending on line-of-sight is also hindered by so called urban canyons. Moreover, the extensive use of all dimensions causes poor situational awareness and enemies can make use of many different ways of approach. The urban design can easily catalyze a 360° fight.

### 2.3.3 *Industrial Area*

An industrial area contains large and small scale manufacturing, assembly, warehousing and distribution facilities. When considering industrial areas, a distinction between older and newer industrial areas can be made. Older industrial areas were established before World War II with a strong linkage to railroad lines, waterways and canals and are characterised by the predominance of frameless masonry, constructed of stone. These buildings are two or more stories in height with low ceilings and small sites relative to building size. The area, small and with little or even no parking areas for cars, is often located immediately adjoining residential areas (near the city centre of medium size towns and larger cities) in order to facilitate walking from home to work. Both the overall infrastructure as well as the population density is medium.



Figure 19 Older industrial area [1].



Figure 20 Newer industrial area [1].

New industrial areas, established after World War II, are based on the use of transport by trucks. These areas are mainly located in suburban areas and can be characterised by single story, flat-roofed plants and a modern traffic infrastructure. The present constructions generally have steel frame and lightweight exterior walls. Multi-storey structures usually have reinforced concrete floors and ceilings.

Table 3 summarises the differences between old and new industrial areas.

Table 3 Differences between old and new industrial areas [1].

	Older industrial area	Newer industrial area
Skyline	Medium	Low
Visibility	Medium	High
Building density	Medium	Low
Traffic infrastructure	Medium (pre auto)	Good (modern)
Day/night activities	Day	Day, sometimes night
Building materials	Frameless masonry (stone)	Frameless, prefabricated structures, tilt-up
Area	Global	Global
Population density	Medium	Low/medium

### Military implications

The visibility and movement ability of military forces are relatively low for the medium dense older industrial areas. The masonry constructed buildings are suitable for defensive positions, but can cause significant obstacles when demolished. The newer industrial areas provide good mobility opportunities for military forces. Due to many open spaces there are little obstacles, and excellent observation and communication possibilities.

It is likely that large concentrations of inflammable, explosive or toxic industrial chemicals (hazardous materials, or HAZMAT) will exist in industrial areas, e.g. in an oil refinery, LPG-station or chemical plant, and this presence should concern military forces operating near them. These chemicals can be released by terrorists, targeting industrial chemical facilities for intentional sabotage. This can have an enormous impact: in addition to the loss of life or injury to workers and those living around a chemical facility, an attack on a major chemical production plant would detrimentally impact a nation's economy.

Besides this deliberate release there is also the possibility of an accidental dispersion, caused by say, a natural disaster or a technical error.

#### 2.3.4 Residential Area

A residential area is a place where people live, occupied primarily by private residences. These areas can be found dispersed throughout the urban area: however, large suburban areas (or sprawl) normally form on the outskirts. This type of area often consists of row houses or single-family dwellings set in a grid or ringed pattern in a planned development project, where the street patterns are normally rectangular (grid) or gently curving. Yards, gardens, trees and fences may separate the buildings in a residential area. In some areas in the world, residential areas may be located in high walled compounds with houses built right up the edge of the street.

Residential areas can differ in e.g. (population-) and infrastructure density and skyline. Four classification types can be distinguished:

- 1 Low-open residential areas (single-family houses);
- 2 Low-dense residential areas (terrace linked or cluster houses);
- 3 High-open residential areas (multi-storey apartment buildings);
- 4 High-dense residential areas (apartment buildings in/near city centre).

### **Low-open residential area**

Detached single-family houses with gardens dominate this type of residential area. The main part of the single-family houses is owner occupied, and represents a highly individualised form of housing, offering opportunities and freedom to make individual arrangements. This type of dwelling can be adapted to the owner's requirements to equipment, size, and layout. The house can be arranged inside and outside to achieve a specific desired look that agrees with the owner's taste. This kind of house and residential area is typified by the villa and in that sense by the old upper-middle-class way of living.



### **Low-dense residential area**

Terrace linked or cluster houses represent another typical kind of housing. The houses tend to meet the requirements of families with children and the majority of these houses have their own garden, and the estates contain playgrounds. Compared with the single-family house, this type requires far less land, shorter and cheaper roads and pipelines. Moreover, the area is more densely populated which provides a basis for shops and institutions and better opportunities for various kinds of joint activities among the residents.



### **High-open residential area**

The third type consists of large, modern, well-equipped dwellings in multi-storey buildings. In these buildings, all residents have access to light and air, and from the dwelling there is a view of green areas. The dwelling is normally provided with a balcony, and the green areas are provided with playgrounds and other recreational facilities.



The modern multi-storey building was introduced in a period when technological development made it possible to make building components in factories, convey them to the site, and assemble them there. This new way of housing production was used to meet the increasing demand for dwellings in the 1950s.

### **High-dense residential area**

Dwellings in blocks of multi-storey buildings, typically situated in areas in or near the centre of the city, represent a fourth type of dwelling. These buildings were built in the late 1800s to accommodate the growing population of workers. Compared with the high-open residential area there is far less space for parks and fields.



### Military implications

In residential areas numerous routes are available for vehicular movement. Underground utility systems are normally too small to be used. Rubble will be the principal hindrance to mobility. Basements provide excellent protection from indirect fires. The presence of many people is by far the most crucial factor for the planning and execution of military activities within residential areas.

#### 2.3.5 Transportation Area

A transportation area is a location where freight and passengers originates, terminates or is handled in the transportation process. A transportation area can either be a port, an airport or a railway station.

### Ports

The function of a port is to supply services to freight (warehousing, transshipment, etc.), personnel (travellers) and ships (piers, refuelling, repairs, etc.). A port can either be a *sea-* or a *mainland* port.

Seaports have direct access to the sea (Figure 21). They can be:

- in a delta (e.g. New Orleans, Bangkok);
- at the margin of a delta (e.g. Calcutta, Rangoon and Rotterdam);
- along a river (e.g. Montreal, Antwerp, Portland);
- natural harbours (e.g. San Francisco, Rabaul);
- in an estuary (e.g. Le Havre, New York, Buenos Aires);
- near an estuary (e.g. Liverpool, Lisbon, Quebec);
- in a bay (e.g. Tokyo);
- at a protected location (e.g. Gdansk: sand dunes, Dakar: islands, Honolulu: reefs).



Figure 21 Types of ports [1].

Most coastal cities were built around a port. The port is 'the reason for the city's existence'. Although some port cities have built new port facilities at some distance from the urban area, in most cases the port is located right in the centre of the most heavily populated and congested part of the city. Coastal cities are large centres with more than 20,000 people. Because coastal cities have diverse populations with a range of socio-economic and cultural groups, they offer the expectation of growth and opportunities for economic prosperity and development, providing easy access to the ocean, rivers, beaches and other natural areas. Access to jobs, services, employment and housing choice is also available. In some Asian cities the water not only provides a way of transportation, but is also used to live on (houseboats) and to work on (floating markets).

### **Airports**

In comparison with ports, airfields are generally located farther from the built-up sections of the urban area, depending on their size and when they were built. Older airfields are often closer to the heart of the city, while newer ones can be kilometres away from even the outskirts of the urban area. An airport consists of two major components: *airfields* and *terminals*. An airfield is the physical site of the airport concerned with servicing aircrafts, which includes runways, parking areas and huge hangars for maintenance. The terminal is composed of freight and passenger transit infrastructures as well as infrastructures for plane accommodation. They are also linked with local transport systems, which involves terminals, such as a passenger railway station, within or adjacent to the airport terminal. The different levels of an airport terminal are from top to bottom: restaurants and shops, departures, arrivals, buses, and trains.

### **Railway stations**

A railway station is a place where trains stop to allow passengers to board and alight. They vary greatly, and may include platforms, tunnels, bridges and/or level crossings to reach the platforms, counters and/or ticket machines, waiting rooms, shelters and benches, etc. Many train stations date from the 19<sup>th</sup> century and reflect the architecture of the time, grand in scale and size, lending prestige to the city as well as to the railway operations. The architecture also reflects the hubris of the time.

### **Military implications**

The function for society of transportation areas makes them of particular interest in the urban operation, as history has shown. Transportation areas are the lifeline of a city and the connections to the outside world. Denying their use to the opponent limits his logistical supply capabilities and his manoeuvrability. At the same time, controlling their use enhances one's own capabilities to sustain an operation. And for remote areas of operations these transportations areas can function as port of debarkation for supplies and/or personnel.

Because transportation areas handle huge amounts of freight, often large quantities of packaged foodstuffs and equipment can be stored in terminals nearby these areas. Especially in times of trouble, these valuable resources must be guarded from opponents and looters, and can also be used for the benefit of the military operation.

The location of port facilities within the urban area makes smooth operations problematic. The most significant factors influencing operations are the port's physical layout, the handling capabilities, the transportation infrastructure and security. Ports are particular areas where water and land border on one another. Both types of surface can be used to operate upon (or even under), so in these areas co-operation between land forces, naval forces, marines and/or coast guard is imperative. This includes operations at sea (such as sea basing of naval fire support), in the harbour and up along the rivers.

Often a seaport is situated at the mouth of a river, where the waterways physically cut the city into sectors, limiting the manoeuvrability of land based vehicles. This is also the case when many canals cross the city. To remedy this, bridges, tunnels and ferries connect the separated sectors of the city. These connections are vital to the freedom of movement for all inhabitants of the city and therefore chokepoints in a military operation. Battles have been named after these particular objects (e.g. the

bridges over the Rhine in Arnhem in September 1944 and Remagen in March 1945). When existing bridges and tunnels cannot be used, boats must be deployed or temporary bridges created, seriously hampering the tempo of the operation. And here also the civil population comes into play. When the American forces built a pontoon bridge across the river Pasig during the battle of Manila in February 1945, as soon as the bridge was built, hundreds of civilians poured over the bridge to escape the fighting.

Factors influencing airfield operations include the need to use the airfield for different types of flight operations (including humanitarian operations in UO), the distance from joint force units and supply facilities, road capabilities, security, and airfield capabilities. When the United States invaded Panama in December 1989, the airports were primary objectives of airborne operations, to prevent the Panamanian president to flee, to incapacitate the Panamanian forces and to enable U.S. follow-on forces and supplies to be flown in. Port and airfield facilities as well as railway stations will be susceptible to attack by conventional and unconventional means. As stationary targets, they are vulnerable to air or missile attack. Their size and probable locations, along with the presence of civilians, may encourage sabotage, terrorism, mining, and espionage. Table 4 shows the differences of characteristics between port, airport and railway station.

Table 4 Differences between ports, airports and railway stations [1].

	Port	Airport	Railway Station
Function	Any location where freight and passengers either originates, terminates or is handled in the transportation process.		
Skyline	Low	Low	Low
Visibility	Low	High	Low
Density	High	Low	High
Infrastructure	Good	Excellent	Good
Day/night activities	Day and night	Day and night	Mostly day, often night
Building materials	Frameless prefabricated Concrete wall and slab, tilt up	Framed structure (steel, glass), warehouse (concrete, steel)	Frameless structure
Area	Global	Global	Global
Population density	Low/medium	High	High

### 2.3.6 Slums and Refugee Camps

These functional areas are important when considering urban operations, while they are a likely point of origin of civil unrest.

#### Slums

The United Nations agency UN-HABITAT defines a slum as ‘a heavily populated urban area characterised by substandard housing and squalor’. In many slums, especially in poor countries, many people live in very narrow alleys that do not allow vehicles (like ambulances and fire trucks) to pass. The lack of services such as routine garbage collection allows rubbish to accumulate in huge quantities, and more often than not there is no water or electricity. This lack of infrastructure is caused by the informal nature of settlement and no planning for the poor by government officials. Slums usually consist of irregular, low-cost dwellings, usually

on lands belonging to third parties, and most often located on the periphery of cities. These dwellings are often assembled from pieces of plywood, corrugated metal, sheets of plastic, and any other material that will provide shelter. Slums are mostly found in developing nations, or partially developed nations with an unequal distribution of wealth.

There are several types of slums, but the main types are the following:

- *Inner city slums* are usually rental tenements, which have deteriorated for lack of proper and regular maintenance or repair. These are mostly located in the older sections of the cities and are characterised by a low standard of infrastructure and high person-to-floor space ratios;
- *Squatter settlements* are generally found near urban rivers and canals, beside railway tracks, on governmental land, or on land with vague tenure status. These settlements consist of non-permanent or semi-permanent housing structures, which are laid out in a haphazard manner. The lack of infrastructure and the illegal tenure of land are their additional characteristics;
- *Illegal subdivisions*. These consist of two types: user-rented and user-purchased. In both cases, unscrupulous entrepreneurs invariably rely on political and bureaucratic patronage or connections to enable them to occupy and subdivide the land on the urban fringe.



Figure 22 Slums in Manila, Philippines.

Slums can come in different size and shapes; they can be quite small, with a low density of people and structures, but also huge slums exist. For instance, Kibera in Nairobi is one of the largest slums in Africa, and home to close to one million people. With a population density estimated at 3,000 people per hectare, it is considered to be one of the most crowded places on earth.

### Refugee camps

A *refugee* or *internally displaced person (IDP)* camp<sup>5</sup> is a last resort for displaced people. These camps are meant to be temporary, designed to house people until they can return home safely. But ongoing war or persecution can make it impossible to return, and many people live in camps for years. Unprotected people may also find

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<sup>5</sup> A refugee is a civilian who, no longer receiving protection from his or her own government, crosses a national border to escape the conflict or persecution. Refugees are protected by international law [1]. An IDP, or internally displaced person, is a person who has also fled his or her home because of conflict but has not crossed an international border. He or she remains under the jurisdiction of national authorities and thus is not a refugee. IDPs do not benefit from any specific protection under international law [1].

shelter in a school, train car, warehouse, stadium, or in someone's private home. They usually have left their homes in a hurry, without any of their personal belongings. When living in a camp or building, they often face severe health risks due to overcrowding, insufficient nutrition and poor sanitation.



Figure 23 Refugee camp.

As of 2007, 14 Million refugees and up to 25 million IDPs live in temporary shelters throughout the world. Although some people ultimately return home or move to another country, the number of refugees and IDPs continues to grow.

The number of people living in a camp depends on the crisis. When this number is in the hundreds of thousands, aid agencies will try to set up a few smaller camps with population of no more than 20,000, because smaller camps are easier to manage when it comes to fire risks, security problems, the spreading of diseases, etc.

Large refugee flows invariably turn towards urban areas, in search for aid such as resources, shelter, protection and labour. There, camps are usually located on the edges of towns or cities in a secure area, away from the border, war zones and landmines. In some cases, host governments insist on enclosing refugee camps with barbed wire fences so the refugees don't mix in with the local population.

### **Military implications**

The poor infrastructure, the very high density of people and shelters and the lack of street and public utilities makes this type of areas one of the hardest for military operations. Structures are randomly arranged and formal street naming and numbering as well as easily identifiable buildings and terrain are lacking, which causes great challenges in the field of navigation and co-ordination. Moreover, the mobility is extremely limited due to the narrow paths. The composition of the population can vary from heterogeneous to homogeneous, but in general there is no formal hierarchy or leadership, and administration and identification of the people is poor. This makes the collection of accurate intelligence very difficult. At all levels the situational awareness is very poor, and command and control is very difficult in this environment.

Several threats are present, i.e. the increased risk of fratricide and civilian casualties due to the weak structures, or the risk of large, rapidly spreading fires and spreading diseases because of bad living conditions. When humanitarian aid organisations are not (sufficiently) present, military troops can get involved in order to provide security and aid, often (over)stretching the military medical and supply capabilities.

### 2.3.7 Recreation Area

Stadiums, parks, sports fields, and school playgrounds are of high interest during operations in urban terrain. Because of their regular function, at times, they can attract vast numbers of people. The concentration of people in itself can be of importance to an operation, because accidents, unrest or even riots can originate from it or the gathered people can be the target of insurgents. In urban operations, these areas can be used for other purposes as well, such as holding civilians, interrogation centres, insurgent segregation areas, and prisoner of war holding facilities. Public baths, swimming facilities, and cisterns are useful in providing bathing facilities. They also provide an alternate water source when public utilities break down.

Recreational areas can also afford suitable aircraft landing and pickup zones and artillery firing locations. They can provide logistic support areas and aerial resupply possibilities because they are often located centrally. Finally, large open areas (and immense or unusually shaped structures) within urban areas are often easier to observe (especially from the air) and can serve as excellent target reference points where one can shift or control fires. When large numbers of people are gathered on a relative small and open area, they are very vulnerable. Indirect fire and heavy automatic weapons can turn crowded open areas into killing zones.

## 2.4 Cities of the Future

The ongoing urbanisation causes major congestion and a lack of green space. To solve this problem plans for massive constructions have been made, combining all functions of a city or society into one structure and providing accommodation for hundreds of thousands of people. An example is the Shimizu TRY 2004 Mega-City Pyramid, a proposed project for construction of a massive pyramid in Tokyo, Japan<sup>6</sup>. The pyramid city would be built over Tokyo Bay, and thus would not have to compete for very expensive space in one of the most densely populated land areas in Asia. The construction would not be a vast, closed structure, but instead provide a pyramidal exoskeleton in which numerous skyscrapers are incorporated. The structure would be 12 times higher than the Great Pyramid at Giza. If built, it will be the largest man-made structure on earth. The structure would be 2,004 meters (6,575 feet) high and have a footprint of 8 square kilometres. The building would be zoned into residential, commercial and leisure areas. 50 km<sup>2</sup> would be given over to some 240,000 housing units, enough for 750,000 people. Each building would have its own energy resources (sun and wind). 24 km<sup>2</sup> will be assigned to offices and commercial facilities intended to employ 800,000 people. The remaining 14 km<sup>2</sup> would be used for research and leisure purposes.

Other 'cities of the future' may consist of a maze of tunnels and chambers entirely underground, not unlike a giant ant nest, opening onto huge twenty-story-deep air wells.

### Military implications

The characteristics of these immense city-constructions largely differ from any currently existing city. Manoeuvring inside such constructions, with its numerous

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<sup>6</sup> More information on the Shimizu TRY 2004 Mega-City Pyramid is available on the internet, e.g. [www.wikipedia.org](http://www.wikipedia.org) and [www.binisystems.com](http://www.binisystems.com) (the website of one of the architects who proposed this project).

traffic ramps, elevators and staircases can easily be hampered or blocked. The use of (heavy) mechanised vehicles might not even be possible or practicable. Current military communication and navigation devices would probably not function at all, severely restricting situational awareness and command and control. Fire support cannot be deployed inside such constructions and from the outside only the outermost spaces can be targeted without causing excessive collateral damage. Those mega-cities are the operation domain of dismounted troops and engagements are by definition close quarter. The density of people is enormous, which increases the risk of civilian casualties.

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## 3 The Civilian Population

### 3.1 Introduction

The presence of the civilian population represents the most complex aspect of urban operations. The presence of civilians has a direct effect on the planning and execution of a military mission. There are four main reasons for this:

- 1 Civilians are the centre of gravity;
- 2 Civilians are non-combatants and potential war victims;
- 3 Civilians are potential partners;
- 4 Civilians are potential opponents.

#### **Civilians are the centre of gravity**

Nowadays, stability and reconstruction operations are more common types of operations than full combat operations.<sup>7</sup> In those operations, military forces assist local parties and the population in (re)building the nation's security, governmental and economic capabilities, countering the influence of insurgents. While combat activities against insurgents are necessary at times, the main focus is to gain the support of the local population towards the objectives of the mission.

#### **Civilians are non-combatants and potential war victims**

The presence of civilians has a direct effect on urban operations especially since civilians tend to stay in their homes during execution of military activities in the city. Examples which show this kind of behaviour are World War II and Grozny. Many civilians will stay in place, try to protect their property, and try to avoid the fighting.

The presence of civilians affects movement and manoeuvre of militaries. By international humanitarian law, military activities should prevent civilian losses as much as possible. Besides that, damage to the infrastructure which is vital to the civilian population should also be prevented because (1) it obstructs winning the so-called *hearts and minds* of the population, (2) the infrastructure is essential to the civilians *and* the contending parties, and (3) a possible reconstruction period will be limited. That is, unintentional damage or incidental damage affecting facilities, equipment or personnel, occurring as a result of military actions directed against targeted enemy forces or facilities should be limited. Such damage can occur to friendly, neutral, and even enemy forces.

Against international conventions, some parties deliberately abuse the local population for their purposes. E.g. some parties locate important military systems and supplies near public facilities; others actively use the population as human shield to protect own forces. Insurgents can disappear in the crowd and even when they can be distinguished clearly, military forces have to weigh their threat against the risk to the surrounding civilians. Not engaging will probably result in the escape of the insurgents, while engaging them in the middle of a crowd and causing other

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<sup>7</sup> However the one does not exclude the other. 'Three Block War' denotes the nowadays applicable term for operating in urban areas where a unit conducts different activities along the spectrum of combat fighting, peacekeeping and humanitarian aid.

victims, could lead to a propaganda victory for the insurgents. Furthermore, civilians can be the ultimate means to force a government to its knees, when military forces alone cannot defeat the other party or when the costs of military action for the own forces are deemed too high. The aerial bombings of German cities in World War II (e.g. Dresden) and the atomic bombs on Hiroshima and Nagasaki are examples of this.

### **Civilians are potential partners**

Besides considering the presence of civilians as more or less a neutral factor, another important aspect of planning and executing military activities in urban areas concerns the hearts and minds of the population. By winning and/or preserving the hearts and minds, it will be easier to plan and execute the military activities. More than that, active support of the local civilians can lead to valuable information provided by the civilians.

After winning the hearts and minds, not losing the hearts and minds becomes the subsequent objective. For example, in Iraq, it was decided to use tanks to patrol through the urban streets. The usage of these heavily armoured vehicles damaged the infrastructure and caused traffic accidents with severe civilian casualties, decreasing the forces' credibility to the population.

### **Civilians are potential opponents**

If the population is opposed to the military and/or their objectives, they can easily hinder military plans and activities, e.g. by providing supplies and refuge to insurgents or by organising demonstrations and/or initiating blockades. In the latter case, the military must be capable to perform public order management to control crowds or even riots. At the same time, it is important to change the potential opponents into potential partners.

Since opposing civilians are very hard to distinguish from neutral civilians, soldiers are being confronted with the toughest of choices, where acting pre-emptively on a potential threat could result in mistakenly victimising innocent people. On the other hand, waiting to better assess the situation might waste valuable reaction time, which could lead to casualties to ones own troops. Suicide bombers are a recent example of this.

In order to prevent civilian losses and win the hearts and minds of the population, commanders must know the demographic structure of the population (e.g. population size), have a thorough understanding of the social characteristics of the population ('what is on the people's minds'), and the processes they are involved in ('what are they doing' and 'how do they manifest'). §3.2 summarises the demographic structure of members of the urban population.

In case the hearts and minds have not (yet) been won, the military must be capable to handle the potentially violent behaviour of (groups within) the civilian population (public order management). In §3.3 the factors that influence crowd behaviour are introduced.

## 3.2 Social Characteristics

### 3.2.1 Demographic Composition

In order to understand the social dynamics of the urban population, the commander needs to determine which groups live in the concerning urban area, what relationships exist among them and how each population group will respond to friendly and threat activities. Each urban area has its own demographic composition. Additionally, in large urban areas it is likely that subcultures will develop, each having its own characteristics. For instance, the culture within the slums in Mexico City differs from the culture within the high tech city centre of Mexico City.

From a demographic point of view, a population can be characterised by for instance:

- population size;
- group size based on a significant grouping e.g. age, sex, political affiliation, religion etc.;
- increasing or decreasing migration trends;
- languages (distribution dialects, relationship to social structure);
- educational levels and literacy rates;
- crime rates;
- birth and death rates;
- labour statistics and considerations:
  - skilled – unskilled;
  - imported – exported;
  - unemployment;
  - standard wages and per capital income;
  - workday and norms.

Note that this list is not exhaustive.

Besides these statistical factors, a population has the following properties: health, history and, norms and values. These factors help to explain the root of the demographic conditions and therefore explain and predict behaviour of the population. These factors can apply to a whole society or groups of people that are categorised by for example nationality, education or religion. Note that these factors are overlapping and interdependent.

#### **Health**

Determining the conditions of the population's health includes verifying aspects like possible presence of particular diseases which are 'more common' in a community but also examining possible presence of nutritional deficiency.

During a mission it is important that militaries take their own health into account by e.g. having vaccinations against contagious diseases. Furthermore, the population may be helped with particular medicines which militaries can supply them with.

#### **History**

By being familiar with the history of the population and its urban area, the relationship between participating multinational forces, allies and the subgroups of the population among themselves can be explained. Sometimes deeply rooted

sentiments date back to centuries ago; nowadays these sentiments still play a role in the relations among parties. Important elements can be the roles they have played in the past (e.g. former colonists), who are/were the heroes, the antagonists and the protagonists? This information may give a better view of the present and perhaps future relationships.

### **Norms and values**

The prevailing norms and values, moral codes, and taboos of a population are one of the most important social aspects of a population which should be considered. This affects among other things the attitudes towards age, sex and race; role of the clan, tribe and/or family; biases between ethnic groups; urban-rural similarities and differences; exchanges of gifts; visiting practices; dating and marriage; clothing; recreation, entertainment and humour; alcohol and drug use; eating and dietary practices; important (religious) holidays and festivals; important sports and entertainment events; display of emotions; greetings, leave-takings and gestures, etc.

Taking the last mentioned habits as an example: when talking to dignitaries in middle-eastern cultures, it is important not to be direct. Focus on the small talk at the start of the conversation and get to the point at the end of the conversation. A direct confrontation is considered to be impolite in these cultures.

In some denominations of Islam it is a custom for women to cover (at least) their hair in the presence of men (except for their husbands). Therefore, these women will always wear a headscarf (or other variants like a burka) outside their homes. Inside their homes and on their land property they don't have to cover their hair in the presence of their family. For this reason the walls of the qalas are very high which prevent persons on the outside to look into peoples courtyards.

During operations in the Middle-East military forces could take up their observation position on the top of a hill from where a view over qalas was provided. It occurred that they were asked by local men whether they could move their position because the militaries were able to see inside the walls of the qalas which forced their wives to cover their hair. Ignoring these cultural beliefs may lead to resistant behaviour. Also, in this example local religion does not only potentially constrain military activities (e.g. taking an observation position) but can also influence the composition of the military unit. In some cultures it is very disrespectful when a male soldier has to body-search a female, or even when he starts a conversation with a female. In these cases female soldiers and/or female interpreters are necessary.

Constant awareness of the local norms and values are therefore essential during the planning and execution of military activities.

The adherent religion is one of the main factors that have a huge impact on the norms and values of a population. For example, in the Buddhism five prescriptions exist which shape the basis ethic. Christianity has the Ten Commandments. It is important to have knowledge on the religion(s) the civilian population practices since in lots of countries religion has been or still is playing a role in conflict or religion can even be the origin of a conflict. Examples of these countries are China, Ireland, Iran, Mexico, Sudan, etc. All kinds of religions are involved: Christian, Islam, Judaism, Hindu, Muslim and Buddhist, subgroups like Catholics versus Protestants, Shiites versus Sunni, but also indigenous religions like Sikh and Parsi.

Note that an entire population may not practice one single religion. Within an urban area subgroups may be developed, each practicing a different religion. This complicates the preparation and execution of an urban operation. An example is the population of the city of Beirut, which consists of Christians, Muslims and Druses.

In addition to an explanation and prediction of the behaviour of the population, knowing the status of above mentioned factors also helps commanders determine how those interests motivate groups to future action – previous patterns of activity are critical in this regards. Knowing the status of these factors is critical to operational success. Then commanders can develop or modify courses of action as appropriate. Certain courses of action may be needed to improve the interaction between military forces and civilians (and between other agencies) to accomplish common goals. Others may be needed to influence favourable support, stabilise neutral groups, or neutralise hostile groups. Still others may require more forceful means to control and protect—never to punish—civilians.

### 3.2.2 *Leaders, Leadership and Organisation*

For groups to exert meaningful influence, leadership provides vision, direction, and organised coherence. Some groups depend on a charismatic leader to provide cohesion; although in some cultures, the spokesman is not the leader. Others de-emphasise individual leadership and provide redundancy and replacement in decision making. Others combine elements of both these types of leadership and organisation. Based solely on personality, a leader may centralise power or, while still being in ultimate control, decentralise decision making and execution to subordinates. In contrast, a single person may head a group while a ruling council actually makes and executes policy. Groups centred on one leader (which may or may not be the officially designated leader) can often produce decisions and initiate actions rapidly but are vulnerable to disruptions if key personalities are removed or co-opted. Groups with shared or redundant leadership take longer to make decisions yet are more resistant to change and outside influence. Commanders must understand how authority and responsibility is held or shared within and between each of the identified demographic groups; they must understand leadership and the social hierarchy.

Commanders at all levels should devote considerable effort to identify and cultivate relationships with civilian leaders in their area of operation. Both formal and informal leaders should be taken into account. This civilian leadership will include political, religious, tribal or clan, ethnic, and economic leaders. Commanders should consider that their attention toward and discussion with identified leaders may increase (or, some instance, decrease) the targeted leaders' prestige and power. While this may be intentional, commanders must often ensure that the leaders that they choose to deal with are legitimate and accepted in the eyes of the urban population. Otherwise, they may further imbalance an already weak power structure and exacerbate the situation. In unique circumstances, commanders may need to identify and interact with the leadership of criminal organisations. These civilian leaders will be the means to affect change and allow the urban populace to understand and accept the purpose behind military operations. As importantly, they will be the conduit for understanding the urban society's sentiments, perceptions, and reactions to military operations. As such, reliable and trustworthy linguists that

can not only interpret the language but can serve as cultural advisors to military forces will be in great demand. Keeping the local population objectively informed, not only of current operations but also of the intent and desired end state, is often a key task for commanders. A poor communications effort and a lack of understanding of intent may alienate the local population from the friendly forces and cause significant problems in future activities.

### **3.3 Crowd Behaviour**

#### *3.3.1 Introduction*

Public order management has become an important part of military operations since urban operations (especially urban peace keeping and peace making operations) are more common. In order to be able to maintain public order, and in particular to manage crowds and to prevent violent crowd behaviour, knowledge of crowd dynamics is essential to the military.

A crowd denotes a gathering of people joined in for a particular reason but not necessarily violence. A crowd is composed of individuals that do not surrender their own decision-making. It is the availability of information within the crowd that influences individual decision-making.

A crowd is a perfect hiding place for adversaries. Often they use civilians as a shield or to start a riot. Therefore, it is important for military forces to control crowds.

There are several situations where crowds arise. Examples are during rush hour in a train station, on a market (at a market day) in a city, at the beach on a sunny day, a demonstration and a (planned) rebellion. There are two factors a commander should take into account when crowds tend to arise. First the planning and execution of military activities may be influenced. For example, for gaining intelligence purposes it could be best to execute a social patrol in an urban area at a market day, where lots of people are available to talk with. Secondly, militaries should be prepared to handle with potential violent behaviour in case the situation escalates.

#### *3.3.2 Crowd Types*

There exist four crowd types, varying from a casual crowd (a crowd with a low chance to become violent), to a mob (an aggressive and hostile crowd):

##### **Casual crowd**

A casual crowd is incoherent, does not have a collective goal, and does not show collective behaviour. The only common factor between the crowd members is their location. The visitors of a market on a central market place represent an example of a casual crowd. This crowd includes many individuals; each individual is present for his/her own reason. Control of a casual crowd can be obtained relatively easy, e.g. by removing particular individuals within the crowd.

##### **Sighting crowd**

A sighting crowd visits an event, like a football match, a house-on-fire, or a rock concert. Control of a sighting crowd is not difficult, but it requires diplomatic and robust action by the local authorities.

### **Agitated crowd**

An agitated crowd comes together to share emotions. An emotional crowd can easily become violent, e.g. after distinct acts of an individual, or after non-tactical actions of policemen or military. A direct confrontation with an agitated crowd has to be avoided in order to prevent escalation.

### **Mob**

A mob is a crowd characterised by aggression and hostility. Many people join an emotional happening, where physical activities take place, like screaming and throwing objects. Crowd control is difficult, and may require multiple simultaneous actions at different locations. The initial objective must be to temper the emotions of individuals within the crowd. Violent interventions may be needed to stabilise the situation.

#### *3.3.3 Factors influencing Crowd Behaviour*

In case a crowd has been formed, multiple factors can contribute to violent behaviour within the crowd. This section describes the factors which influence crowd behaviour. Often, it isn't that obvious for a military force to influence (all) these factors. However, it is important for militaries to be aware of these factors. Possibly they can anticipate to some of them.

### **Approach**

Military forces are in full command of their own approach against a crowd. The applied approach influences the crowd's behaviour greatly. If the forces use their batons, it is possible that the crowd will react by also using violence (e.g. by throwing stones). When forces act expectantly, it is less likely that the crowd will become violent. §6.6 provides a brief overview of crowd management tactics.

### **Size of crowd**

The size of a crowd was thought to be one of the most important factors influencing the tendency of a crowd to a riot. It was assumed that a large group of people always creates more anonymity than a small group. But people are not anonymous to people surrounding them. Study results (see references of [2]) show that the influence of the crowd's size on its tendency to become riotous may not be as great as was believed, and that there are more important factors which should be considered.

However, just the sheer presence of a crowd, even if they are passive or involved in peaceful activities, influences an operation. Manoeuvrability of military forces will be seriously affected. The gathering of large numbers of people increases the risks of accidents, in which the military forces could get involved.

### **Individuals**

Individuals in a crowd constantly evaluate their present situation and make their decisions on the basis of weighing potential risk versus potential gain.

The likelihood of violent behaviour will be reduced when the risk of being injured, arrested or even killed is expected to be great compared with the probable gain. In some cases it is also possible that the gain is more important to participants than personal security. This is true for many religiously motivated riots in the Middle East.

The internal crowd dynamic is mostly driven by the actions of small subgroups consisting of 10-15 people. Though these subgroups do overlap, they do not create a homogenous entity in terms of personal preferences. There are likely to be core subgroups responsible for most of the violence, and then there are general members of the crowd who are relatively easily discouraged and dispersed. The latter are people that give up as soon as they are threatened by a force or already have a tendency to disperse that is subdued by the fear of reprisals from the violent subgroups.

Most recent studies have demonstrated that in any crowd, there is never a moment when 100% of the crowd are performing the same action. Most studies have shown that usually only small groups participate in any violent behaviour.

### **Leadership**

One of the most important factors that determine whether a crowd will choose for confrontation or will disperse peacefully is the influence of tactical leaders in the crowd. Leaders are figures with impact on the entire crowd and do not refer to people who are leading or influencing small subgroups of individuals.

General tendency of crowd members can be assumed to be avoiding personal threat. But in the presence of leaders the personal preferences of members of the crowd are strongly modulated by the leaders.

### **Access to weapons**

Furthermore, a possible access to weapons should also be considered. The weapons used in this context could be as primitive as stones and/or sticks. The crowd members would have an expectation of violence in case of presence of weapons.

### **Commitment to a certain cause**

Participants of a crowd may have a commitment to a common cause, e.g. a common sociological status / attitude or a common cause related to the necessities of life (a common need for water, food, and/or safety). At present, this may be one of the controlling influences in many middle-Eastern countries.

### **Use of drugs or alcohol**

Use of drugs or alcohol by the crowd may increase the tendency of violent behaviour. People who are under the influence of drugs or alcohol are likely to be more aggressive with fewer social restraints. Also their perception of danger is reduced. Furthermore, they are less susceptible to physical pain. Therefore it may be necessary to use more intensive force to suppress them.

### **The societal acceptance or even encouragement of violence**

This is probably an important factor in instances of ethnic or religious riots especially in combination with a high level of commitment to a common cause.

### **Emotional stress**

For a highly stressed crowd a small incident can contribute to triggering unwanted reaction.

### **Socio-economic status**

The ones that are risking less by violent behaviour are more likely to take chances than those who potentially risk loosing their status.

### **Focus of the crowd**

The more coherent the crowd, the more easily it can be led into coordinated behaviour.

### **Age of crowd members**

Younger people are more likely to take risks than older people.

### **Presence or absence of media**

Various studies have demonstrated the great influence of the media. The media can be indirectly or even directly responsible for the onset of a riot. Many riots are started by rumours. Recent riots demonstrate that media can contribute to both escalation and suppression of violence. Therefore, it is important that militaries distribute information to the people. Uninformed citizens in a country that is just subjugated in war have the potential to demonstrate and possibly riot. The citizens should be informed on the military goals and actions. This has a strong link with winning the hearts and minds (§3.1).

The condition or origin of a crowd is not mentioned in the above described factors influencing crowd behaviour. This is because the condition of a crowd does not seem to be an important factor of influence. A dispersing crowd is not significantly less probable to become violent than a freshly gathered crowd.

## **3.4 References**

This chapter has largely been based on this publication:

- [1] United States Headquarters Department of Army (October 2006). *Urban Operations*. Field Manual 3-06.

Other cited publications include:

- [2] DRDC (August 2006). *Modelling Crowd Behaviour in Military Operational Research*. Centre for Operational Research and Analysis.
- [3] United States Joint Chiefs of Staff (16 September 2002). *Doctrine for Joint Urban Operations*. Joint Publication 3-06. 151 p.
- [4] United States Department of Defence (2 February 2007). *Joint Urban Operations. Joint Integrating Concept*. U.S. Joint Forces Command, Suffolk VA, USA. 123 p.



## 4 Urban Systems

### 4.1 Introduction 'System of Systems'

*System of Systems* is a relatively new term that involves multiple heterogeneous, distributed systems that are embedded in networks at multiple levels and in multiple domains. This term can be applied on an urban environment.

While the terrain implications of urban areas are significant, this concept argues that urban areas are not merely terrain that must be operated *in*, but also objects and services that must be operated *on*.

Each urban environment has an identifiable system of (urban) systems that constantly change and interact, and support the total functioning of an urban area. The systems represent the various roles the urban area plays, both for its own inhabitants and for the surrounding area: source of government, cultural centre, manufacturing centre, provider of services, source of jobs, marketplace for goods and services, etc. Some of these structures, processes and functions are fundamental to the functioning of the urban environment, providing for basic human needs, while others satisfy higher-order desires rather than essential needs.

Urban systems are overlapping and interdependent categories. They include their physical composition, supporting utilities and social aspects. Urban systems have impact on the population, the normal operation of the city, and potentially the long-term success of military operations conducted there.

Hundreds of urban systems may exist but they can be categorised into six main categories:

- 1 Energy and drink water supply;
- 2 Economy and commerce;
- 3 Transportation and distribution;
- 4 Communication and information;
- 5 Culture;
- 6 Administration and human services.

Commanders should analyze key facilities in each category and determine their role and importance throughout all phases of the urban operation. As there is much overlap between urban systems, this analysis considers each system individually and in relation to others to determine an appropriate course of action toward it.

This chapter describes the six main categories of urban systems and their importance for consideration during the planning and execution of urban operations. Its importance depends among other things on the density of vital infrastructures. One (good) hospital to 1000 people or one to 100.000 people makes quite a difference on the importance of the facility. By determining the critical nodes and vulnerabilities of a city, allied forces can delineate locations where enemy forces may attack (vulnerable) elements within the city infrastructure. Destroying vital infrastructure will have disastrous consequences for the population but will also disrupt or complicate the urban mission. Therefore, it is important to protect these vital infrastructures.

The last section (§ 4.8) describes the military implications of ‘system of systems’.

## 4.2 Energy and Drink Water Supply

Energy and water supply systems are categorised by:

- Drink water supply: purification plant, water pipes, pump stations, etc.;
- Electricity grid: power plants (atomic, coal, gas, water, etc), pylons, cables (above or below the surface), etc.;
- Fuel and gas supply: network of pipes, pump stations;
- Sewer systems related to water distribution systems (see Chapter 2 for further details).

### Water

Water is essential to many basic human needs. As populations grow, demand for potable water increases. In some areas of the world, the supply of fresh water is inadequate to meet these demands. By 2025, between 2.7 and 3.5 billion people may live in water-deficient countries. In developed nations, water companies provide the population with clean water. In much of the developing world, no formal water authorities exist. Sewage, industrial waste, and pollution pose threats to the water supply. Deliberate acts of poisoning cannot be overlooked where access to the water supply is not controlled. Military forces may gain tactical advantage by controlling this system, also its protection minimises the population’s hardship and thus contributes to overall mission success.

### Electricity

Electricity is critical to the normal state within a city. Power companies in a community provide a basic service that provides heat, power and lighting. Because electricity cannot be stored in any sizable amount, damage to any portion of this utility causes an immediate impact on the population. Electricity services are not always available or reliable in the developing world. Interruptions in service are common occurrences in many cities due to a variety of factors. Decayed infrastructure, sabotage, and conflict can disrupt electrical service. As a critical node of the overall city service sector, the electrical facilities are potential targets in an urban conflict. Enemy forces target these facilities to erode support for the local authorities or the military forces.

Military forces may want to control the electric system so that they may maintain this advantage during certain time periods. Likewise, the commander may want to deny enemy access to services provided through electricity. Rather than destroying a power generation capability, forces may gain an advantage by selectively turning off power for a specified time, retaining the ability to return to normal operation at a moment’s notice.

### Fuel

All societies require fuel, such as petrol, diesel, wood, coal, oil, or natural gas for basic heating and cooking. Fuel is needed for industrial production and is therefore vital to the economy. In fact, every sector of a city’s infrastructure relies on fuel to some degree. Violence may result from fuel scarcity. From a tactical and operational perspective, protecting the urban area’s fuel supplies and facilities prevents unnecessary hardship to the civilian population and, therefore, facilitates mission accomplishment.

### **4.3 Economy and Commerce**

This system serves as a backbone of society. It provides income to the population and produces industrial and agricultural supplies. This system encompasses:

- Business and financial centres (including shopping centres, restaurants, hotels, marketplaces, banks, trading centres, and business offices);
- Outlying industrial, mineral, and agricultural features (e.g. farms, food processing and storage centres, manufacturing plants, and mines).

An essential aspect of this area during operations may be the political sensitivity of industries investing and operating in a foreign country, particularly during stability operations. An enemy or a disgruntled civilian population may attack or disrupt commercial activities as a political statement against the home country or its allies. Food production facilities also may assist commanders in food services and may be an essential concern during relief operations. During long-term stability operations, visible, material, and tangible economic progress consisting of the creation or restoration (and protection) of businesses, agriculture, and overall jobs will often be critical to:

- generating or maintaining the urban population's support to forces and operations;
- reducing support to threat forces and operations to include eliminating civilians as a potential manpower pool for insurgent or terrorist organisations and activities;
- lowering other hostile civilian activities such as protests and riots in times of shortcoming;
- transitioning the urban area back to legitimate civilian responsibility and control.

This urban system also consists of the production and storage of toxic industrial chemicals used in agriculture (insecticides, herbicides, and fertilisers), manufacturing, cleaning, and research (to include biological agents). Fertiliser plants may be of specific concern as they contribute to providing a key material in terrorist and insurgent bomb-making activities. A thorough analysis of this urban system may also be essential to understanding how urban insurgencies are funded and supported. This helps commanders to understand the true organisation of the insurgency as well as to suggest methods to isolate insurgents from their economic or financial support. In their overall assessment of this urban system, commanders should also consider the activities and influence of criminal organisations or elements.

### **4.4 Transportation and Distribution**

The transportation network is a critical component of a city's 24/7 activity. It facilitates the movement of material and personnel in and around the city. In modern cities, the transportation network supports rapid (inter)national travel, often via several avenues.

Developing cities often have little means of public transportation. Foot traffic, livestock, and bicycles represent main sources of travel in underdeveloped cities and compete for road space with more modern forms of transportation.

The 'transportation and distribution' system can be categorised into:

- Networked highways and railways (e.g. bridges, subways and tunnels, underpasses and overpasses, and ferries);
- Ports, harbours, and inland waterways;
- Airports, seaplane stations, and heliports;
- Mass transit;
- Cableways and tramways;
- Transport companies and delivery services that facilitate the movement of supplies, equipment, and people.

Most urban areas (particularly in developing countries) have two forms of transportation and distribution systems that exist simultaneously: a formal system and a Para transit system. Formal systems are characterised by large organisations, bureaucracy, imported technology, scheduled services, fixed fares or rates and limited employment opportunities for the urban populace. Examples of formal systems are trains and busses. Para transit systems are characterised by low barriers to entry, family and individual entrepreneur organisations, adapted technology, flexible routes, destinations, and times of service, and negotiated prices. Examples of Para transit systems are taxis. The Para transit system is more decentralised and covers a much greater portion of the urban area than the formal system. Together with elements of the formal system, Para transit plays a key role in the movement of goods and people into, out of, and within the urban area. This key role also includes the city's food supply zone that may extend up to 100 kilometres from the urban centre. Understanding both systems will help commanders establishing effective movement control in a developing country city.

When military forces are deployed in an urban theatre, transportation and distribution systems in the urban area can contribute greatly to the movement of forces, manoeuvre, and logistic operations throughout the entire area of operation. Control of decisive points in this urban system may be important to the military operation and to the normal functioning of the urban area (and surrounding rural areas). Supplies travelling through the transportation and distribution system may be military-specific supplies (such as ammunition and repair parts) and supplies for both the military and urban population (such as food, medicine, and oil). The system may also support the movement of military forces and the urban area's population for which it was designed.

Therefore, care must be taken not to disrupt the transportation system of a city. Securing air and seaports is imperative for follow-on forces and supplies, but there are many possible implications of securing all the transportation nodes and stopping all inter- and intra-city movement. While the military mission may be immediately facilitated, critical needs (heating supplies, food, etc.) of the non-combatant populace could go unmet. Commanders may have to develop innovative methods that limit the transit of adversary supplies and reinforcements while facilitating the movement of their own resources and those of civilians. This last consideration attempts to minimise hardship and promote normalcy in the urban area and will increase in significance as the need for legitimacy increases.

Before using the transportation systems, the accessibility of the systems should be explored. A bridge may be walked upon, but not necessarily driven upon because of for example the weight or the narrowness of the bridge. The accessibility of roads can also vary; a sand road should be tread on a very different way than an asphalted road. A striking example is the battle in Nasiriyah, Iraq in 2003, where a US company drove into a side street which proved to consist of such deep mud, that several tanks and a battalion command post vehicle became stuck, influencing the forthcoming battle.

#### 4.5 Communications and Information

The communications and information system controls the flow of information to the people within the area of operation as well as to those outside the area of operation. Providing a community with information may influence individuals' and crowds' perspectives. It is a critical enabler that helps coordinate, organise, and manage urban activities and influence and control the urban society.

##### System components

This urban system is comprised of the facilities and its facilitators (e.g. generators) and the formal and informal means to transmit information and data from place to place. It includes:

- Telecommunications (e.g. (mobile) telephone, radio, television, and computer networks);
- Police, fire, and rescue communications systems;
- Public address, loudspeaker, and emergency alert systems;
- The postal system;
- Printed media (e.g. newspapers, magazines, billboards and posters, banners, graffiti);
- Informal human interaction conveying information (e.g. messengers like imam, priest and church, open-air speeches and protests, everyday conversations);
- Other inventive informal signalling means (e.g. burning tires).

Communication facilities in modern cities are highly developed.

Complicated networks of landlines, radio relay stations, fibre optics, cellular services, and the Internet provide a vast web of communication capabilities. This communication redundancy allows for the constant flow of information. Cybernetic functions link systems in the urban area and connect the area to other parts of the world. This latter aspect creates important implications for commanders of a major operation. Operations involving this cybernetic function may produce undesirable effects on a greater scale than initially intended.

Developing countries may have little in the way of communication infrastructure. Information flow can depend on primitive means — courier, smoke signals, hand signals or drums. Even in countries with little communication infrastructure, radios, cell phones, and satellite communications offer quick ways to pass information.

##### The role of the media

The media is central to the communications and information infrastructure and a critical operational concern because of the frequent usage by political leaders. Compared to other operational environments (jungles, deserts, mountains, and cold weather areas), the media has more access to urban operations. This is due largely

to airports, sea and river ports, and major road networks; ready access to power sources and telecommunications facilities; as well as access to existing local media structures.

The picture of a conflict drawn by the media influences the possible support of the population for the military mission. A way to deliberately attempt to share perception, manipulate cognitions, and direct behaviour to achieve a response that furthers the desired intent is propaganda. The Iraq war is a practical example of successful propaganda (that is, it had a major impact on the beliefs of the population). During the 2003 invasion of Iraq, the Iraqi Information Minister Mohammed Saeed al-Sahaf repeatedly claimed Iraqi forces were decisively winning every battle. Even up to the overthrow of the Iraqi government at Baghdad, he maintained that the United States would soon be defeated, in contrast with all other media. Due to this, he quickly became a cult figure in the West, and gained recognition on the website [WeLoveTheIraqiInformationMinister.com](http://WeLoveTheIraqiInformationMinister.com). The Iraqis, misled by his propaganda, on the other hand, were shocked when instead Iraq was defeated.

Commanders cannot control the media; however, by monitoring the information that the media receives and generates, they can plan and execute public affairs operations that will induce cooperation. Failure to provide sufficient information can hamper a commander's ability to conduct the mission. Poor relationships with the media can result in inaccurate and even biased reporting. Such reporting can cause a public reaction that influences the ability to achieve operational objectives. For example, during the Russian 1994-95 battle against Chechen separatists in Grozny, the Russian military refused to communicate with reporters. Consequently, the media reported primarily from the perspective of the Chechen rebels. This encouraged both local and international support for the rebels. Therefore, commanders but also (local, political) leaders can have some influence on the media.

## 4.6 Culture

This urban system encompasses the organisations and structures that provide the urban populace with its social identity and reflect its culture.

The cultural system includes:

- Historic monuments;
- Works of art;
- Religious organisations, places of worship, and shrines;
- Museums and archaeological sites;
- Literary and scientific publications and collections;
- Recreational facilities (e.g. amusement parks, golf courses, and stadiums).

In many countries there is a system of protection of buildings and structures which are considered to be of cultural interest, particularly religious structures. Cultural heritage receives special protection in conformity with the International Humanitarian Law (often referred to as the Laws of War) comprised of the Geneva Conventions and the Hague Conventions, as well as subsequent treaties, case law, and customary international law. Laws of War are a set of rules which seek, for humanitarian reasons, to limit the effects of armed conflict. Next to cultural

heritage, also other objects/buildings are protected. For example buildings for health care, necessities of life (e.g. water supply) and social welfare (e.g. home for elderly). Laws of War also protect people who are not or are no longer participating in the hostilities and restrict the means and methods of warfare. This includes for example women and children, but also people with a religious function, people who serve civilian health care or surveillance, and journalists.

When military units break or seem to have broken the Laws of War, this can negatively influence the support of the urban population for their operations. E.g. in Bagdad two journalists were killed after they came under fire of an American tank. American forces were acting in self-defence having encountered small-arms fire coming from the direction of a hotel. The deaths of these two journalists led to a lot of negative publicity.

Besides the Laws of War cultural heritage are protected simply because they are 'civilian objects'; cultural heritage are of great importance for the population. Their protective status has a higher threshold than the regular civilian objects. Therefore, they can't easily be used for military purposes. The Hague Convention of 1907 specifically states that "the attack or bombardment of towns, villages, habitations or buildings which are not defended is prohibited" and that "in sieges and bombardments all necessary steps should be taken to preserve buildings used for e.g. worship, art and medical purposes." The irregular opponent may take advantage of this special protection by exploiting cultural heritage.

The presence of protected buildings and structures has consequences for the planning and the execution of military activities. Some facilities will need security and law enforcement protection in order to protect them from looting and pilferage. Furthermore, commanders will need to quickly educate, inform, and continually remind the urban populace (and the media) that the cultural estate may lose its protected status when used by threats for military purposes.

Furthermore, some buildings do not only have a cultural value but represent a unique social, religious and political place in a city. For example, Mosques are often the centre of cultural, political, religious and social activities in the Middle Eastern city. It is often a good barometer of the attitudes and disposition of its urban population. Monitoring the Mosque's activity will enable commanders to observe the heartbeat of the community. Attitudes expressed in and around the Mosque are a means for commanders to know the disposition of the population and the reaction of people to changing events, e.g. military operations.

#### **4.7 Administration and Human Services**

This wide-ranging urban system covers urban administrative organisations and service functions concerned with an urban area's public governance, health, safety, and welfare. Together, it encompasses:

- community, town and governmental services (e.g. embassies and diplomatic organisations);
- activities that manage vital records (e.g. birth certificates and deeds);
- the judicial system;
- hospitals and other medical services and facilities;
- public housing and shelter;
- waste and hazardous material storage and processing facilities;

- emergency and first-responder services such as police, fire, and rescue;
- prisons;
- welfare and social service systems.

In most developed countries the human services and facilities are advanced. However, in underdeveloped countries they are very poorly organised. The public housing of for instance an African village is hardly comparable with a high tech city as Shanghai.

Also the organisation of the judicial system can be very different. In some countries a judicial system may be lacking or poorly organised. It could also be corrupt. This may affect the military planning and execution greatly.

While the health services infrastructure of most developed cities is very advanced, medical facilities are deficient in many countries. International humanitarian organisations may represent the only viable medical care available. The rudimentary care provided in most developing world cities is not up to Western standards. Both the quality and the quantity of health facilities, services and personnel are lacking in these countries. Compounding this problem is the presence of deadly parasites and diseases. HIV is particularly devastating the urban centres of the developing world and therefore the local blood supply must be looked upon with great suspicion. Disasters (natural or manmade) can significantly worsen the already poor health services condition. Environmental hazards leading to contaminated water, air, soil or food, the lack of fuel for heating and sterilisation, pollution, and increased injuries could overwhelm a city's medical infrastructure and create immense suffering. In the military planning phase it is important for the commander to be aware of these circumstances. If there is a lack in health facilities the commander should anticipate to this. Offering support to an existing medical system may augment the military mission, as well as foster its legitimacy, but can also stress own logistical lines.

#### **4.8 Military Implications of System of Systems**

Summarising, each urban area has an identifiable system of systems that support the functioning of the area. These systems are constantly changing and interacting with one another. They have impact on the population and on the military operations conducted there.

Therefore, it is essential for the commander's situational awareness that he understands the key systems of an urban area. Military planners must analyze key facilities in each urban system and determine their role and importance for the population, the opponent and for the military forces themselves. This "systems thinking" will aid in uncovering key relationships and connections that can help reveal centres of gravity and decisive points throughout all phases of the urban operation. From there, the commander should recommend courses of actions for each key facility, with short and long-term potential effects.

As there is much overlap between the urban systems, the analysis considers each system individually and in relation to others. It should be determined how each system affects the civilian population; how it might function both in support of and in opposition to joint urban operations and what potential effects different

operational actions might have. An example of not taking the whole chain of elements into account but just one of the elements is in Iraq, where the local police was trained to maintain law and order and subsequently arrested perpetrators and put them away in prison. However the judicial system was not capable to administer justice, so the prisons filled up with people awaiting their trial. This led to immense unrest within the population.

Understanding how specific elements of the urban society affect operations (and vice versa), begins with analyzing the size, location, and composition of the urban society. Therefore commanders need (inter)national help. They need to rely on the expertise of others with infrastructure-specific expertise as military engineers, (N)GOs, embassies and public work employees. Commanders can then decide whether civilian proximity and density represent a significant risk to their mission. In this analysis, commanders should consider that urban areas, on many levels, are in constant motion. The densities of circulating people and other traffic often vary according to the time of day (e.g. rush hours or market times). But also cultural and religious events influence the flow and presence of people. Examples of cultural events are sporting events or national holidays. Examples of religious events are every Sunday going to church or annually celebrating the Ramadan. Therefore in planning urban operations, commanders must consider the timing, rhythms or patterns of the population and their displacements through the urban area (incl. refugee displacements). Identifying and understanding trends and patterns of activity may provide critical information to commanders.

The following aspects should be kept in mind during the planning and execution of military activities.

### **Keep essential urban systems operational for the local population**

Through (military) action, whether intentionally or not, urban systems can dramatically transform. Destroying or disrupting any portion of an urban system can have a cascading effect on the other systems. For instance, by destroying a bridge in a city people may be unable to reach their workplace, doctor, church, family, etc. This may have financial, medical, social or psychological consequences.

Furthermore, it is important for commanders to analyse whether civilian facilities are sufficient to support the civilian population during the execution of the military mission. For instance, are the medical facilities capable to support the civilian population?

### **Use of urban systems by own troops**

A city's infrastructure can also support the mission. When militaries operate in urban areas, they will (have to) use urban systems. Local airfields or ports are vital for sustained operations. In addition, host country medical facilities become vital when allied casualties are greater than organic medical capabilities can handle.

Therefore, when destroying or disrupting an urban system, it could also have a tremendous effect on the military forces. Taking again the example 'destroying a bridge', militaries are unable to (easily) access the other end of the bridge. This can lead to logistic problems as providing medicines, food supplies, fuel supplies etc. for the civilians as well as the militaries.

Note that military forces may still be able to gain an operational advantage by disrupting (a part of) an urban system while minimising unwanted and unintended effects.

**Deny opponents using the urban systems**

It is likely that the adversary operates in an urban area and thus relies on the same systems as the population. For instance, transportation systems like roads and airfields provide the only means for people, equipment and supplies to access other areas. Controlling these critical transportation nodes may prevent the adversary from re-supplying his forces. This is particularly true when his bases or facilities are physically located in or near the urban area.

In World War II, the Allied Forces decided to destroy the industrial capability of the Germans, to deny the German forces supplies and new equipment. In the end this resulted in the indiscriminate aerial bombing of whole cities. It took many years and substantial investments after the war, before the German industrial capabilities were rebuilt. Modern technology makes it possible to temporarily disable certain systems, so their use is at specific times denied to the opponent and the systems can be restored later, for use by the population and the own military forces.

Jamming electromagnetic frequencies or short-circuiting electrical power plants are some examples.

## 4.9 References

This chapter has largely been based on this publication:

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Other cited publications include:

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- [3] DiMarco, L.A. (2004). *Traditions, Changes, and Challenges: Military Operations and the Middle Eastern City*. Combat Studies Institute Press, Fort Leavenworth, KS, USA. 81 p.
- [4] Hoogland, E. van (2006). *Toekomstverkenning “Optreden verstedelijkt gebied”* (in Dutch). Netherlands Ministry of Defence, Defence Staff, DS/OBBP/OB/TV, The Hague, the Netherlands. 99 p.
- [5] United States Department of Defence (2 February 2007). *Joint Urban Operations. Joint Integrating Concept*. U.S. Joint Forces Command, Suffolk VA, USA. 123 p.
- [6] United States Joint Chiefs of Staff (16 September 2002). *Doctrine for Joint Urban Operations*. Joint Publication 3-06. 151 p.
- [7] United States Marine Corps (1998). *Urban Generic Information Requirements Handbook*. Quantico, VA, USA. Marine Corps Intelligence Activity.
- [8] United States Marine Corps (3 January 2003). *Urban Patrolling Military Operations on Urbanized Terrain*. U.S. Marine Corps Warfighting Laboratory, Quantico, VA, USA. 28 p.



## 5 The Urban Threat

This chapter addresses the characteristics of the urban threat. §5.1 provides an overview of the main threat components. These components include military as well as non-military threats. Subsequently §5.2 focuses on *insurgency*, the most characteristic military threat within the urban area.

### 5.1 Overview of the Urban Threat

#### 5.1.1 *Military Threats*

The military threats present in urban areas range from conventional military forces, paramilitary forces and guerrillas to terrorists, criminal groups and angry crowds. In general, the objectives of opposing forces may include:

- to defeat or to influence friendly forces militarily;
- to undermine the legitimacy of the friendly force;
- to defeat or to influence third players either potential coalition members or other states which are not a party to the conflict;
- to win the support of the local population or at least to deny that support to the friendly forces;
- to gain territorial advantage;
- to cause friendly forces significant attrition in order to undermine the political will and public opinion (in homelands as well) to make them leave the area.

The urban military threat can be divided into two categories: regular and irregular opponents. These two types of opponent differ in objectives, but also in doctrine, organisation and equipment.

*Regular opponents* are military forces that have an organised hierarchical structure, plentiful military resources and are typically uniformly outfitted. Generally the members are motivated by a national cause and follow orders generated several levels above them. Regular opposing forces are typically represented by a nation's military or organised insurgency with outside support, and thus usually have some level of formal military training. Usually, these types of forces have artillery, armour, and/or ground support assets. Most regular forces will follow or base their tactics on standardised doctrine.

*Irregular opponents* or *insurgents* differ from the regular threat in tactics and means as well as in motives. One important difference concerns the ethical considerations or in the case of the insurgent the *lack* of ethical considerations. Insurgents are usually inclined to operate on urban terrain in order to involve civilians in their battle, a tactic that is unacceptable for regular forces, which abide by international law such as the Geneva Convention. Insurgents will also tend to operate in an urban environment, because they are skilled at developing and adapting techniques to counter the technological and numerical supremacy and the trained procedures of regular armed forces, and can fully interact with the other components of the urban battlefield: terrain, society, and infrastructure. This urban threat is often referred to as '*asymmetric threat*', which can be defined as: *a threat emanating from the potential use of dissimilar means or methods to circumvent or negate an opponent's strengths while exploiting his weaknesses to obtain a disproportionate result* [3].

Asymmetry is by nature complex and unpredictable and stresses the regular forces to adapt their TTPs.

It should be noted that the characterisation of regular and irregular forces is not fixed. Regular forces can apply irregular methods or defy the laws of war (e.g. abusing civilians or prisoners of war). When defeat is near, organised units can revert to small cell guerrilla type of actions. Conversely, when irregular opponents gain sufficient influence and resources, they can formally organise themselves and start to act more openly.

Until now, irregular opponents represented the key military threat in urban terrain. §5.2 will provide a detailed overview of the motives, backgrounds, tactics and weapons of irregular opponents. Note that irregular conflicts come in many different forms, e.g. guerrilla warfare, wars of liberation, revolution, terrorism, riots and underground resistance (Table 5). For terms of readability, in the remainder part of this report these types of military opposition will be defined by the generic term *insurgency*<sup>8</sup>. Similarly, the accompanying different types of irregular opponents will be defined by the generic term *insurgents*<sup>9</sup>.

Table 5 Regular versus irregular conflict [8].

Regular Conflict	Irregular Conflict
Desired military end state derived from the desired political end state	Desired military and political end state intertwined
Security of the state	Security of the group
Symmetrical warfare	Asymmetrical warfare
Large unit under central control	Small units under local control
Combined arms	Individual weapon systems
Manned weapons	Armed men
Large-scale deployment of fire power and manoeuvre	Hit-and-run, guerrilla tactics and terrorism
Overt operations	Usually covert operations
Established doctrine, tactics and techniques	Unorthodox tactics and techniques
Humanitarian law of war observed	Humanitarian law of war not observed
Civilian population in principle only passively or unwillingly involved in the conflict	Civilian population virtually always involved in the conflict
Position of (local) authorities clear	(Local) authorities may sympathise with or even belong to the insurgent group

### 5.1.2 Non-Military Threats

In addition to the challenges caused by opposing forces, military units also have to be aware of the existence of so called non-military threats. Some of these threats are specific for an urban area, others are not, but possibly their effects will be increased by this environment. On this matter soldiers and their leaders must be aware of the

<sup>8</sup> US doctrine defines *insurgency* as organized movement aimed at the overthrow of a constituted government through the use of subversion and armed conflict. Although the military threat is not limited to the scope of this definition, this term is sufficient since the characteristics also apply on other irregular forces.

<sup>9</sup> This reports gives an overview of the most important characteristics of insurgents, and does not extensively consider the many differences between insurgents in motives, manifestation or organization. We are aware that these differences do exist though.

dangers and related protective measures and useful education and training against the types of non-military threats shown in Table 6.

Table 6 Non-military threats [13].

<b>Non-military threat</b>	<b>Description</b>
<b>Fire</b>	This concerns the threat of fire in built areas and/or the natural environment. The fire may or may not be caused by military operations.
<b>Danger of collapse</b>	The danger of collapse of e.g. houses, etc.
<b>Moving in complex terrain</b>	Moving in urban terrain often means moving in complex terrain (steps, infrastructure, rubble, collapsed buildings, etc.) that puts an additional physical load on dismounted units if compared to other types of terrain.
<b>Accidents</b>	Grazes, cuts, bruises, etc., due to the presence of rubble, collapsed buildings, etc.
<b>Dust</b>	Presence of dust particles caused by collapse, or sand, etc.
<b>Noise</b>	Loud or protracted noise, e.g. caused by traffic, bombardments, crowds, etc.
<b>Less situational awareness</b>	The presence of (high) buildings and various levels (underground and above ground) hampers both observation and communication and thus reduces situational awareness.
<b>Climatic threat</b>	Effects on small unit operations caused by temperature, solar radiation, precipitation or wind.
<b>Insects and animals</b>	Danger of infection as a result of physical contact with insects or animals like rats and dead animals, but also unhygienic conditions offering opportunities to bacteria, moulds, parasites, viruses and worms.
<b>Impure water</b>	The danger of impure drinking water leading to all kinds of contaminations and afflictions.
<b>Physical threat</b>	Threat caused by extreme effort, lack of food or any other deficiency.
<b>Psychological threat</b>	Threat caused by emotional stress due to combat conditions, images seen and/or inhuman conditions, such as famine.

Non-military threats affect the physical and/or mental health of personnel and in general are responsible for a sometimes significant loss of soldiers and civilians, be it by disease or even death. But these non-military threats can also influence operations in another way. Fire is a health risk for the individual soldier, but on a larger scale it can also have its effect on an entire operation, especially since the military are not equipped and trained to fight fire. An example urban operation is the battle of Manila in February 1945, where the Japanese defenders created large scale fires. In some cases the U.S. forces had to devote their troops to evacuate the civilian population. In other cases fires denied access to routes and areas, delaying the U.S. forces' advance.

Another example is rubble. The rubble created by damaged urban infrastructure is a physical threat for the soldiers, increasing risks for injury and complicating their manoeuvrability. It also negatively affects other capabilities, for example electromagnetic detection of explosive devices or other (unexploded) ordnance is almost rendered useless by the scattered infrastructural material.

The various non-military threats often show a relation or a causal connection. Figure 24 shows the clusters of non-military threats during urban operations (using interrupted lines), including their mutual relations. The arrows indicate the most likely order of cause and effect. The figure shows three clusters. The first (and largest) cluster is related to operating in an environment with buildings and other infrastructure (fire, noise, dust, danger of collapse, complex terrain and accidents). The second cluster is also typical of operations in urban terrain; it leads to less situational awareness. The third cluster may be termed climate and hygiene (climate, impure water, and insects and animals). The non-military threats listed in the third cluster are not unique to urban terrain, but they do indeed exert a(n) (major) influence. The three clusters all have an effect on the physical and psychological threat, and these are also mutually related. It is, of course, possible to devise other relations (a fire in a dry climate will be different than a fire in a wet climate), but this division is used because it shows the most plausible relations.

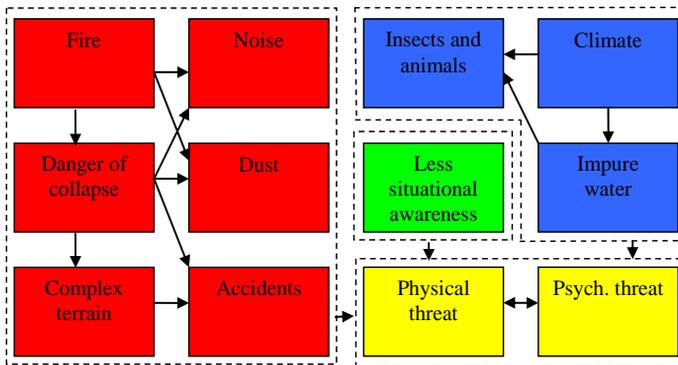


Figure 24 Relations between the non-military threats [13].

Important knowledge that all soldiers should have, concerns 1) the non-military threats in general, 2) the effects of non-military threats on the own performance, the performance of the team and the mission as a whole, as well as on the population, and 3) the use of the available means and tools for protection.

## 5.2 Insurgency

To be fully prepared for UO it is necessary to identify and analyze the insurgents; this analysis will provide more insight in their motives and the way they think and act. However, a single description that covers all types of insurgents cannot be created; every form of insurgency itself is unique and the accompanying manifestations of insurgents differ in practice. However, some parallels can be made. The following sections describe these parallels as well as the differences, in terms of motives (§5.2.1), tactics and behaviours (§5.2.2) and weapons (§5.2.3).<sup>10</sup>

<sup>10</sup> This section summarises the motives, tactics and weapons of insurgents. This does not mean that the described weapons and tactics are applied by insurgents only. Regular forces present in the urban area can apply similar tactics and weapons.

### 5.2.1 *Motives of Insurgents*

Roughly two types of insurgents exist: ideologically motivated insurgents and monetarily motivated insurgents.

#### **Ideologically (including religiously) motivated insurgents**

Ideologically motivated insurgents are usually organised into a non-hierarchical fashion or have few layers of command. In addition, ideologically motivated forces can be divided into two primary types. The first type, the semi-skilled light infantry or semi-organised groups of thugs, are normally poorly trained and equipped. The other type is highly trained, equipped and skilled, such as terrorists, gendarme or police. Neither type should be underestimated, especially the semi-skilled light infantry. They know the terrain and may have the support of the population and can use it to their advantage. The preference of these forces is to use violence in a systematic manner to achieve their goals. This can be translated to mean that the primary intent of any violence is to influence an audience other than the victim.

Ideologically motivated insurgents are deeply committed to their cause and will fight ruthlessly and fanatically to accomplish their mission. Because of their beliefs, members are willing to conduct tactically unsound missions (i.e. suicide attacks) in promotion of the strategic cause and potential rewards.

The evidence of this is even more apparent now after September 11th, although this has been true for centuries with such groups as the Muslim Moros in the Philippines or Black Tamils in Sri Lanka. Usually insurgents in this category have significant financial support from such sources as: outside supporters, ransoms, and drug trafficking. The ones without much financial support generally are semi-skilled infantry equipped with cheap weapons with low technology (e.g. AK-47). If the insurgents' ideals and support are internally rooted, the insurgent will fanatically defend its roots and leadership. If rooted externally, these outside connections will be obscured, as demonstrated by radical Islamic networks throughout the world, and the threat will remain even when the local group is nullified.

#### **Monetarily motivated (economical, criminal) insurgents**

Monetarily motivated insurgents, such as warlords, militarised criminal gangs, and organised crime groups, are motivated by money or power (e.g. used for profit). They can use the same tactics and methods as ideologically motivated insurgents, but they are less likely to do so. This is because a monetarily motivated individual is less fanatical than his ideological counterpart and will resort to staying alive when circumstances are going against him. As a result, this kind of insurgents will be more prone to flee when events are becoming unfavourable.

### 5.2.2 *Behaviours and Tactics of Insurgents*

Over time the insurgents have discovered that the urban area, either small or large, offers them many tactical advantages, especially against modern armies. They tend to favour operating in urban areas, because it allows them to neutralise the technological and numerical advantages of traditional military forces. This is done by taking advantage of restrictions of conventional forces due to the Rules of Engagement (RoE), cultural bias, media presence and location. They will also make optimum use of the physical, social and infrastructural characteristics of the urban area to cause terror, chaos and surprise.

The subsequent paragraphs provide descriptions of the basic insurgent tactics.

### **Use the population to its advantage**

The most common tactic among insurgent operating in urban areas is to use the population to its advantage. This can be done in a number of ways to include:

- a *Ability to mass crowds quickly*  
Insurgents can often assemble and manoeuvre the present civilians into crowds and demonstrations. They can use these crowds, especially non-combatants like women and children, to restrict military responses.
- b *Use population for cover, concealment and deception*  
Insurgent members can blend in with the population by adopting any number of nonthreatening ('civilian') characteristics by not wearing identifiable uniforms. This makes detection very difficult. Civilians can also be used for cover, such as hostages or where collateral damage is likely.
- c *Burden opponents resources*  
Insurgents can use the population for placing a burden on own forces' logistical and force protection resources, for example, by herding refugees into friendly controlled sectors.
- d *Important intelligence source*  
An insurgent may use the population as an important intelligence source. Local hires, civilians with access to base camp perimeters, and refugees moving through friendly controlled sectors may be manipulated by insurgents to provide information on friendly dispositions, readiness, and intent.

In many cases the population is also used by insurgents for propaganda purposes or to limit the actions of regular forces by taking advantage of the moral concerns. These two tactics will be further addressed in tactic 'Win the information war' and 'Make moral responsibilities a weakness' respectively.

### **Win the information war**

The term 'information war' refers to everything that could be of use for propaganda and/or psychological purposes, i.e. the skilful use of the media (the 'CNN effect') or hackers. The insurgents, in most cases being at a disadvantage qualitatively and quantitatively to regular forces, have come to realise that this information war can be an equaliser by having a significant impact on own operations and support for those operations. Even though the insurgents may be unsuccessful tactically, they can still achieve strategic success through success in the information war.

The chance of success is multiplied by one major advantage: unlike regular forces the insurgents do not feel any diffidence about misleading the target audience by spreading lies, fabrications, and deceptions. This propaganda method is called *black propaganda* or *black psyops* (psychological operations). Their objective is not always to make themselves look good and their opponent's soldiers look bad; frequently their only objective is to get attention, and the blood of innocents draws that attention.

Another proven information warfare tactic of insurgents is to prevent accurate and timely casualty assessments by their opponents; they often remove all wounded and dead soldiers as well as damaged equipment from the battlefield immediately.

### **Manipulate key facilities**

Another insurgent tactic is to focus on manipulating key facilities within the urban systems (Chapter 4). Controlling power stations, public services, water sources, and communication stations permits insurgents to shape the combat environment to their benefit. In addition, it lessens the credibility of the government by chipping away at morale, attacking notable government targets and disrupting the daily life of the populace. Facilities of these types could be used to: permit the establishment of simple and reliable communications; disseminate information as part of the information war; control resources used by the population; and as a method to employ *Weapons of Mass Destruction* (see §5.2.3).

### **Engage the entire force**

Combat stress and non-wound casualties have always had a significant effect on forces involved in military operations. It is predicted that in urban operations, own forces' susceptibility to these types of casualties will be even greater. The insurgents will attempt to magnify these stresses by engaging all or significant portions of a unit in continuous operations. Snipers, Improvised Explosive Devices (IEDs), mines, and booby traps combined with the closeness and high intensity of urban combat contribute to an unremitting fear of attack from any direction that further increases stress casualties.

### **Focus attacks on service support and unprotected force**

Like any opponent, insurgents will target those own forces less proficient in basic infantry skills. This could be done by ambushing support operations or poorly guarded convoys. Besides increasing the stresses on own forces, an additional benefit to insurgents is that own infantry units will end up providing security/manpower for service support units that otherwise could be occupied locating and engaging the insurgents. For example, the urban guerrillas in Afghanistan during the Russian occupation were never strong enough to capture a city, but their constant raids and ambushes created a siege mentality among the inhabitants and diverted large numbers of soldiers from the main battle for control of the countryside.

### **Employ urban-oriented weapons**

In principle, insurgents give the portability, reliability and ruggedness of their weapons priority over the technical level. They may occasionally have access to heavier weapons as well (such as tanks and artillery); however, these will always be deployed selectively. They prefer to use light weapons, which are characterised by compactness, lethality and simplicity of operation. Modern weapons are becoming ever smaller and lighter; explosives are getting increasingly difficult to detect and increase the probability of lethality. Remote control and timing mechanisms are also enabling insurgents to deploy their weapons further away from the target or to engage potential targets over greater distances. Insurgent weapons are much like the nature of urbanisation and the urban environment: inventive and varied. Many insurgents will integrate widely available off-the-shelf technologies into their weapon systems and armed forces. The main categories of weapons used by insurgents will be examined in §5.2.3.

**Use all the dimensions of urban terrain**

Urban combat is more confined and vertical than non-urban combat. Those forces not accustomed to operating in UO usually do not consider all the military impact of these factors. Throughout the world, insurgents have come to realise this and strive to take advantage of it. For example, the Chechen rebels sent out tank killer patrols made up of 3-5 rocket-propelled grenade (RPG) teams, who ambushed Russian tanks with volley fire from above, behind, and the sides. One of their favourite tactics was to eliminate the front and rear vehicle of the convoy; obstructing the way out so the rest of the convoy could be easily slaughtered.

**Use of anti-air weapons**

Effective anti-air defences, especially against helicopters, can be improvised by the insurgents, using a mixture of anti-air and ground (i.e. heavy machine guns, rocket-propelled grenades) weapons, and ambush tactics specifically adapted to the urban environment.

**Hugging**

In UO the technique of hugging has been developed by insurgents to negate an opponent's high-firepower stand-off weapon systems (e.g. artillery, mortars and close air support), typically an asset of a regular force. Hugging is when the insurgents stay as close as possible to their opponent, civilians or essential (cultural) objects in engagements. By doing this, the insurgent takes advantage of the opponent's hesitancy in using these types of weapon systems due to the risk of injuring its own troops.

**Use of snipers**

In the urban environment, building structures create isolated areas where positions with excellent fields of fire and cover and concealment are widely available (see also §2.1). Snipers gain three advantages. First, they gain a larger choice of locations suitable for conducting fire (windows, attics, basements, holes in walls, etc.). Second, the presence of concealed passages provides additional manoeuvre routes. Third, they gain the ability to achieve wide fields of observation and fire when they occupy building roofs and upper floors.

Capitalising on these advantages, in recent urban operations the use of snipers has become commonplace. Weapons that are designed specifically for the sniper are widespread. These weapons have a very small minute of angle accuracy, a long maximum effective range (typically between 1000 and 2000 meters, but such distances are not needed in an urban environment), a high muzzle velocity, and a scope mount requiring no special tools. These urban conflicts have shown that the impact of sniping can produce results far out of proportion to the number of personnel committed to sniping. For example, enemy snipers are one of the leading casualty producers (in excess of 40% by Russian estimates) among Russian servicemen in combat in Chechnya.

Snipers are typically experienced (e.g. do not panic) and patient (e.g. calm and calculating) with a high level of marksmanship skills, expert in concealment, and shoot at only important targets. Important targets are chosen in roughly the following order: commanders, snipers, artillery observers, forward air controllers, communications personnel, grenade launcher operators, towed gun and mortar crews, and other personnel as they present themselves. An additional important

benefit of snipers is the detailed, constant, and up-to-the-minute intelligence they can gather in the forward area.

#### **Use of ambushes**

Generally the insurgent is outgunned and outmanned by the friendly forces, and as a result small unit, hit-and-run ambush tactics are used to counter this advantage. An insurgent will conduct quick, hard-hitting ambushes with small units and disengage before their enemy can bring significant firepower to bear. To increase the chances of succeeding, the insurgent tend to operate at night.

#### **Limit engagements to short durations**

For an insurgent to survive it usually attacks in a 'quick and dirty way'. Because of this, these groups typically consist of small units made up of 10-30 men. These groups are usually at an extreme disadvantage in resources and manpower compared to their opponent, and as a result they try to limit actions to short-durations so the foes resources and manpower advantages cannot be brought to bear. The Mujahidin urban warfare tactics in Afghanistan during the Russian occupation were low-level and fairly unsophisticated. Their actions were usually limited to a single strike followed by an immediate withdrawal to avoid decisive engagement with a better armed and supported enemy force.

#### **Make moral responsibilities a weakness**

Many insurgents will use tactics and orchestrate information to attack national will and sensitivities in an attempt to force the military to establish more restrictive Rules of Engagement. The insurgents may also take advantage of moral responsibilities of the regular opponent. One such manoeuvre described previously is to make the civil population a burden on the logistic and force protection resources. Also, insurgents may not abide by international agreements (such as the Geneva conventions). This will be further elaborated in the following paragraph.

#### **Use of extreme cruel methods**

In most cases insurgents see no limitations to their violence; their actions are usually without any moral and political constraints. They often strive to mislead and provoke the soldiers into attacking the wrong people, in order to decrease the sympathy of the population for the military forces. Another tactic is the intentional and specific selection of civilians as direct targets of their own. Specifically, the criminal intent is shown when babies, children, mothers, and the elderly are murdered, or injured, and put in harms way. Most of the time, the victims of insurgents are targeted not because they are threats, but because they are specific "symbols, tools, animals or corrupt beings" that tie into a specific view of the world that the insurgent possesses.

In the current theatre of war, beheadings have emerged as an insurgent tactic, especially in Iraq since April 2004. Foreign civilians have borne the brunt of the beheadings, although U.S. and Iraqi military personnel have also been targeted. After kidnapping the victim, the insurgents typically make some sort of demand of the government of the hostage's nation and give a time limit for the demand to be carried out, often 72 hours. Beheading is often threatened if the government fails to heed the wishes of the hostage takers. Frequently the beheadings are videotaped and made available on the Internet.

The use of the above-mentioned tactics can have many reasons. Insurgents can use these cruel methods to spread fear by demonstrating their strength, and to get attention on the world stages. More important, the aim is often to cause friendly forces to overreact and lose their legitimacy. The insurgents can then use such an overreaction to unite others with their cause.

Many examples exist of such atrocities and the influence they have on soldiers and their home front. In Grozny the Chechens placed the decapitated heads of Russian soldiers along the road and hung their bodies upside down in windows. This struck fear into the hearts of the following Russian troops. In Afghanistan the Mujahidin were feared for their cruel way of dealing with captured soldiers. As a result shot down Russian helicopter pilots preferred suicide over being captured. The media coverage of dragging the bodies of killed American soldiers behind cars through the streets of Mogadishu was an important reason why the Americans withdrew their forces from Somalia.

### **Military use of women and children**

An upcoming trend is the use of children as active soldiers. Child soldiers are commonly defined as 'persons fewer than 18 years of age engaged in deadly combat or combat support as part of an armed force or group'. Children as young as 8 years of age are being forcibly recruited, coerced and induced to become combatants. Researchers estimate that as many as 300,000 child soldiers are involved in conflict across the globe today.

The insurgents make use of child soldiers for several reasons. For one, it has many implications for the mental health of the opposing military troops in combat; it will have the effect of demoralising allied forces and soldiers may hesitate to fire on children. Another reason is that children can be easily indoctrinated and turned into fearless warriors, with cruel methods of operating. This is done by fostering dependency so the child feels bound to the group. Often the children are forced to kill or be killed. Their victims may be enemy prisoners, other children or even the child's own family and friends. Insisting on violence against their own family increases the child's isolation as they no longer have a place they can ever safely return in the future. They are left with nothing to lose and become a very dangerous threat.

Another advantage for the insurgents in using child soldiers is that children are not easily associated with combat, as a result of which they are not suspected of being a threat. This advantage for the insurgents also applies on female soldiers, when fighting against a Western military force.

### **5.2.3 Weapons and Equipment of Insurgents**

As mentioned before, the technological level of weapons used by the insurgents is confined to a narrow band. The portability and ruggedness of weapons are the top priorities. However, within this group of weapons there can be some significant differences between capabilities. Insurgents will use their available assets to acquire weapons that satisfy their needs. For those insurgents with minimal resources, very basic weapons are all that can be obtained. Conversely, insurgents with more resources can obtain more capable weapons. Better weapons typically offer more functionality, increased range and firepower, but which weapons an insurgent

ultimately uses depends on their availability. This section summarises the most favoured threat weapons of insurgents.

### **Mortars**

Indirect fire is an important tool in urban combat, and can be provided by both low trajectory artillery and high-arc mortars. However, because artillery systems are expensive, most insurgents will not have artillery. In comparison, mortars are inexpensive, generally referred to as 'the poor man's artillery' with some being so inexpensive they are disposable. Mortars will be ubiquitous in urban combat because of their low cost, portability and high-angle fire capabilities. Besides the identified mortars, ones that are homemade are appearing. For example, in Northern Ireland urban guerrillas seal tubes on one end with charges to launch 40-60 pound projectiles. They are inaccurate, but very destructive. Improvised mortars are fairly easy to make, but are usually inaccurate and unreliable. The acquisition by insurgents of military mortars will significantly increase the lethality and range of this type of weapons system. The smaller types are particularly desirable because of their high level of mobility.

### **Improvised Explosive Devices**

An improvised explosive devices (IED) is an important means for insurgents; IEDs are known for their effectiveness as terrorist weapons and have been responsible for many of the more than 2,000 U.S. combat deaths in Iraq, and 178 U.S. combat deaths in Afghanistan between 2001 and mid 2008 [6]. Of the 16 Dutch mortal victims in Afghanistan between July 2006 and July 2008, 7 were caused by IEDs. Figures are still rising and do not take into account the injured personnel.

An IED can be almost anything with any type of material and initiator. It is a homemade device that is designed to cause death or injury by using explosives alone or in combination with toxic chemicals, biological toxins, or radiological material. IEDs can be produced in varying sizes, functioning methods and delivery methods and can utilise commercial or military explosives, home-made explosives, or military ordnance and ordnance components. They are unique in nature because the IED builder has had to improvise with the materials at hand. Designed to defeat a specific target or type of target, they generally become more difficult to detect and protect against as they become more sophisticated.

There are several types of IEDs. One type that is increasingly being used in the current theatre of war is the so-called mobile IED; they are either vehicle or person borne. A vehicle borne IED (VBIED) is a sizeable explosive installed into/onto a vehicle (normally a car, but occasionally a motorcycle, van or truck) that is initiated by the driver. It can be initiated in different ways, e.g. remotely controlled or timed. A growing technique in VBIED attacks in Iraq has involved the use of multiple vehicles. In such instances, the lead vehicle is used as a decoy or barrier buster. Once stopped or neutralised and with coalition forces starting to move to inspect or detain – the main VBIED comes crashing through and into the crowd before detonating; thus resulting in an increase of the casualty ratio.

A person borne IED (PBIED) is an explosive carried by a person, which usually employs a high-explosive/fragmentary effect and uses a command detonation firing system, some sort of switch or button the person activates by hand. Explosives with

fragmentation can be contained in a vest, belt, or clothing that is specifically modified to carry this concealed material.

PBIEDs are almost always inextricably bound up with the term *suicide bombers*. These insurgents attack a military or civilian target, with the intention to kill others, knowing that he or she will either certainly or most likely die in the process. Although use of suicide attacks has occurred throughout history — particularly with the Japanese kamikaze pilots of World War II — its main notoriety as a specific kind of attack has increased since the 1980s.

A fairly new type of IED is the Explosively Formed Penetrator (EFP). This is a shaped charge that is effective at long stand-off range from the target (50 meters or more). An EFP is essentially a cylindrical shaped charge with a concave metal disc (often copper) in front, pointed inwards. The force of the shaped charge turns the disc into a bolt of molten metal, capable of penetrating the protection of most armoured vehicles. EFPs are difficult to counter because they can be placed at a distance from their intended targets.

Another type of IED insurgents are currently utilising is the *aerial* improvised explosive device (AIED), deployed in attacks against helicopters. AIEDs are placed in known flight paths and set off when low flying helicopters pass by. The devices shoot 50 feet into the air and detonate, spraying metal fragments that are capable of bringing down a helicopter.

IEDs can also be identified by their employment method. Regularly, IEDs are employed based on an understanding of the opponent's behaviour. For example, in Grozny Chechen snipers would fire at advancing Russian troops from a certain angle, forcing them to take cover in an alley or building already booby-trapped. A new militant trend in this category is the house borne IED (HBIED). These so called *house bombs* can cause many more casualties than smaller improvised explosive devices, which rarely kill more than one or two people at a time. Increasingly insurgents are creating a "daisy chain" of house bombs, in which an initial explosion can trigger blasts up and down a block.

Dummy IEDs are used as well to disrupt economic and social life and to force the police and the army to take action. Insurgents need only place enough real IEDs to ensure that the authorities cannot afford to ignore any warning. Both dummy and real IEDs can be used as bait to fix specialist personnel while they deal with them. An alternative classification of IEDs can be made according to the initiation method of the IEDs, as shown in Table 7.

### **Rocket Propelled Grenades (RPGs) and other Shoulder-Fired Anti-armour Weapons**

Rocket-Propelled Grenade (RPG) is a loose term describing hand-held, shoulder-launched anti-tank weapons capable of firing an unguided rocket equipped with an explosive warhead. This weapon class is of major significance in urban operations, because the utility of shoulder-fired weapons has expanded. For example, during an extended fire fight in Mogadishu, Somalia, U.S. helicopter and special operations forces discovered too late that the Somalis had radically modified their rocket-propelled grenade launchers. Originally designed to penetrate armour, RPG-7 warheads were successfully modified to airburst and shoot down U.S. helicopters. To counter the potentially fatal back blast from shooting the RPG-7 at a raised

Table 7 Classification of IEDs by initiation method.

IED Type	Description
<b>CWIED</b> Command Wire IED	An explosive initiated by the perpetrator by means of a signal through an electrical wire.
<b>RCIED</b> Radio Controlled IED	An explosive initiated by the perpetrator by means of a radio signal.
<b>PPIED</b> Pressure Plate IED	An explosive initiated by the victim by stepping on a pressure switch.
<b>SPBIED</b> Suicide Person Borne IED	An explosive intentionally initiated by the person carrying the device (suicide bomber)
<b>SVBIED</b> Suicide Vehicle Borne IED	An explosive installed into/onto a vehicle, intentionally initiated by a person in the vehicle

elevation, special deflectors were placed on the rear of the launcher tubes, redirecting the blast upwards and safely away from the firer.

### Grenades and Molotov cocktails

Grenade launchers and hand-thrown grenades have proven to be highly effective in UO against the abundance of structures that provide cover and confined spaces. They provide a short range, within 200 meters, close combat bursting area capability. A well known example is the Molotov cocktail (or petrol bomb). This is a crude incendiary weapon which consists of a glass bottle semi-filled with flammable liquid, usually gasoline (petrol) or alcohol (generally methanol or ethanol), the mouth of the bottle is stoppered with a cork or other type of airtight bung (rubber, glass, or plastic), and a cloth rag fixed securely around the mouth. The weapon is used by first soaking the rag in a flammable liquid immediately prior to using it, lighting the rag and throwing the bottle at the target. The bottle shatters on impact, spilling the flammable liquid over the target which is then ignited by the burning rag (urban dictionary). Molotov cocktails can ruin an armoured vehicle when dropped inside.

### Machine guns

In urban areas, close quarters combat is common and insurgents, like any combatant, typically need to react with quick-firing and large volumes of fire. Machine guns provide this capability while still being portable.

### Flame, incendiary and blast weapons

Flame, incendiary and blast weapons, such as Fougasse, the M202A1 Flash, white phosphorous, thermo baric, and other incendiary agents, are highly effective against personnel in confined spaces. The concept of throwing fire has existed since ancient times (e.g. Greek fire). Man-portable flame throwers have been used since World War I against trenches and fortified positions. They have been used frequently by all sides in the urban battles of World War II. Besides the physical impact of flame weapons (burning the targets or suffocating the occupants of a space by consuming the oxygen), they also have a great psychological impact. Blast explosives kill or injure with the blast wave; with flying debris or by collapsing buildings; and by the blast wind throwing bodies against the ground, equipment, structures, and other stationary objects. Nowadays flame weapons are abandoned by most armies, although the Russians are producing a rocket propelled incendiary launcher (Shmel

or Bumblebee), which has been deployed during the Russian campaign in Afghanistan and in Grozny.

### **Chemical, Biological, Radiological and Nuclear (CBRN) weapons**

The effect of the use of these weapons is enormous; the potential for mass destruction and the deep-seated fear most people have for these weapons make them attractive to groups wishing to attract international attention. Although an explosive nuclear device is acknowledged to be beyond the financial and technical reach of most insurgent groups, a chemical or biological weapon, or a radiological dispersion device using nuclear contaminants, is not. The technology is simple and the payoff is potentially higher than that of conventional explosives [10].

The disadvantage for insurgents, however, is that the use of such weapons, if deployed in their own territory, is highly likely to cause large numbers of casualties, whereby public support for the 'cause' may evaporate. This also means that the threat of deployment of such weapons is not always credible, unless it comes from a terrorist group. As part of a conflict, the use of chemical and biological weapons in this context is still the most likely.

A radioactive weapon that many fear, but that has not been used with any success, is the dirty bomb. This is one type of a radiological dispersal device (RDD) that combines a conventional explosive, such as dynamite, with radioactive material. The terms dirty bomb and RDD are often used interchangeably in the media. Most RDDs would not release enough radiation to kill people or cause severe illness - the conventional explosive itself would be more harmful to individuals than the radioactive material. However, depending on the scenario, an RDD explosion could create fear, contaminate property, and require potentially costly cleanup. Making prompt, accurate information available to the public could prevent the fear sought by terrorists.

A dirty bomb is in no way similar to a nuclear weapon or nuclear bomb. A nuclear bomb creates an explosion that is millions of times more powerful than that of a dirty bomb. The cloud of radiation from a nuclear bomb could spread tens to hundreds of square kilometres, whereas a dirty bomb's radiation could be dispersed within a few blocks or kilometres of the explosion. A dirty bomb is not a "Weapon of Mass Destruction" but a "Weapon of Mass Disruption," where contamination and anxiety are the terrorists' major objectives.

### **Sighting devices**

Night-vision equipment, image intensifiers and thermal imaging devices will enable insurgents to operate effectively even in darkness. The proliferation of these assets and the fact that they have become cheaper make the use of sighting devices more likely.

### **Non-weapons**

These are objects, often vehicles, which were not designed as weapons but which could nevertheless be used as such. Examples are passenger aircraft, tankers, chemical transport trains and cargo ships. Such vehicles, if used as weapons, can cause huge numbers of casualties and massive material damage. Insurgents will therefore mainly deploy them against isolated objects in their home territory or in the enemy's home territory. Non-weapons are also suitable for use in terrorist attacks.

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## 6 Key Operational Capabilities for Urban Operations

The previous chapters described the characteristics of the urban area and their military implications. This chapter integrates the military implications into a description of the overall required military power in urban operations with typical examples at the individual soldier and small unit level (§6.1), and provides an overview of the key operational capabilities required in urban operations (§6.2 through §6.6). The main required operational capabilities are capabilities to perform (1) Effect Based Operations, (2) joint, combined and interagency operations, (3) COIN operations, (4) information operations, and (5) public order management. Please note that the common term in the description of these capabilities is “operations”, this is how they are defined in military terminology. This term does not imply that these concepts are some sort of different types of military activities, separable from urban operations. Instead, they are characteristics and aspects of a military operation; they can be applied simultaneously and are an integral part of urban operations.

Also, this overview is not meant to be exhaustive or complete, so it cannot be used as a definitive checklist. Its purpose is to indicate that in urban operations military complexity culminates; proper preparation at all military levels is mandatory to conduct these operations successfully.

### 6.1 Overall Required Military Power

Military power can be considered as the product of three factors: the physical component, the mental component and the conceptual component. Urban operations have an impact on all these components.

#### **The physical component**

The physical component comprises of the personnel and material of an organisation. Urban operations have greatly influenced the training of personnel. Many countries have built specialised training sites, where troops can practice their tactics, techniques and procedures in a live urban environment. In combination with laser engagement systems they form powerful training environments. Also sometimes instrumentation is added to these villages, although the physical urban environment still poses some technical challenges for these systems. In some cases specific physical training is developed, to prepare troops to better negotiate the obstacles in the urban terrain. The application of virtual simulation for urban operations is also rising, where (adapted) commercial shooting games are used to train procedures in the urban environment.

New equipment, improvements on existing material and weapon systems tuned to the urban environment or alternative methods of use are introduced. Examples are protective kneepads for the individual soldier, breaching tools, short(er) firearms and unmanned (reconnaissance) ground vehicles. But many problems still need to be solved. Better communication and sensory systems or logistical supply systems are clear examples in this field.

#### **The mental component**

The mental component comprises of the motivation to perform tasks and effective leadership of the troops. The nature of urban operations has imposed great changes

in the military organisation, where a great deal of responsibility resides more than ever at the small unit level. This is reflected by terms as “junior leader’s war” and “strategic corporal” to characterise urban operations. The latter term reflects the notion that the (in)activities of even a corporal can have an impact on the tactical, strategic or even the political outcome of the mission. However, this does not imply that every soldier must consider the possible strategic consequences of his actions, because he has not got the required oversight. Instead, well-trained TTPs and clear guidance must assist every military to be aware that the support of the local population should be won and that the urban systems, especially cultural and religious heritage, should be spared as much as possible. Yet the opponents are right among them and in this environment Rules of Engagement, often requiring split-second decisions, are more difficult to apply.

Another characteristic of urban operations is the so called “three block war”<sup>11</sup>, to denote that a (larger) unit can be conducting different activities along the spectrum of the modern battlefield simultaneously, such as high intensity fighting, peacekeeping and humanitarian relief. But this also implies that an individual soldier and his direct leadership can be confronted with a rapid change of the nature of his activities, such as is the case in reconstruction operations, in which violence can break loose at unexpected moments and from within the very population they are trying to assist. Numerous examples exist where troops, trained for violent combat activities, have problems to quickly shift to policing and reconstruction activities.

As in every type of fight, the morale of the troops is an important factor of combat power. It is explicable that an adversary driven by financial profit might reveal a different perseverance and be less fanatical than an insurgent who is driven by deep religious motives. Adversaries of all sorts of backgrounds and motives can be encountered in urban operations.

Besides trying to diminish the physical capacity of an opponent, targeting the mental component and thereby depriving their will to fight can contribute to defeat the opponent. Especially in case of counter-insurgency operations this is an important course of action. This is because it has been proven many times that it is nearly impossible to physically defeat insurgents and terrorists. Offensive actions can diminish their capacity, but that is often only temporal and new insurgents will rise. Insurgents live on the support of the local population, so besides targeting the mental component of insurgents, it is even more important to influence the opinion of the population, in order to deprive the insurgents of the sea they swim in. Conversely, insurgents do not have the capability to physically defeat superior regular forces. Therefore targeting the morale of peace keeping forces, that of their home front, but also that of the own inhabitants is their main method to achieve their objectives. Violent actions, like for example bomb attacks and kidnappings, in combination with information operations to exploit committed atrocities can be highly effective when they are not countered properly.

But not only the motives and actions of the own troops and those of the opponents influence the mental component, also the nature of the urban environment itself draws a heavy burden on the troops. Lack of situational awareness and the presence of a multitude of military and non-military threats require a lot of the mental constitution of the troops to avoid confusion and chaos.

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<sup>11</sup> This term was coined in 1997 by General Charles C. Krulak, Commandant of the U.S. Marine Corps.

### **The conceptual component**

The conceptual component comprises the doctrine and procedures of (military) operations. Doctrine is defined as the formal expression of military thought valid for a certain period of time. Doctrine is general in nature and describes fundamentals, principles and preconditions of military operations at the different operational levels.

Today, joint and/or combined operations are rather rule than exception, because few nations can afford or are capable to execute a complex mission by themselves. Also for political reasons it is often important to establish a coalition of several troop contributing nations. NATO's Strategic Concept states that interaction between Alliance forces and the civil environment (both governmental and non-governmental) in which they operate is crucial to the success of operations. Therefore cooperation, or at least coordination, with other governmental departments and civil organisations is an integral part of current operations. To be able to operate in a multinational setting, some preconditions have to be satisfied. Interoperable C4I systems and a common language are examples. Formalised and documented doctrine is another essential precondition to prepare troops, execute operations and enable cooperation along the hierarchy and with other parties (joint, combined, interagency). If common doctrine is not available, at least one has to have a thorough knowledge of each others doctrine and to have trained working together.

Lessons learned show that for successful urban operations, the organisation of troops is essential and that even the smallest of units can be confronted with joint aspects. The combination of combat, combat support and combat service support elements is required, leading to the concept of combined arms teams.

Examples exist where an infantry platoon of nation A is embedded in a company of nation B, or where a Quick Reaction Force of nation A is sent to assist a patrol of nation B. Or even at the individual level, where a specialist like a Forward Air Controller of nation A is attached to a convoy of nation B and guides an aircraft of nation C. This is only possible because of known, accepted and certified common procedures.

Common doctrine also creates flexibility in training and education. A couple of years ago the RNLA/Training Command provided experienced instructors to the British Royal Army to assist them in training platoons on a British urban training site. Such an exchange based on common doctrine is for example not yet possible in case of German instructors for Dutch troops.

## **6.2 Effect Based (Approach to) Operations (EBAO)**

The nature of modern operations, and that of urban operations in particular, imply that more than only pure military objectives have to be taken into account and that a multitude of different actors can influence the situation. To deal with these complexities, often an Effect Based Approach to Operations (EBAO) is applied. This is not a completely different method compared to the traditional way of planning and executing military operations, nor is it a template that guarantees success, suggesting that all uncertainties and unknowns in the complex environment can be made calculable or predictable and thus manageable. Instead, it is a framework that makes the military aware that they must consider more factors and with different dimensions. Examples are:

- The end state and the way to achieve it, is expressed in terms of effects, where an effect can be defined as a change in the environment. And that is also what an end state, military objectives and decisive points are. However, these effects must also take non-military objectives into account, such as political, economic and social objectives. Such effects are often more qualitative of nature and are more difficult to strictly define in time and space (How can one decide if the political situation is stable (enough) or when the needs of the population are met (sufficiently)?). Moreover, this type of changes may take considerable time to achieve, far overstretching the duration of a military rotation in a mission.
- Effects are not independent, but in modern operations complex interrelations among effects are more rule than exception. For monitoring and controlling purposes, clearly sequenced objectives are very practical and this is how traditionally decisive points are defined on separate lines of operation. But such a model can not represent the reality of modern operations. For example, decreasing the physical capabilities of insurgents will decrease their influence and thus contributes to more economical development. Conversely, a growth of the economical situation will undermine the support from the population for the insurgents and that will decrease their influence. Also many effects are not achieved consecutively, but progress is made on them in parallel. On the other hand, achieving progress on one effect might negatively influence the progress on another effect (e.g. eradicating poppy fields contributes positively to diminishing the narcotics trade, but it might also decrease popular support when that population is largely dependent on poppy as source of income). Reciprocal relations, parallel effects and negative effects are but examples of the complexity of dealing with modern operations.
- The military force and the opponent are not the only actors influencing the environment. Instead many different actors can play their part, whether they are military, governmental, non-governmental, national, international, or private organisations. They can actively or passively support the military mission, be true neutral in their actions or they can oppose the military mission. It is of paramount importance that the military force is aware of the presence and influence of all actors in the environment. Where possible and beneficial, active co-operation can be sought with certain parties, resulting in joint, combined and interagency operations. But the military force must realise that also if only liaison is established or even when no information at all is exchanged, those other actors can achieve certain effects. Therefore this will influence the priorities and activities of the military force. Dealing with many different actors is also called the *Comprehensive Approach*.

There is no standardised doctrine (yet) about how to implement an Effect Based Approach, but being aware of the presence of other actors, how they can influence many different aspects of the environment, and taking that into account in one's own activities, is the first step towards being successful in this complex environment.

### 6.3 Joint, Combined and Interagency Operations

#### **Joint operations**

Joint operations is a general term to describe the integration of the various service branches of a state's armed forces into one unified command. The complementary forces from a state, such as army, navy, air force and special forces, are meant to

work together in joint operations, rather than planning and executing military operations separate from each other. For instance, air forces can support land forces by increasing the limited situational awareness in urban areas, or by providing fire support. When operating in coastal urban areas, the navy can bring several important capabilities, e.g. naval gunfire support, or logistic and medical support from sea. To successfully work together, equipment and procedures of the branches must be interoperable.

### **Combined operations**

In combined operations forces of two or more allied nations are acting together for the accomplishment of a single mission. This collaboration helps the military forces to cope with the complexity of the urban operations, while each nation may provide capabilities and strengths that their allies do not possess and vice versa. However, in addition to synchronising equipment and procedures, there are also some other difficulties arising from this: although the missions of the multinational partners may often appear similar, rules of engagement, home-country policies, and sensitivities may differ among partners.

### **Interagency operations**

In interagency operations military units cooperate with (are supported by or are supporting) non-military agencies in order to accomplish the mission. There are many different types of non-military agencies and they can include:

- National governmental departments, such as the Ministry of Foreign Affairs and Development Co-operation.
- International or Intergovernmental Organisations (IO) are established by co-operating states to serve common public interest of those states. These organisations have well-defined structures, roles, and responsibilities and are usually equipped with the resources and expertise to participate in complex interagency operations. Examples are the United Nations and its bodies, and the International Red Cross. IOs can also be bound to a specific region, such as the North Atlantic Treaty Organisation (NATO) or the Organisation for Security and Co-operation in Europe (OSCE).
- Nongovernmental Organisations (NGO) are driven by humanitarian or religious objectives and are in principle independent from a government. Therefore, they do not operate within the military or governmental hierarchy or the chain of command. Any relationship between the armed forces and an NGO is best characterised as a professional or circumstantial association.

The need to conduct or participate in cross spectrum operations, where besides military objectives, also political, social and economical objectives have to be achieved, leads to a natural increase in the importance of effectively orchestrating military and civil actions, which is obviously also the case in joint and combined operation. This is especially true in urban areas where the proximity of enemy and friendly forces, activities per unit time, and non-combatants needing aid, far exceed that generally found in other environments. It naturally follows that there is a similar increase in the importance of interagency cooperation at all stages of preparing for and executing an operation or campaign. In operations in which not only military objectives have to be achieved and where military forces have to finally transfer control to civilian authorities, other agencies and organisations must play a role. This means that the military have to liaise, cooperate with or leave activities to other parties. In instable and insecure situations this is more easily said

than done. Some IO/NGOs do not want to be associated with military forces, afraid that this might damage their impartial position. In cases where coordination or cooperation is established, different attitudes, methods of operation, capabilities and experiences are causes of friction.

Much has to be learned on both sides; working together, training together, and refining working relations are essential. The same applies for performing successful joint and combined operations.

#### **6.4 Counter Insurgency (COIN)**

Counter insurgency (COIN) is an extremely complex form of warfare. COIN capabilities represent the military, paramilitary, political, economic, psychological, and civic action taken by a government to defeat insurgency (JP 1-02). An insurgency is designed to weaken the control and legitimacy of an established government, occupying power, or other political authority while increasing insurgent control. Political power is the central issue in insurgencies and counter insurgencies; each side of the conflict aims to get the population to accept its governance or authority as legitimate. Insurgents use all available tools – political, informational, military as well as economic – to overthrow the existing authority. Counterinsurgents - who are bound by international conventions and regulations - use all instruments of national power to sustain the established or emerging legitimate government and reduce the likelihood of an emerging crisis. The protection, welfare and support of the population are vital to the success of the COIN operations. Without a secure environment, no permanent reforms can be implemented and disorder spreads.

Practitioners of COIN must begin by understanding the specific circumstances of their particular situation. The history of COIN shows how varied and adaptive it can be, and why practitioners must understand that they cannot focus on countering just one insurgent approach. This is particularly true when addressing a continually complex, changing situation.

Today's operational environment includes a new kind of insurgency, one that seeks to impose revolutionary change worldwide. Al Qaeda is a well-known example of such an insurgency. This movement seeks to transform the Islamic world and reorder its relationships with other regions and cultures. It is notable for its members' willingness to execute suicide attacks and large scale atrocities to achieve their ends. Such groups often feed on local grievances. Defeating such enemies requires a global, strategic response – one that addresses the array of linked resources and conflicts that sustain these movements while tactically addressing the local grievances that feed them.

To execute COIN operations successfully it is important to manage information and expectations. Thoroughly understanding the society and culture within which counterinsurgent operations are being conducted is essential. Effective counterinsurgents understand local norms; they use locally tailored approaches to control expectations. Managing expectations also involves demonstrating economic and political progress as a result of COIN actions to show the populace how life is improving.

Furthermore, counterinsurgents should be able to adapt quickly. Insurgents use amoral and barbaric approaches to preserve their greatest goal. They constantly adapt to the situation which obliges counterinsurgents to develop the ability to learn and adapt rapidly and continuously.

Another requirement for executing COIN operations effectually is the ability to calculate carefully the type and amount of force to be applied and who wields it for any operation. Any use of force generates a series of reactions. If the host nation police have a reasonable reputation for competence and impartiality, it is better for them to execute urban operations possibly requiring the use of force (e.g. house searches, arrests, crowd management); the populace is likely to view that application of force as more legitimate.

Effective COIN operations are decentralised and higher commanders owe it to their subordinates to push as many capabilities as possible down to their level. Mission command encourages the initiative of subordinates and facilitates the learning that must occur at every level.

A result of the above mentioned requirements for successful COIN operations is that counterinsurgents should prepare themselves for a long-term commitment. COIN operations demand considerable expenditures of time and resources since insurgents are protracted by nature.

## **6.5 Information Operations (IO)**

The information environment is the sum of individuals, organisations, and systems that collect, process, and disseminate information; it also includes the information itself. In urban operations, the information environment is extremely dense due to the proliferation of info systems and widespread access to those systems. Therefore, information operations are of vital importance here.

Information Operations (IO) is the military concept that deals with information as a means, target and weapon, and is integral to the successful execution of military operations. A key goal of IO is to achieve and maintain information superiority; this provides the joint force a competitive advantage only when it is effectively translated into superior decisions. IO are described as the integrated employment of electronic warfare (EW), computer network operations (CNO), psychological operations (PsyOps), military deception (MILDEC), operations security (OPSEC) and Public Affairs (PA), in concert with specified supporting and related capabilities, to influence, disrupt, corrupt or usurp adversarial human and automated decision making while protecting our own. The subsequent paragraphs describe the components of IO, and their interdependency, into more detail.

### **Electronic Warfare (EW)**

EW can be defined as military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. Electronic warfare consists of three divisions: electronic attack, electronic protection, and electronic warfare support. Electronic attack (EA) is the active or passive use of the electromagnetic spectrum to deny its use by an adversary. Electronic protection (EP) includes all activities related to making enemy EA activities less successful by means of protecting friendly personnel, facilities,

equipment or objectives. EP can also be implemented to prevent friendly forces from being affected by their own EA. Electronic support (ES) is the passive use of the electromagnetic spectrum to gain intelligence about other parties on the battlefield in order to find, identify, locate and intercept potential threats or targets.

### **Computer Network Operations (CNO)**

CNO is comprised of computer network attack, computer network defence, and related computer network exploitation enabling operations. This core capability is becoming more important every day and affects not only military capabilities but extends to the whole society that depends more and more on information systems. While the costs to execute network attacks diminish, the impact they can have increases. Moreover, network attacks can be executed by nations, organisations, but also by a creative individual (hacker). Network attack, or cyber warfare, has several levels, ranging from web vandalism, interception of (classified) data, modifying data, distributed denial of services (overflowing computer servers with data aiming to make them inaccessible), equipment disruption and finally to attacking critical urban systems, such as financial markets, communications systems and energy facilities.

### **Psychological Operations (PsyOps)**

PsyOps are the planned psychological activities using methods of communications and other means directed to approved audiences in order to influence perceptions, attitudes, and behaviour, affecting the achievement of political and military objectives. The distinction between *white* and *black* PsyOps can be made. White or overt PsyOps refers to messages emanating from a clearly identifiable source. In black PsyOps, the covert activity, the information is purportedly from one source, but is in fact created by someone else. The hope of Black PsyOps is that the target audience does not see through the ruse and believes the information is coming from the wrongly attributed source, which it sees as more credible. The latter usually is far more 'economical with the truth' than its white counterpart, whose success is dependent upon credibility and therefore adheres largely to factual statements or what might be termed 'credible truths'. This does not mean the whole truth is told; it simply means that white PsyOps do not lie deliberately whereas black PsyOps, born of a lie, tends to fall into the realm of political or military deception activities. *Grey* PsyOps, in which the source is unidentifiable, falls between the two extremes and are neither completely true nor false, but may be considered exaggerations and half-truths.

### **Military deception (MILDEC)**

MILDEC targets adversary decision makers through conduits to affect their information, information systems, and decision making processes, thereby causing the adversary to take specific actions (or inactions) that will contribute to the accomplishment of the friendly mission. Conduits consist of all the systems, organisations and individuals through which information reaches the adversary. MILDEC should affect the quality of information available for adversary decisions in the following ways: (1) deliberately presents misleading information to adversaries to degrade the accuracy of adversary information (2) seeks to give adversary decision makers a false sense of completeness about friendly forces or intention (3) may cause the adversary to misjudge the relevance of available information and misallocate operational or intelligence resources.

### **Operations Security (OPSEC)**

OPSEC is the process of identifying critical information and subsequently analyzing friendly actions attendant to military operations and other activities to (1) identify those actions that can be observed by adversary intelligence systems; (2) determine indicators that adversary intelligence systems might obtain that could be interpreted or pieced together to derive critical information in time to be useful to adversaries; and (3) select and execute measures that eliminate or reduce to an acceptable level the vulnerabilities of friendly actions to adversary exploitation. MILDEC and OPSEC are complementary activities — MILDEC seeks to encourage incorrect analysis, causing the adversary to arrive at specific false deductions, while OPSEC seeks to deny real information to an adversary, and prevent correct deduction of friendly intentions and plans.

### **Public Affairs (PA)**

PA is targeted on expediting the flow of accurate and timely information about the activities of the military joint forces to the public and internal audiences. PA does not exist to create news or overtly influence public opinion; it exists to provide factual information so its audiences can make informed opinions.

Is it essential to be aware of the interdependency of the core capabilities of IO. For instance, EW activities support PsyOps by, when appropriate, degrading the adversary's ability to see, report, and process information and by isolating the target audience from information. Therefore, IO can only be effective when the six core elements integrate their activities to create a synergistic effect.

## **6.6 Public Order Management (POM)**

Civilians are the centre of gravity in urban operations (Chapter 3). Military forces assist local parties and the population in (re)building the nation's security, governmental and economic capabilities, countering the influence of insurgents. In order to prevent and suppress violence within the urban population, public order management (POM) capabilities are needed, e.g. during humanitarian operations, when people can more quickly become violent because they are in the need for food and water. Public order management focuses on preventing a crisis situation by controlling factors which may lead to escalation. Here, the behaviour of the crowd/individuals (see §3.3) has to be influenced in such a way that negative processes within the crowd are being transformed into a less destructive direction. In principle, this is done without using lethal weapons and under the principles of proportionality and subsidiarity.

### **Intelligence**

In order to prepare for POM activities, POM units need information indicating potential future civil disturbances. Examples of activities indicating civil disturbance are religious events, propaganda activities, demonstrations, and official manifestations. Such intelligence can be obtained by maintaining contacts with local leaders and organisations (e.g. by means of CIMIC).

### **Prevention**

Prevention is meant to prevent escalation of (expected) civil disturbances. Preventive measures are focused on environment and local leaders.

Preventing crowd formation and preventing riots both have a far higher success probability than controlling a (violent) crowd.

An effective approach of preventing crowd formation is to communicate with the (in)formal leader(s) of the involved group(s). E.g. in case demonstrations are planned, it is effective to arrange meetings with the organiser(s) beforehand. Such engagements consider for example the starting time and the duration of the demonstration.

Alternatively, a POM unit can address the crowd directly. By doing this, the commander can communicate the unit's intentions, calm the crowd, and change the mindset of the participants. Multiple information flows can be used to address the crowd (e.g. media, (loud)speakers).

It is important to coordinate the several disciplines that contribute to prevention. Examples of possible disciplines are CIMIC, PSYOPS and NGOs.

### **Deterrence**

By means of deterrence, or "showing the force", the controlling force creates the perception that it is willing and capable to use all available means, including lethal force. Here, the *perception* of threat is often more important than the threat itself. A perceived lack of determination, capabilities, and operation efficacy on the side of the suppressive force will likely encourage an increase in violence.

### **Intervention**

Public order interventions can take place at multiple violence levels, ranging from incident management (low violence level) to crowd combat (high violence level):

- 1 Incident management: restoring public order by intervening in (small) incidents between individuals (e.g. a street fight between two persons);
- 2 Crowd control: maintaining the public order during meetings of large groups of people (systematic planning of crowd guidance);
- 3 Riot control: restoring public order by violently intervening in riots, without presence of the threat of lethal weapons and explosives;
- 4 Crowd combat: restoring public order by violently intervening in riots, in presence of (the threat of) lethal weapons and explosives (e.g. during the civil unrest in (suburbs of) Paris in 2005).

In urban operations, public order management is typically a joint effort of local police authorities and military units. Depending on e.g. the availability, professionalism, and trustworthiness of the local police, military units can either operate at all violence levels, or just at the higher levels. POM can either be the primary task of a military unit (military police), or a secondary task. In the last case, POM tasks are carried out by military units primarily trained for military tasks other than POM, and secondarily having knowledge, skills and means to perform elementary public order management tasks. POM means include non-lethal and less-lethal means to scare off civilians and to prevent them from disrupting the execution of the urban operation. POM units have to use violence against unarmed groups of civilians proportionally, even if they hinder military actions. Therefore, it is essential that POM units are capable to operate in the whole spectrum of violence. If a situation does escalate to lethal violence, then the combat forces have to take over.

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## 7 Urban Operations Doctrine

Operations in urban terrain have been identified since early military doctrine. An ancient historic example is the famous Chinese general Sun Tzu, who stated in his book “The Art of War” to attack cities only when there is no alternative. That assertion has been adopted throughout the years and was reflected in the military doctrine of many modern armed forces. But those were different times. Nowadays, operations are more likely to take place in urban environments than any other environment. And despite the advice to avoid fighting in cities, throughout history military operations have taken place in cities. So there are valuable lessons learned that should be incorporated in modern doctrine. To verify this assumption, we have looked at doctrinal publications of the Netherlands, NATO and 5 current strategic partner countries of the Netherlands, namely France, Germany, Norway, United Kingdom, and the United States.

### 7.1 Current International Urban Operations Doctrine

For the Netherlands and many of its 5 strategic partner countries it is policy that national doctrine should be consistent with NATO doctrine in order to facilitate cooperation. A substantial amount of operational and tactical level doctrine is produced by NATO, with national (branches of military) services using it, as appropriate, for guidance. On the other hand, sometimes new insights and developments first emerge at the national level before they are formalised and adopted within NATO. It is fair to say that national and NATO doctrines influence each other mutually.

The next conclusion is that all of these nations and NATO have identified the urban environment as an inevitable, very important or even the dominant area of current and future military operations. Also, there seems to be consensus that urban operations are not a specific type of operation, but that urban areas provide a different and unquestionably challenging environment. This coincides with the observation that previous distinction in types of operations along the spectrum of violence is being abandoned, such as peace building, peace keeping, peace enforcement and combat operations. Most contemporary operations turn out to slide across a spectrum of characteristics during their execution, resulting in the doctrinal conception of “operations are operations”. This does not express that all operations are the same. On the contrary, it means that each operation is unique, but that each operation potentially can require all capabilities of a military organisation to be able to cover all the levels of force that could be faced, either consecutively or even simultaneously, as the concept of “three block war” states. Considering that a defence organisation must be prepared to use all its competences at all times does not relieve the organisation of the obligation to describe the consequences of the urban environment on its operations.

It is observed that in the last years much has been discussed and published about urban operations. A good example is the yearly multinational exercise Joint Urban Warrior (JUW), which is cosponsored by the US Marine Corps (USMC) and US Joint Forces Command (USJFCOM). JUW is designed to address and improve joint and combined urban operations by using concept development and experimentation

(CD&E). JUW involves Service, Joint, Multinational, and Interagency participation throughout the pathway (info: [www.wargaming.quantico.usmc.mil](http://www.wargaming.quantico.usmc.mil)).

Despite all these efforts, only a small portion has been captured in formal doctrine and very little of it has been standardised. NATO is also aware of this deficiency and is currently coordinating initiatives to incorporate the challenges of the urban environment in NATO doctrine. The ACT Joint Urban Operations Working Group has drafted a Combined Joint Urban Operations (CJUO) Concept (version 2.0, February 2008) and the NATO Urban Operations Working Group has drafted a NATO Urban Operations Tactical Handbook (to be published in October 2008).

A large part of doctrine is based on military experiences gained during past operations. Nations do not only refer to their own experiences, but also to relevant experiences of comparable forces. It is therefore explicable that many western nations take the lessons learned and doctrinal publications from the United States and the United Kingdom into account. Added to this is the likelihood of working together with these nations in joint and combined operations and the pure practical reason that documents from these countries are available and published in a language many people can read.

At the lowest level of doctrine reside the skills, drills, techniques, tactics and procedures (TTPs). They provide the guidelines for the lower tactical levels. Each nation has devised and described specific TTPs for operating in the urban environment, such as clearing rooms, fortifying buildings and patrolling through urban environments. An example of the latter tactic is “urban swarm” or “satellite patrolling”, in which small units patrolling assigned areas are on call to respond to actions in neighbouring sectors. This tactic is appropriate to a low-intensity conflict situation.

These procedures are taught and trained in specialised and sometimes instrumented training sites. An overview of these urban training sites can be found at the password required NATO web site [www.fibuamoutside.info](http://www.fibuamoutside.info). In the near future an annex to the new NATO Urban Operations Tactical Handbook, meant as a training facilities catalogue, will cover the whole range of urban training facilities. Many NATO countries run one or more of these sites and in some cases troops can use the facilities of another nation.

The TTPs are primarily aimed at combat in built-up areas. Only few armed forces can afford it to use extensive role-playing, where the battlefield can be populated with civilians and media and where crowd management measures can be practised.

Lessons learned from experiences in urban combat show that one of the greatest success factors is the deployment of Combined Arms Teams, in which combat, combat support and combat service support capabilities are integrated. The composition of units is heavily depending on the level of force that has to be faced and must also be effect driven. This is applied even at the lowest tactical levels. For example, in a high level of force scenario, it is realistic to deploy a unit that is composed of an infantry section with two armoured infantry fighting vehicles, a main battle tank, an engineering squad, a forward observer and a medical vehicle.

This principle is applied today, where units are tailored to the mission or even to a specific operation. However, in the peace establishment, units are still mainly

organised according to the branches of service and that does not facilitate to embed the concept of Combined Arms Teams in the core of military operations.

Despite the fact that urban operations are considered the domain of the small, combined arms units (the “junior leader’s war”), the higher levels still have an important role to fulfil. They have to set the goals for the subordinate units and create the conditions for them to execute their tasks. As opposed to attrition warfare, this goes far beyond the creation of a manoeuvre plan and decide when and where to deploy the reserve forces. Here we touch the subject of Effects Based Operations. Modern operations require forces to plan and act taking into account more than only military factors. Objectives must be addressed in the domain of Political, Military, Economic, Social, Infrastructure and Information systems (PMESII). Another acronym used in this context is DIME, to denote the four elements of national power: Diplomatic, Information, Military and Economic power. A third term used in this context is 3D Approach, indicating that 3 aspects have to be taken into account: Diplomacy (e.g. assisting the local government, liaising with local power brokers), Development (e.g. assisting in reconstruction of infrastructure and economy, liaising with International Organisations and Non-Governmental Organisations (IO/NGOs) and Defence (e.g. training local security forces, fighting opposing forces). Current missions are using such effects based approaches, but they are learning by doing. Much has been discussed and reported on the use of these approaches, but there still is no approved NATO handbook on Effects Based Operations.

The NATO Combined Joint Urban Operations (CJUO) Concept adopts the USECT conceptual framework that assists in designing and executing operations in urban areas. The USECT concept contains the following elements:

- Understand: to create sufficient situational awareness of the local situation, this is a continuous process.
- Shape: set favourable conditions for the other elements of the USECT concept;
- Engage: execute activities to achieve the operational objectives, this can include physical engagement of opposing forces.
- Consolidate: focuses on protecting what has been gained
- Transition: reminds that in the end a civil administration has to take over control and that (foreign) military forces have to redeploy.

Appendix D.2 provides more information on the USECT concept.

Of course existing higher level doctrinal publications mention the urban context. But that is done in a fairly conceptual way. Characteristics of the physical urban terrain are described, just like the necessity to understand the interrelations among urban systems, the importance to familiarise with local cultural aspects, etc. But clear guidelines on how to deal with all these aspects are marginal to non-existent. Again, on the subject of combat operations some new operational concepts are proposed in the NATO Combined Joint Urban Operations (CJUO) Concept. These concepts are tailored to the urban environment and include Nodal Isolation, Precision Strike, Nodal Capture and Expansion, Soft-Point Capture and Expansion, Segment and Capture/Isolate. These concepts are more surgical in nature than the traditional concepts and offer the prospect of significantly reducing both friendly and civilian casualties, and collateral damage. Therefore they are more suitable operational concepts for the wide range of possible operations in urban

environment. They also may be better able to achieve success and require fewer military forces than the more traditional methods.

Existing doctrine also observes that urban operations require different orders of magnitude of familiar dimensions. For example, the rule of thumb that a force ratio of 3:1 is required in favour of the attacking force against a prepared enemy is not valid in an urban fight. Depending on the capabilities of the forces, ratios of 8:1 or even 10:1 are mentioned. Other examples include the notion that ammunition expenditure in an urban fight during a certain period of time is significantly higher than in other combat situations. The same is true for water consumption for the own troops. But actionable data, to be used to create realistic plans is often not available. The same is true for planning humanitarian relief operations. The military find it sometimes difficult to estimate the amount of required supplies for the civilian population. In these cases it can be worthwhile to inquire other organisations that have more experience with these matters, or even to seek cooperation with them.

### **Summary**

To summarise, it can be concluded that urban operations are considered as very important, but also that there are shortcomings in current doctrine. The most important ones are:

- There are no NATO standard tactics tailored to the urban environment. An initial version of the NATO Urban Operations Tactical Handbook is going to be published in October 2008 as a STANAG. However, this document is not doctrine, but a collection of best practices gathered from the contributing nations. The current version of the document has been updated to make the connection with the NATO CJUO concept and to transform it into a guideline in order to allow the nations to develop their own TTPs and conduct their own training.
- It is well understood that urban operations go far beyond achieving military objectives, purely centred on defeating an opposing force or dominating terrain. Instead, also non-kinetic effects regarding governmental and socio-economic development have to be addressed. Although some efforts have been made, there still is no approved NATO handbook on Effects Based Operations, providing guidelines how to plan and how to monitor such operations. Such doctrine also lacks at national level.
- The complexity of urban operations derives from the physical characteristics of the environment, the population, the urban systems and their interrelations. Urban operations are the territory of small tactical units. In order to be successful, higher level units must shape favourable conditions for their subordinate units. Clear standardised guidelines on how to deal with all these aspects, qualitatively and quantitatively, is marginal to non-existent.
- Urban operations require coordination and cooperation of many different types of organisations, denoted by joint, combined and interagency. Especially regarding the collaboration between military and non-military organisations much has to be explored and experienced. There are no standardised procedures and no clear understanding of each other's capabilities, strengths and weaknesses.

The main operational capabilities required for urban operations are capabilities to perform (1) effect based approach to operations, (2) joint, combined and interagency operations, (3) COIN operations, (4) information operations, and

(5) public order management (see Chapter 6). All nations realise that current doctrine does not yet fully provide the guidelines to deal with the challenges of the urban environment. Therefore NATO and the individual nations indicate that doctrinal publications are being revised and that new versions will be published from the second half of 2008 and beyond.

## **7.2 Current Urban Operations Doctrine in the Netherlands**

This chapter summarises the current doctrine of the Netherlands armed forces in relation to urban operations.

The general conclusions regarding the status of urban operations doctrine at NATO level are fully applicable to the situation in the Netherlands. Urban operations are considered a very important theme, but the urban area is seen as just one of the potential operating environments, although a very complex one. As a consequence, there will be no specific urban operations publication and only at the lower tactical levels up to date and specific urban operations doctrine publications are available. The higher military levels, which have to shape the conditions for the subordinate units, lack clear doctrinal guidelines to deal with the urban complexity. However, several characteristics of the urban environment are considered, without making the specific reference to urban operations. For instance, in the doctrinal publications at joint and at service level, the irregular opponent is considered, and briefly the main characteristics of irregular warfare are described. These publications also address the impact of a population on the military operation, and the importance of military concepts such as Information Operations and Effect Based Operations. Last but not least, it is fully recognised that joint, combined and interagency aspects are inevitably bound up with urban operations, but doctrine on how to successfully implement this, still has to take shape.

At the lower level of doctrine, the several (branches of) military services consider urban operations in a more or lesser extent. The Royal Netherlands Army devotes the most attention to urban operations in comparison with the other military services, which is understandable because of its (almost always) leading position in urban operations. A specific handbook exists describing the skills, drills and TTPs for the individual soldier and up to battalion level to operate effectively in the urban environment.

The handbooks of the Royal Netherlands Air Force do not address urban operations as a separate mission or role. Instead, specific planning considerations are described that are derived from the urban environment and RoEs, having an impact on techniques and tactics.

The Royal Netherlands Navy sees a specific role for the fleet when operating in littoral urban areas, where fire support can be offered (which includes naval gunfire support), but also logistical and medical support from sea (sea basing). For the Royal Netherlands Marine Corps, the tactical handbooks of the Royal Netherlands Army are guiding, in conjunction with those of the GBR Royal Marines and the US Marine Corps.

The Royal Netherlands Military Police is a police organisation with a military status. It is placed under the Netherlands Ministry of Defence, although the greatest part of their tasks is carried out under authority of other ministries. Their handbooks emphasise that in the context of their role current urban operations are usually

humanitarian operations instead of combat operations. Therefore the handbooks focus on Public Order Management and explicate the operational consequences of the presence of the urban population.

### 7.3 References

Relevant international doctrine publications:

- [1] NATO ACT Joint Urban Operations Working Group (2008). *Bi-SC input to Combined Joint Urban Operations (CJUO) Concept*. Version 2.0. May 2008.
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- [6] Royal Netherlands Army (2005). *Landmacht Doctrine Publicatie, Deel II-C: Gevechtsoperaties tegen een irregulier optredende tegenstander* (in Dutch). Retrieved August 2008, from [www.landmacht.nl/organisatie/taken/militaire\\_doctrine.aspx](http://www.landmacht.nl/organisatie/taken/militaire_doctrine.aspx) (pp. 429-712).
- [7] Royal Netherlands Army (2005). *Handboek 7- 40 Optreden in verstedelijkt gebied niveau IV en V* (in Dutch).
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- [11] Royal Netherlands Military Police (January 2008). *Betugelen van Woelingen op de Nederlandse Antillen en Aruba* (classification: confidential) (in Dutch). Handbook Public Order Management HB 19-2.
- [12] Royal Netherlands Military Police (January 2008). *Bijstandseenheden Koninklijke Marechaussee. Opleidings- en Trainingshandboek voor BE-eenheden KMar* (classification: confidential) (in Dutch).



## Signature

The Hague, September 2008

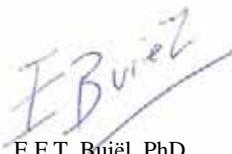
TNO Defence, Security and Safety

A handwritten signature in blue ink, appearing to read 'M.H.E. 't Hart', written in a cursive style with a large loop at the end.

M.H.E. 't Hart MSc  
Author

A handwritten signature in blue ink, appearing to read 'N. Vink', written in a cursive style.

N. Vink MSc  
Author

A handwritten signature in blue ink, appearing to read 'E.F.T. Buiel', written in a cursive style with a long underline.

E.F.T. Buiel, PhD  
Project Manager



## A Improving the Urban Operation Capabilities

Two important mechanisms to improve current urban operations doctrine and the capabilities of armed forces to effectively and efficiently conduct operations in urban terrain are (1) performing research, including Concept Development and Experimentation, and (2) identifying and incorporating lessons learned. These two topics are shortly discussed in this appendix.

### A.1 TNO Research Context

This report is a product of the research programme “Urban Operations”, carried out by TNO Defence, Security and Safety. This research programme runs from mid 2007 until the end of 2010. Objective of this programme is to obtain and maintain scientific knowledge, skills and infrastructure regarding operations in urban environments in order to support the Netherlands armed forces. Application is envisioned for determining required capabilities of the armed forces to successfully operate in urban environments, procurement of equipment for training and execution of urban operations and to formulate doctrine to plan and execute joint, combined and interagency operations in urban terrain.

Urban operations are not considered as a specific type of operation; instead, the urban environment is a special environment in which all types of operation can take place. Also the research regarding urban operations is not only concentrated in one programme, but many other research programmes and projects are (also) relevant for urban operations. For example by taking the urban environment into account as operational context, to derive requirements or to test results.

Given the number of published TNO reports and the numerous types of relations of the research with urban operations, it is not useful to provide here a list of published reports. Instead, to give some insight in the broadness of the research conducted and as a starting point to further information, the most relevant research areas are explained.

First and foremost is the predecessor of the current research programme, “**Small Unit Operations**”. A work package was dedicated to urban operations and produced a number of reports, of which the following are especially noteworthy:

- The protection of combined arms units when operating in urban terrain. This study identified the strong and weak points regarding protection of small, combined arms units (up to company level) and recommended solutions to overcome or diminish the weaknesses.
- Shortcomings of logistic support during urban operations. This study identified shortcomings of the current logistic concepts when employed in the urban environment. The following logistic functions were considered: supply, maintenance and military health care.
- The implications of non-military threats to personnel in urban operations. This study identified the non-military threats and recommended the required soldier’s knowledge and competencies for the protection against these threats.

Also, as part of this programme, international co-operation regarding analyses of small units operations was established and the simulation toolkit Infantry Warrior

Simulation (IWARS) was obtained<sup>12</sup>. This toolkit is still being improved, taking Dutch input into account.

The research programme “**Soldier operations**” is focussed on defining and evaluating the capabilities of a soldier in cross spectrum operations. These capabilities include his equipment and combat gear, and human factors. In this programme the urban environment is considered as a specific demanding context, where both physical and mental challenges have to be overcome.

The research programme “**Analysis of land based operations**” seeks to find methods and tools to analyse larger scale operations in order to define or validate requirements to materiel, doctrine and organisations. The urban environment is taken as an important operational context.

Dedicated training and instruction is an essential prerequisite to operate effectively. The research programme “**Integral training concepts**” investigates training goals, training methods and concepts to support trainers and trainees in making optimal use of the limited training time and supporting training means. Urban operations and its training means comprise one of the topics of this programme. Amongst others, TNO has assisted in defining the requirements for instrumentation at one of the urban training sites of the RNLA. The resulting TNO reports are taken into account in a recently accepted (2008) study on the renewed education and training for urban operations of the RNLA.

As described in this report, the urban environment is the domain of small units, where the performance of communication equipment is heavily influenced by the omnipresent urban systems. The research programmes “**Networked enabled capabilities**” and “**C4I**” investigate command and control issues and solutions at all levels, taking the urban context into account as one of the likely scenarios.

Information operations are important across the spectrum of operations and in all environments, but especially in the urban environment, where the population is an extra factor to be taken into account. Therefore the research of the programme “**Information operations**” is also relevant for urban operations. This programme supports the embedding of Information Operations in the armed forces, emphasising on the protection of information-infrastructures and PsyOps.

The population and irregular forces also stress the importance of and complicate the collection and interpretation of information. Intelligence Preparation of the Battlefield is therefore enhanced with these elements. Another topic in the research programme “**Validated intelligence**” is the application of geospatial intelligence, to provide insight in the physical structure of the urban terrain.

Simulation is applied for amongst others concept development and experimentation, analyses, training and mission rehearsal. Simulation can be live (real people in a real environment), virtual (real people in a simulated environment) or constructive (simulated people in a simulated environment). The research programme

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<sup>12</sup> The Project Agreement *IWARS Toolkit Enhancement* (PA IWARS) is a mutually beneficial 7-year formal international agreement focussed on exchanging information on small unit operations. Partners are the U.S. Army Natick Soldier Research, Development & Engineering Center (NSRDEC), the U.S. Army Materiel System Analysis Activity (AMSAA) and TNO.

**“Multifunctional simulation”** especially looks at techniques to quickly and accurately create terrain databases from various input sources. Having timely terrain information available is an important requirement for urban operations, but due to the complex structure of the urban terrain, this poses some extra challenges. Terrain databases of the two RNLA urban training sites have become available for various purposes.

The urban environment makes high demands on land based platforms. In order to find the right balance between manoeuvrability, lethality and protection, the research programme **“Technologies for land based platforms and weapon systems in a future force”** tries to identify requirements and possible technological solutions for future platforms and weapon systems. Urban operations are taken into account as one of the operational contexts for this programme.

An irregular opponent will deploy all means and tactics to harm a regular force or even the civilian population. Current operations in Iraq and Afghanistan show an increase of the use of Improvised Explosive Devices (IEDs). They are easy to manufacture and to use, and they have a great impact, both physically and mentally on the opponent. Much effort is put into countering this specific threat. The research programme **“Increase of efficiency and safety of EOD operations against IEDs and UXOs”** aims at enhancing procedures and technology to detect and neutralise IEDs.

Currently there is insufficient knowledge of the (physical) effects of munitions within the urban environment, so it is difficult to determine the right (kind of) weapon or munition to achieve a certain effect or to avoid undesired effects. This involves questions like “Will this ammunition penetrate that wall?”, “Will this ammunition cause that structure to collapse?” and “What are safety zones when deploying this weapon?”. At TNO, research is being conducted to gain more insight in the possible effects of munitions in a built up area. This comprises of the effects in the vicinity of the firing platform (e.g. blast in a confined space), the flight/ballistic trajectory and in the vicinity of the point of impact on various types of structures (e.g. brick or concrete walls). The latter should include the direct and indirect effects in front of, on and behind the structure.

Operations in urban terrain have more dimensions than physically defeating the opponent. Capacity building of the local government and local security forces and shaping the conditions for further socio-economic development are examples of activities inherent to modern operations. Those activities are not the responsibility of armed forces alone, instead an active role and co-operation with other services, departments and organisations is required. That is easier said than done, because there are many differences in equipment, procedures and culture that have to be overcome. In research programmes aimed at social security, TNO assists in investigating requirements and capabilities of civil services, police and fire brigade both separately and in combination with the armed forces.

As stated before, this is not an exhaustive list of all research performed by TNO that has a relevant link to urban operations. However, it provides a rough outline of the type of research TNO is capable of, in order to support our armed forces to improve their effectiveness in the ever demanding urban environment.

For further information regarding TNO research related to urban operations, please contact Mr. R.G.W. Gouweleeuw (e-mail: rudi.gouweleeuw@tno.nl).

## **A.2 International Research Context**

Of course, TNO is not the only organisation conducting research in order to support the armed forces improving their effectiveness and efficiency in urban operations. Every nation has its own research organisation(s), sometimes even part of the military establishment. And naturally, research is driven by national priorities. Scientific and operational information is shared by means of special exchange agreements, international conferences and sometimes multinational exercises.

In a NATO context, international research is co-ordinated by the Research and Technology Organisation and its current relevant activities are listed in Appendix D. Several of the underlying panels that focus on urban operations, have taken some of the capability gaps for urban operations as starting point. These capability gaps were identified by the SAS-030 panel and a recent update of these capability gaps is published in the ACT CJUO Concept. They can act as guideline to identify and prioritise research topics.

Despite the current world-wide research activities, there still are underexposed topics, while there is an operational need for them. Examples of topics that require further research are: identifying and collecting data of effects of weapons and munitions on and around urban structures (taking into account the different materials found in urban terrain), determining and evaluating concepts of logistical support in an urban environment and further elaborating on how to improve (inter)national, (non-)military agencies and organisations (joint, combined and interagency operations, see §6.3).

## **A.3 Lessons Learned Identification and Incorporation**

During operations, forces are constantly being confronted with new situations and adapt their behaviour accordingly. They apply standard doctrine, try out new concepts, see things go well and sometimes also go wrong. In general they learn from it. But these lessons should not only be limited to the concerning unit, but should also be passed on to other units, to other parts of the organisation and even to other partners. Analysing operations and identifying lessons learned is one step, but acting upon them and incorporating them into the organisation is another. Every nation recognises the importance of lessons learned, but in many nations the processing of lessons learned can be improved upon. For example, not every nation has a central point for collecting and disseminating lessons learned or a suchlike bureau that is properly manned. Sometimes still stove-pipes exist among the different branches, further obstructing lessons learned to be shared across all parts of an organisation.

Information is also exchanged at the international level. An important source is composed of publications, such as doctrine, analyses of operations, operational debriefings and personal accounts. Also, experts on urban operations from different nations meet in special working groups and at international conferences. These formal and informal networks of domain experts are another invaluable source to share experiences and improve mutual knowledge of new concepts and projects.

But in many cases these military experts have a limited posting and move on to a different function after a couple of years. And then the process of getting acquainted with the community starts all over again.



## B Suggested Literature

Urban operations have been conducted throughout the ages and many historic overviews, stories, personal accounts and lessons learned have been published. And the number of publications is growing every day. Those documents often provide an excellent context or background to illustrate (some of) the characteristics of the urban operational environment. It is impossible to read all publications, so how to select a limited number of readings that provide insight in typical urban characteristics in true operational settings? Therefore this appendix describes 11 suggested readings, ranging from official reports and analyses to novels based on fact, addressing the whole spectrum of operations, covering issues at the low tactical level to the strategic level and set in the period from World War II to today. While this list should not be considered as the definitive top urban operations publication list, it is composed with contributions of international subject matter experts in the field of urban operations and the readings have provided valuable information for this study. It is also not intended to suggest a certain ranking, because each of these publications treats different aspects of the multifaceted urban operation. To further guide the reader, a one-sentence subject is provided, followed by a short summary of each publication.

- 1 “Street Smart: Intelligence Preparation of the Battlefield for Urban Operations” by Jamison Jo Medby and Russell W. Glenn. The RAND Corporation, 2002 (ISBN 0-8330-3171-6)

**SUBJECT:** *A methodology for assessing the characteristics of an urban operational area*

Because of the complexity of urban operations, the collection and interpretation of information is even more important. This publication describes the tool Intelligence Preparation of the Battlespace (IPB) and how it can be modified for urban operations. IPB assists in both the planning and the execution of operations and intelligence missions in urban areas. IPB is an analytic process used to organise and analyze information on terrain, weather, and the threat within a unit’s area of operations and associated area of interest. Through its systematic four-step approach, members of command and intelligence staffs use IPB to predict how an adversary will act within a certain area of operations given the terrain, weather, and other contextual conditions. IPB for urbanised areas is not so clear-cut. Terrain analysis must include both the terrain on which the city sits and a comprehensive assessment of how buildings will affect manoeuvre, weapons systems, logistics, and all battlefield operating systems. Civilians on the battlefield add a crucial dimension to the analysis, requiring thoughtful consideration of all of their many potential effects.

The authors suggest that IPB is a sound methodology for assessing the characteristics of an urban operational area. With modifications that allow it to more flexibly assimilate information about urban population groups, construction, and infrastructure, IPB can provide intelligence that the process as it is currently employed cannot supply.

This publication also contains an extensive bibliography and references to web sites relevant for urban operations.

- 2 “Operation BANNER, an analysis of military operations in Northern Ireland”. UK Army Code 71842, prepared under the direction of the Chief of the General Staff, July 2006  
SUBJECT: *Countering civil unrest, insurgency and terrorism*  
This compact document is written by the UK Ministry of Defence and describes the role of the British armed forces in Northern Ireland during the period of 1969 to 2006, known as “The Troubles”. The British Army called their deployment Operation BANNER. The document provides an overview of the major events and the complexity of the relations among the different parties, be it religious, political or paramilitary. This is the background to address issues at the strategic, operational and tactical conduct of the operation, exemplified with accurate operational data. Recommendations cover the importance to understand the local conditions and associated intelligence operations, training and rotations, force protection, information operations and mission command. The main conclusion is that success was achieved not by physically defeating the insurgents and terrorists, but by creating the conditions which allowed political and social processes to be established and where the security forces could suppress violence and intimidation to a level acceptable for the population. Any force being involved in modern counter insurgency operations should take the identified lessons into account.
- 3 “Operation Just Cause” by Thomas, Donnelly, Margaret Roth and Caleb Baker, Lexington books, 1991 (ISBN 0-669-24975-0)  
SUBJECT: *Urban attack followed by reconstruction activities*  
This book describes the events that took place in December 1989, when US Army and Special Forces units invaded Panama to capture the political leader Manuel Noriega, disable his Panama Defence Forces (PDF) and subsequently set the conditions for a new democratic government and an accepted law enforcing institution. The operation consisted of assaults on dozens of objectives throughout the country, ranging from airfields to PDF strongholds in Panama City. Simultaneously, prisoners had to be rescued and collateral damage had to be minimised. The fact that US forces were already stationed in Panama, together with their families, thus provided both advantages and disadvantages.  
The success of the combat operations can be attributed to the level of training of the US troops in urban operations, also during night time, the deployment of combined arms, superior aerial fire support, the disputable motivation of the PDF troops and the supporting attitude of the local population. The fighting was intense but short and within days the combat troops had to switch roles to stability operations, providing civil law and order and assisting in reconstruction. The operation also illustrated the use of local systems, such as medical facilities and local contractors to transport supplies.  
The book concludes with a chapter of lessons learned, which can be read independently and describes many facts so characteristic for urban operations.
- 4 “People make the city: Joint Urban Operations Observations and Insights from Afghanistan and Iraq” by Russell W. Glenn, Christopher Paul, Todd C. Helmus, Paul Steinberg, The RAND Corporation, 2007 (ISBN 978-0-8330-4153-1)  
SUBJECT: *Observations characterising urban operations*  
The objective of this study was to reveal tools that will better enable military and civilian alike to meet national policy objectives best through more effective conduct

of urban combat and restoration. The study drew heavily on written material and interviews pertaining to Operation Enduring Freedom (Afghanistan) and Operation Iraqi Freedom (Iraq). Much of the written information used is from military personnel still serving in theatre at the time of its writing. Interviews included those with members of the US, UK, and Australian armed forces and civilians working to reconstruct Iraq. The military personnel represent the four service arms and both regular and special operations organisations.

This publication presents many observations characterising joint urban operations, organised using the USECT framework. The focus of this analysis is at the operational and strategic levels, but also many tactical observations are made.

5 “City Fights”, edited by Col John Antal and Maj Bradley Gericke. Balantine Books, 2003 (ISBN 0-89141-781-8)

SUBJECT: *High intensity urban fighting, major battles*

This book describes 13 examples of major combat in cities in the years from 1940 to 1968, commenting on the characteristics of each particular battle. The last chapter summarises lessons learned from these urban battles. Although capabilities of the armed forces have changed, such as the lethality and accuracy of weapon systems, many of the lessons are still valid today.

While each story has its own background and addresses one or more characteristics of urban fights, reading four of the chapters in particular provides a good overview of urban fights:

- **Stalingrad** illustrates that a city fight consumes incredible resources, both personnel (more than two Armies were involved) and logistics. It also describes the Russian adaptation of decentralised C2 to exploit local opportunities, the employment of small storm groups hugging the enemy to minimise the influence of artillery and air support, the influence of snipers using the urban structure, the role of the different arms and branches, and the way the Russians traded time at the operational level for losses at the tactical level.
- **Warsaw** illustrates how the structure of the urban environment (barricades, sewers) can be used by defenders and attackers, the destruction of a city by a mechanised force, sniper and counter sniper tactics, the abuse of civilians and how the Polish troops could resist a superior mechanised force but had to surrender because of lack of support and supplies.
- **Berlin** illustrates the massive amounts of forces needed to attack a city and the resulting casualties and how combined arms are the key to success in urban operations.
- **Jaffa** illustrates how a small, highly motivated force, supported by limited indirect fire and engineer capability, can use the urban structure, e.g. by blowing their way through houses and collapsing buildings on enemy forces.

- 6 “Block by block: the challenges of Urban Operations”, edited by William G. Roberston and Lawrence A. Yates, U.S. Army Command and General Staff College Press

SUBJECT: *High intensity urban fighting, major battles*

This publication describes 11 examples of urban warfare, an historic overview of urban battles through the ages, and some thoughts on future operations in urban areas.

While each story has its own background and addresses one or more characteristics of urban fights, reading two of the chapters in particular provides a good overview of urban fights:

- **Manila** illustrates how Japanese naval staff troops, inexperienced in urban fighting and with only improvised equipment, but with discipline and dedication, could put up a strong defence, making use of the city's resources. For example, artillery shells and depth charges were used to mine the streets, which were covered by machineguns. Fire proved to be a typical threat. When the Japanese set fire to major buildings, the American forces had no way to fight the fires or bring them under control, delaying their attack. Because of the well developed Japanese defensive positions and the strong buildings, the Americans used massive artillery and tank fires to reduce the resistance, destroying much of the city's infrastructure. Also the population was prominently present, crowding the streets, first cheering the liberators, later fleeing the fighting, but they also engaged in looting. When the battle was over, the U.S. forces present had to revive and run the battle-torn city.
- **Hue** illustrates (1) how the physical characteristics of a city with a fortified walled citadel and numerous waterways favour the defenders, (2) the difficulty of higher echelons to gain sufficient situational awareness, and (3) the dilemma to preserve the sacred old city versus deploying tanks, artillery and close air support. When those restrictions were lifted, nearly 40% of the city was destroyed and 80% of the population was made homeless. As another result, the bodies in the street caused a serious threat to public health.

Finally, the chapter on the humanitarian operation after hurricane Andrew in Florida, 1992, describes the events of the most extensive urban rescue and humanitarian operation in American history. It points out that military forces are better suited to deal with natural disasters and their consequences than other government agencies. Reasons are amongst others leadership, organisation, equipment, trained and disciplined personnel and resources. First, the military focused on providing food, water, shelter and security. In the next phase, their role expanded to assist in restoring public services (power, sewage, etc.) and removing obstructing and dangerous debris. Finally, they transferred responsibility for reconstitution and reconstruction of the disaster area to non-military organisations. It also showed that the mandatory supporting of civil organisations did not go flawlessly, due to lack of familiarity and knowledge of each others capabilities, procedures and equipment.

- 7 “A bridge too far” by Cornelius Ryan, Simon & Schuster, 1995 (ISBN 0684803305)

SUBJECT: *High intensity urban fighting*

In September 1944 the allied forces launched operation Market Garden, the attempt to take several bridges across Dutch rivers by airborne assaults (Market) and subsequently advance from Belgium across these bridges into the Ruhr industrial heart of Germany (Garden). The most northern bridge lay at Arnhem across the river Rhine and was the objective of the British 1<sup>st</sup> Airborne Division. The troops had to land some 12 kilometres from the main bridge and upon landing unexpectedly encountered the remnants of two German Panzer divisions, which were in need of rest and were deployed near Arnhem to refit. Only one battalion of approximately 750 men reached the bridge, while more than 10.000 troops were landed near Arnhem. The lightly equipped paratroopers held the northern side of the bridge for nearly ten days of high intensity urban fighting, before they had to withdraw across the river Rhine. Only 4.000 troops made it back to their own lines. This book tells the story of this operation from the perspectives of the British attackers, the German defenders and the civilian population.

- 8 “Black Hawk Down” by Mark Bowden, Penguin books, 1999 (ISBN 0-451-20393-3)

SUBJECT: *High intensity urban fighting, 1 day action*

This book describes the events on October 3, 1993, when U.S. Special Forces units tried to arrest two lieutenants of a Somali warlord in Mogadishu. One unit was inserted by helicopters in the middle of the city to make the apprehension, while a ground force moved in to exfiltrate the first unit. The operation went terribly wrong when subsequently two Black Hawk helicopters were shot down by RPG fire. While U.S. troops tried to reach the crash sites to rescue the surviving crew members, Somali rebels and angered civilians filled the streets. What followed was an urban fight, characterised by lack of situational awareness of the ground troops, close quarter fighting and where rebels used non-combatants as cover. Only through fire superiority, better training and perseverance the U.S. troops managed to withdraw to base, but at the cost of eighteen dead and more than seventy badly wounded. The media coverage showing American bodies being dragged through the streets and the attempts to release a captured helicopter pilot caused the U.S. to withdraw from Somalia.

The motion picture “Black Hawk Down”, directed by Ridley Scott, is based on this book and captures the characteristics of this intense urban battle quite well.

- 9 “Ambush Alley” by Tim Pritchard, Presidio Press, 2006 (ISBN 0-891-41881-4)

SUBJECT: *High intensity urban fighting, 1 day action*

This book describes the efforts of a U.S. Marine battalion to capture two important bridges in the Iraqi town of Nasiriyah in March 2003, in order to open a route towards Baghdad. Although the actions are concentrated along a broad straight road through the city, they demonstrate a number of characteristics so typical for urban operations.

Most striking are the consequences of poor situational awareness, amongst others caused by inadequate information about the city (causing a whole company and part of the battalion staff to literally get stuck in a side street), failing radio communications (partly due to physical shielding of the signals by

buildings and partly due to overloading of the radio nets), inaccurate intelligence on the opponents and the fog of war of high intensity close quarter battle. The intended battalion led operation degenerated into company and smaller unit actions, relying on personal initiative. Sadly, this also resulted in a severe friendly fire incident. The combination of infantry, tanks and superior firepower and marksmanship is what finally made the Marines achieve their objectives.

- 10 “Thunder Run” by David Zucchini. Grove press, 2004. (ISBN 0-802-14179-X)  
SUBJECT: *High intensity urban fighting, major battles*  
This book describes the American military's lightning capture of Baghdad in April 2003 by the 2nd Brigade of the 3rd Infantry Division. The Spartan Brigade's mission was to slice through Baghdad to the heart of the Hussein regime in order to break the Iraqi army and the Iraqi people's will to fight. Conventional wisdom held that it was unwise to send armoured forces into urban areas and that it was unwise to fight in cities at all. However, American planners were convinced that an armoured force could smash through Baghdad's defences without getting bogged down in house-to-house fighting. More important, though, the mission was designed to win the information war in Iraq. The presence of American tanks in Baghdad would give the lie to propaganda that said Iraqi troops were winning the war. Not everything went right for the brigade during its two assaults on Baghdad. The Iraqis' low-tech weapons pounded the Americans' high-tech tanks and Bradley armoured vehicles on both missions and exacted a heavy price from support vehicles brought up to refuel and rearm the Spartan Brigade. Iraqi fighters also came close to severing the brigade's line of communication at highway interchanges. The author was an embedded journalist during the fight and his narrative focuses on the captains, lieutenants and sergeants who led the fight.
- 11 “The Caucasus conflict and Russian security: the Russian armed forces confront Chechnya III. The battle for Grozny, 1-26 January 1995” by Timothy Thomas. Journal of Slavic Military Studies Vol. 10, No. 1 (March 1997), pp. 50-108  
SUBJECT: *High intensity urban fighting, high level lessons learned*  
This article provides a global overview of the battle for the city of Grozny, Chechnya, which lasted about a month. It does not focus so much on the tactical issues, but, making use of mainly Russian sources, a number of lessons learned are provided. They cover issues like the need for co-ordination among troops at several levels, proper preparation and training, especially in urban terrain, logistic supply, adequate intelligence on the opponent, political knowledge of the use of military force, and the role of the media. Regarding the last point, the Russians did not cover the operation, so one-sided reports negatively influenced the Russian home front.

## C A Historic Perspective to Urban Operations<sup>13</sup>

### C.1 Introduction: Reasons to Fight in a City

Just like in modern times, in ancient times cities were often the centre of leadership, economics, and culture, and thus could represent a strategic centre of gravity, destroying the enemy's morale, his ability to sustain a war, and his capability to govern. Additionally, they often were the location of an essential operational consideration such as a dominating geographical location, the presence of an enemy force, or an important logistics base. Finally, from a defensive point of view, cities offered important asymmetric advantages in terms of cover and concealment that could offset the advantages of attacking forces.

Bypassing the urban area was a viable technique; however, it had disadvantages. It required that the attacker tolerates the urban garrison in his rear and that he maintain sufficient forces to contain the threat of forays by the city garrison. Another effect of bypassing large important cities was that it often extended the political viability of the opposition and the duration of the campaign, thus jeopardising the achievement of quick and decisive victory.

### C.2 Weapons, Equipment and Tactics

Fighting for and in cities caused armies to develop unique weapons, equipment, and tactics to ensure success.

Until the twentieth century, man-made fortresses and defensive works were integral to most important urban areas. Walls were the primary means of city protection, but cities also used other obstacles to prevent the attacker from gaining access to the walls. Defensive forces equipped themselves with caltrops, wire, and sharpened stakes pounded into the ground as means to impede the advance of the attacker. These were primarily effective against cavalry and wheeled transportation. Attackers often used bundles of branches, or fascines, to fill ditches and cover wet ground to facilitate the forward movement of men and equipment. Another important piece of equipment was the gabion, a large wicker basket filled with dirt. They were used by the thousands by both attackers and defenders to provide cover and rapidly prepare defensive positions. Sandbags were also invented as a tool of urban sieges and they were used in a similar manner as gabions.

The invention of artillery - one of the most important weapon advances in military history - was a direct response to urban fortification. Artillery was initially designed specifically to deal with the walls of medieval castles and walled cities. It was so effective that it quickly caused the demise of the castle and resulted in drastic changes in the design of fortified cities. Another important development was the hand grenade, which was used by both the offense and the defence.

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<sup>13</sup> This section is largely based on Chapter 1 'UO through the ages' written by Lieutenant Colonel Lou DiMarco, U.S. Army, in: Robertson, W.G. (2003). *Block by Block: The Challenges of Urban Operations*. U.S. Army Command and General Staff College Press, Fort Leavenworth, Kansas.

Small arms technology radically changed infantry tactics. In an urban area, these developments had the effect of turning individual buildings manned by small groups of soldiers into miniature fortresses. Groups of buildings became mutually supporting defensive networks. These man-made defensive networks were much less homogenous than the city wall and hence a much more difficult artillery target. Additionally, the lethality of infantry meant that the integrity of the urban defence was not broken by a break of the walls. Defenders now had the capability of defending effectively throughout the depth of the urban environment—a technique impossible when infantry tactics relied on massed close-knit formations to achieve effective firepower.

Before cannon were available to breach walls, armies had to scale them. This was known as attack by escalade, and it could be accomplished only with great difficulty using scaling ladders or siege towers. Another tactic important to city fighting was mining and countermining. Bombardment was another tactical option available to the attacker. The most important, common, complex and successful tactic was the formal siege.

Special “grenadier” troops were initially organised to handle the dangerous hand grenade. Very important were engineers, to advise a commander how to defend or attack a city. Others were sappers (digging trenches) and miners (digging tunnels).

### **C.3 Required Resources**

Urban operations have traditionally required more logistic support than conventional operations. Munitions were used in prodigious amounts in the conduct of urban siege operations, and the supply of artillery munitions in particular was a major concern. A final resource that proved essential for successful urban operations was the morale and will of soldiers and leaders. Urban operations, whether attacking or defending, were physically exhausting and mentally stressful—even more so than regular operations. This was largely a function of the extended duration of the operation, often primitive living conditions, the challenges of overcoming man-made obstacles and fortifications, and the intensity of combat once joined. Urban operations thus required soldiers who were mentally and physically tough, skilled, and motivated to succeed.

### **C.4 The Presence of Civilians**

Civilians have always been present on the urban battlefield, and both defending and attacking commanders had to plan for dealing with the urban population. Ancient and relatively unsophisticated armies attacking into urban areas often dealt with the civil population by massacre or slavery. As armies and civilisations became more sophisticated, the advantages of taxes, resources, and commerce inherent in the urban population became apparent. Additionally, as religious influences grew, moral considerations also influenced behaviour. Mitigating damage to the urban population was not an easy task because of the close proximity of civilians to the military operation. It was often made more difficult because the population was frequently openly hostile to the attacking force.

## **C.5 Modern Times**

Modern urban operations, like their predecessors, require excessive troops, time, and supplies to be successful. Soldiers and leaders committed to urban combat continue to require inordinately high morale, steadfast will, and patience to endure the stress and gruelling physical conditions of the urban environment.

The techniques of urban combat may have changed significantly, but many of the principles remain constant. Modern tactical urban combat still devolves into suppression, breaching, and assaulting fortified positions. Ironically, many cities retain elements of classic fortifications, and these can still affect modern military operations.

Modern forces executing urban operations require special weapons and equipment designed to be optimised in the urban environment. Specialised tactics and troops also continue to have a role against enemies in the urban environment. Modern commanders can benefit from employing specialised troops to act as advisers and to execute specific unique missions in the urban environment. The modern equivalent of grenadiers, sappers, and miners may be civil affairs specialists, snipers, and special operating forces. The escalate of the twenty-first century may use helicopters instead of scaling ladders, but the principles remain the same.



## D NATO Programs related to Urban Operations

### D.1 Overview of RTO Panels

The Research and Technology Organisation (RTO) is the single focus in NATO for Defence Research and Technology activities (see Figure 25). Its mission is to conduct and promote co-operative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective co-ordination with other NATO bodies involved in R&T activities.

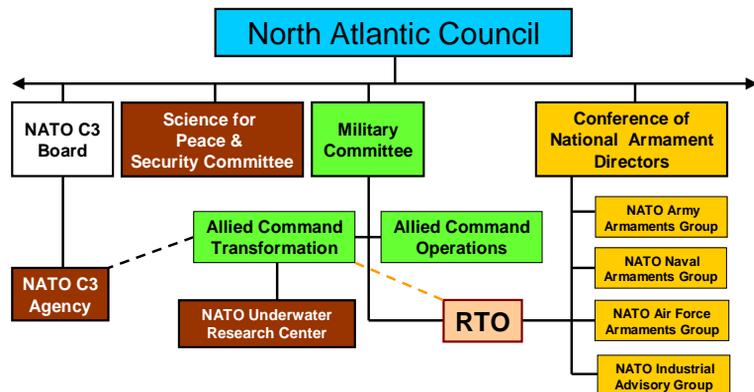


Figure 25 The NATO R&T/D Community.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also co-ordinates RTO's co-operation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of co-operation.

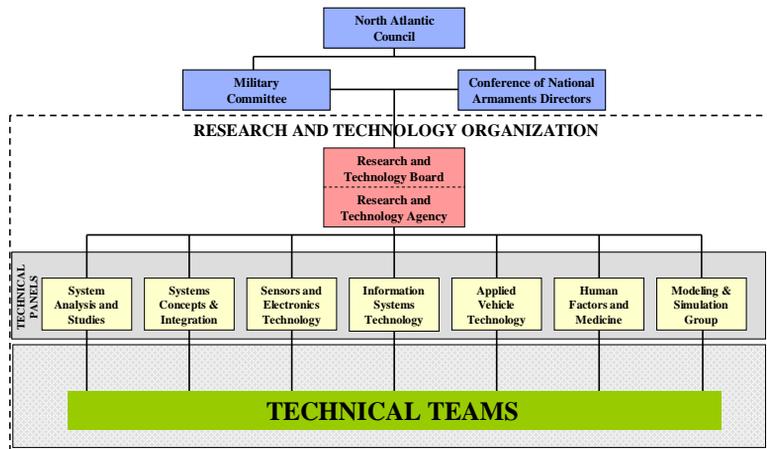


Figure 26 NATO RTO Structure.

The total spectrum of R&T activities is covered by the following 7 bodies (see Figure 26):

- Applied Vehicle Technology (AVT) Panel;
- Human Factors and Medicine (HFM) Panel;
- Information Systems Technology (IST) Panel;
- NATO Modelling and Simulation (NMSG) Group;
- Studies, Analysis and Simulation (SAS) Panel;
- Systems Concepts and Integration (SCI) Panel;
- Sensors and Electronics Technology (SET) Panel.

These bodies are made up of national representatives as well as generally recognised ‘world class’ scientists. They also provide a communication link to military users and other NATO bodies. RTO’s scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier co-operation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

## D.2 Workgroup SAS-030 Urban Operations in the Year 2020

### Workgroup data

Begin: 01-06-2000

End: 01-12-2001

### Objectives

The purpose of the Study Group RTO Technical Report Land Operations in the Year 2020 has been to develop a conceptual framework for operations in an urban area to address operational level needs and that will support the operational commander in future NATO urban operations in 2020.

### Results

The conceptual framework for planning and conducting urban operations is constructed from the interrelated Understand, Shape, Engage, Consolidate and Transition (USECT) activities. Although not all elements of USECT necessarily need to occur in an urban operation, the (final) objective for a military commander is to transfer control of the urban area to the local authorities or an international organisation, which is the transition from an unstable situation to a self-sustainable stable situation. Therefore the planning and execution of urban operations should always be based with this Transition activity in mind.

USECT moves the focus from the traditionally predominant Engagement element to the Understand element. Understanding the urban battle space will lead to effective and precise targeting and influencing the situation and achievement of the desired end state.

The interrelated military and non-military activities described in the USECT framework form the basis to achieve objectives with fewer casualties, less collateral damage to urban systems, and reduced harm to the non-combatant population. This general approach will enable forces to function more effectively in the uncertain operations of an urban area.

#### *1 Understand (U)*

'Understand' denotes the necessity to collect and interpret information on the factors of influence in the urban battlefield. The need to 'understand' will continue throughout any operation. It is critical to creating and maintaining an advantage in the tempo of any operation. Intelligence Preparation of the Battlespace (IPB) remains a valid tool but it is more complicated by the human factors present.

While armed forces will have a range of technical equipments, weapons and other platforms to assist the acquisition of intelligence and information, the overriding factor in the conduct of operations in urban areas is the population. Forces need to understand the political, economic, social and cultural aspects of an urban area. This includes physical terrain, buildings, cultural centres and critical infrastructure such as utilities and hospitals.

## 2 *Shape (S)*

The term ‘Shaping’ includes all actions taken to set favourable conditions for the subsequent Engagement, Consolidation and Transition activities.

Shaping has unique aspects in an urban environment because of the presence of civilians, the presence of critical infrastructure and the large number of troops necessary if shaping is not done. Shaping includes the strategic movement of forces into theatre and their positioning for operations, and also actions to maximise mobility, to protect the force and to establish air and maritime superiority. At the same time, establishing refugee camps or sanctuaries for non-combatants, providing safe passage for them, and arranging emergency services, which as shaping activities at the highest level may be the early focus of tactical military activity. Enabling capabilities, such as combat service support, are also part of shaping operations.

Shaping also includes activities to isolate portions of the battle space. The physical isolation of a large urban area will require committing personnel for the identification and control of the movement of personnel, equipment and non-combatants. Because urban systems require particular needs (e.g. energy and information) to function, a complete and indiscriminate isolation of (parts of) the urban area will not be possible and/or acceptable. Activities to isolate opponents from their support (financial, political, information and population) can also achieve desired effects.

Shaping will involve activities to isolate portions of the battle space. It may include the use of lethal and non-lethal means (i.e. Information Operations) and means to achieve effects. Isolation has an external aspect (i.e. cutting-off outside support), and an internal aspect (i.e. cutting-off mutual support). Isolating an opponent may also preclude his withdrawal, thus the ability to continue or reinforce the fight elsewhere. Activities to isolate opponents from their support (financial, political, information, and population) can also achieve desired effects.

The physical isolation of a large urban area will require committing personnel for the identification and control of the movement of personnel, equipment and non-combatants. With the latest technological developments, i.e. cell phones and internet, a total isolation will be almost impossible. The military commander might purposefully decide not to isolate the opponent in certain areas and turn this to his advantage. Because urban systems will require goods, energy and information to function, a complete and indiscriminate isolation of (parts of) the urban area will not be possible and/or acceptable.

At the operational level, shaping a campaign often requires the seizure, disruption, control or destruction of critical nodes (e.g. communication centres) which have been previously identified during the IPB process in line with the requirements of International and local National Law.

## 3 *Engage (E)*

The shaping activities set the conditions for the engagement of adversarial forces. For the commander, engagement activities are those that directly address decisive points on the line of operations, aimed at the adversary’s centre of gravity.

These activities will be those actions taken by the commander against a hostile force, a political situation, or natural or humanitarian predicament that will most directly affect his ability to accomplish his mission. At this point, the commander

brings all available capabilities to bear in order to accomplish operational objectives. This is not the application of force in a void. He has to consider the potential cooperation or interaction with governmental and non-governmental organisations, international and local authorities, and security forces.

#### *4 Consolidate (C)*

The focus of Consolidation is on protecting what has been gained and retaining the initiative to (continue to) disorganise the adversary. This is particularly important in the urban environment which suits an aggressive counter-attacking force. Consolidation thus requires an ongoing process of organising and strengthening an advantage (spatial, psychological, and informational) over the adversary. Consolidation also requires activities geared at mopping up adversarial forces that have been bypassed and processing prisoners. Civil affairs, public affairs and psychological operations will continue to be critical in this phase of the operation. During this stage of operations, the opponent, faced with conventional defeat, may resort to terrorist activities to frustrate consolidation and transition. The new situation could lead the Force into an engagement phase of different nature which demonstrates the need for flexibility that military forces must have to conduct operations in an urban environment. A military commander will need to consider this possibility and make contingencies for this in the early stages of planning. Major challenges of a 3-Block War will be associated with infrastructure collapse, the need for humanitarian assistance, movement of non-combatants and limited engagement actions. Although it is not considered a military responsibility, the military commander will likely be involved in reconstruction of local infrastructure with military assets and knowledge available. It requires the commander to actively seek, establish and expand the use of liaison and co-operation with local authorities and other agencies in order to bring to bear all available capabilities.

#### *5 Transition (T)*

The strategic objective for a military commander in urban areas is to transfer control of the urban area to the local civilian authorities or perhaps an international organisation. At this stage military forces would be gradually re-deployed while the work of the civil administration continues.

The resettlement of displaced civilians and the reconstitution of national military forces if appropriate are central to a transition process. Maintaining the law is essential to these tasks. To ensure safety and security, military forces may have to conduct training with indigenous or multinational law enforcement organisations. The rate of military redeployment will depend on how quickly those organisations establish an effective presence.

Until the local authorities have established a safe and secure environment, law enforcement units, a judicial presence, and a recognised and functioning governmental office with oversight of civilian reconstruction efforts, foreign (non-)military capabilities will still be required.

#### **Reference**

NATO Report SAS-030 *Urban Operations in the Year 2020*, 24 May 2002.

### D.3 Workgroup AVT-120 (RWS) Urban Dispersion Modelling

#### Workgroup data

Begin: 01-01-2004

End: 31-12-2006

#### Objective(s)

The purpose was to gather experts of the NATO countries interested in Defence Against Terrorism (DAT) and Urban Dispersion Modelling (UDM) to provide the current status on state of the art on this topic and to identify important topics to be more deeply investigated. Through workshops and symposia the outcomes will help guide AVT toward the most fruitful areas for an AVT Task Group(s) to work on.

#### Results

The weaknesses in current UDM approaches as well as future research fields were addressed. It is especially recommended to deal with methods to reduce the complex urban environment datasets to allow for rapid UDM and to develop a protocol or procedure for the validation of models.

#### Reference

NATO Report RTO-MP-AVT-120 *Urban Dispersion Modelling*, July 2005

### D.4 Workgroup IST-046 (TG) Command Centre Challenges for Urban Operations

#### Workgroup data

Begin: 01-01-2004

End: 31-12-2006

#### Objective(s)

This activity was initiated after the SAS-030 Urban Seminar War game indicated that the availability of information and knowledge through a fully integrated Command Centre system is an essential resource, and a key asset toward an Understand capability. The aim of this activity was to examine how C2 processes in urban operations can be improved by emerging Information Technologies (IT).

The specific objectives of this study were the following:

- Establish all information requirements for battalion-level and below;
- Identify which information requirements cannot be supported with the current doctrine, organisation, equipment, personnel and training;
- Make an inventory of the technologies that might be relevant for the shortcomings;
- Develop conceptual solutions as a result of the preceding activities;
- Organise a workshop/specialist meeting to discuss the subject of C2 in urban operations;
- Develop a concept demonstrator considering one relevant shortcoming and one potential IT solution.

#### Results

The study group members first identified all information requirements during the planning and conducting of an operation in urban terrain, at the battalion, company and platoon level. More specifically, they created a common list of information

requirements based on a scenario in which the participating nations have defined the basic assumptions for several topics related to the doctrine, tasks and C2 processes. This scenario was prepared and adapted from Urban Challenge, originally created by the Directorate of Land Strategic Concepts of Canada. Three vignettes were designed and exploited to illustrate the range and complexity of urban operations: a crisis response operation, a defensive operation and an offensive operation. A 5-days war gaming exercise was conducted with military experts from Canada, France and the Netherlands. A collaborative working environment was used to enable each participant to provide ideas and concepts in coordination with the other members of the team. From the war gaming exercise, about 400 requirements were identified and grouped into categories. For each of the requirements, the study group assessed how critical the information is, what is the minimal quality required, how dependant on information quality is operational performance and “how bad it is” nowadays. Depending on the assessment results, a prioritised list was established. Fifteen information requirements were considered as critical. In particular the critical information requirement ‘Blue Force Tracking’ has been detailed and considered for the development of a concept solution. The critical information requirements, in a priority order, are:

#### Most critical

- 1 Blue Force Tracking;
- 2 Mapping of the city;
- 3 Red Force Tracking;
- 4 Dynamic route planning (vehicles, soldiers);
- 5 Real-time surveillance of objectives, of routes of approach;
- 6 Communications (coverage map, testing);
- 7 Culture and social visualisation (symbolic non-physical information);
- 8 Buildings layouts for objectives;
- 9 Foe discrimination;
- 10 Prediction of adversary actions.

#### Less critical

- 1 Identification of sites which may be centres of gravity;
- 2 Request for support;
- 3 Performance analysis of capability (sight, weapon systems, etc.);
- 4 Identification of people and equipment in real-time;
- 5 Graphic and verbal situation reports.

The study group made an inventory of the current and future C2 information technology developments that might be relevant for the identified shortcomings. The survey included existing systems, prototypes, as well as studies or ideas on more prospective solutions. To illustrate the major results of IST activity, a movie clip was produced in conjunction with the written report.

#### Reference

NATO Report IST-046 *Command and Control Challenges in Urban Operations*, January 2008

## D.5 Workgroup IST-067 (TG) Tactical Communications in Urban Operations

### Workgroup data

Begin: 01-01-2006

End: 01-12-2008

### Objective(s)

- To determine urban military communications operational requirements, utilising NATO subject matter experts and studies such as Land Operations 2020, Urban Operations 2020 (SAS-30), and various National studies;
- To define technical challenges in meeting these urban operations communications requirements;
- Determine ability to meet these challenges with current communications systems and identify likely shortcomings;
- To identify, assess, and report on collaborative trials and/or assessment activities that will lead to a greater understanding of the true communication capabilities, complementarities and limitations associated with military operations in urban environments;
- Determine communication technology development requirements for current, near-term (2010), and far-term (2020) solutions.

### Reference

IST-067, *Technical Activity Proposal*, 2006

## D.6 Workgroup MSG-032 Urban Combat Advanced Training Technology (UCATT)

### Workgroup data

Begin: 01-06-2003

End: 31-12-2007

### Objective(s)

- Exchange and assess information on MOUT facilities and training/simulation systems. Military feedback as to the effectiveness of current solutions will be obtained with a view toward establishing best practice;
- Identify a suitable architecture and a standard set of interfaces that enable interoperability of MOUT Training components that does not inhibit future research and enhancements;
- Identify limitations and constraints on MOUT development with a view of toward identifying areas for future research;
- Provide a report detailing Best Practices for MOUT Training Facilities.

### Results

A NATO report is drafted, providing NATO with a scalable functional architecture based on USE CASES agreed by the military user community in NATO and partner nations. A web-based register of FIBUA/MOUT sites has been successfully developed and interoperability issues are being addressed. Work on identifying best practice however has been limited. Indications suggest there is still more to be done particularly in developing the standards and more needs to be done to address the other two simulation domains of constructive and virtual simulation in support to

urban training. All three domains, Live, Virtual and Constructive (LVC) will potentially need to be integrated.

#### **Reference**

MSG-032, *Technical Activity Proposal*, 2003  
NATO Report to be released

### **D.7 Workgroup MSG-063 Urban Combat Advanced Training Technology 2 (UCATT 2)**

#### **Workgroup data**

Begin: 01-01-2008

End: 31-12-2010

#### **Objective(s)**

Following the work and recommendations of UCATT (1), the objectives of this working group are:

- Exchange and assess information on MOUT (live/constructive/virtual) installations and training/simulation systems. Military feedback as to the effectiveness of current solutions will be obtained with a view toward establishing best practice;
- Identify a suitable architecture and a standard set of interfaces that enable interoperability of MOUT Training components that does not inhibit future research and enhancements;
- Identify limitations and constraints on MOUT development with a view toward identifying areas for future research;
- Validate the applicability of JC3IEDM as the C4I standard for interfacing to the simulation environment;
- Provide a standard for laser and data communication, audio & visual effects;
- Organise an interoperability demonstration to prove the standards;
- Define a generic set of data for lethality and vulnerability to enable interoperability of nations' simulation systems.

#### **Reference**

MSG-063, *Technical Activity Proposal*, 2008

### **D.8 Workgroup SCI-157 Urban Camouflage for the Individual Soldier System**

#### **Workgroup data**

Begin: 01-01-2005

End: 15-12-2008

#### **Objective(s)**

There is serious concern about protecting the infantry soldier during urban combat situations. The capability to provide stationary vehicles and weapon systems with multi spectral camouflage has been demonstrated and service implementations are underway. The same cannot be said for the soldier involved in dismounted close combat where movement and physiological issues impose significant constraints on

the options available. To date acceptable, successful multi-spectral signature control for the infantryman is not available.

The Group will investigate the multi-spectral signature problem of fighting in urban environments. What are the relevant parameters? Can camouflage provide a solution? The correlation of the significant signature parameters and their constraints will be determined.

The task group will conduct basic research into the feasibility of developing multispectral camouflage techniques, materials and systems that provide increased levels of survivability for soldiers conducting operations in urban environments.

#### **Reference**

SCI-157, *Technical Activity Proposal*, 2005

### **D.9 Workgroup SCI-184 Military Utility of Mobile Camouflage against Advanced Sensors**

#### **Workgroup data**

Begin: 01-01-2007

End: 01-12-2009

#### **Objective(s)**

The objective of this Joint SET/SCI activity is to demonstrate the military utility of multi-spectral signature management technologies (excluding stationary nets) for ground vehicles/mobile equipment. A cross-national analysis of the CDT data to include a focused data collection necessary to fill gaps will be conducted to address fielded and advanced sensors across multiple wavebands.

#### **Reference**

SCI-184, *Technical Activity Proposal*, 2006

### **D.10 Workgroup SET-076 Sensor Requirements for Urban Operations**

#### **Workgroup data**

Begin: 01-06-2003

End: 31-12-2007

#### **Objective(s)**

This activity was initiated to investigate sensors requirements in urban operations. Based on previous studies, which looked at identifying the requirements in terms of information, capabilities and technologies and at current shortcomings in meeting these requirements when dealing with urban operations, SET-076 addresses more specifically sensor requirements and the shortcomings and limitations of existing sensor technologies.

SET-076 aims to identify the fundamental limitations associated with various sensor types when deployed in urban areas and to propose future research topics and collaborative assessment or demonstration activities. The specific objectives of this study are the following:

- Define the sensing problems posed by operations in urban environments;

- Identify likely shortcomings in current sensing capability, and predict likely sensor technology developments in the near future;
- Recommend research areas to address the sensing requirements identified by studies such as Land Operations 2020, Urban Operations 2020 (SAS-030), and various other national studies;
- Provide guidance on overcoming the limitations of sensors that have a potential to be used in urban/complex terrain;
- Propose collaborative trials and/or assessment activities that will lead to a greater understanding of the true sensing capabilities, complementarities and limitations in urban operations.

### Results

First, the team decided to group the capabilities presented by IST-046 into categories. Thus, from IST-046 results, various critical information requirements were consolidated into categories that better reflect the sensors requirements (Table 8). Then, the study group examined technologies potentially able to provide the needed capabilities. A worksheet was prepared to be filled in for each potential technology concept. The worksheet includes the list of information requirements that are addressed by the technology, a drawing picture, a short description, performance, size, cost, maturity, concept of operation and limitations. Finally, the sensors technologies will be evaluated and ranked.

Table 8 Capabilities Categories Defined by SET-076.

Category	Description
Other Study	Not a sensor requirement. This need will have to be addressed elsewhere.
Mapping Facilities	Find, geo-locate, and identify facilities.
Mapping Utilities	Find, geo-locate, and identify utilities
Mapping Routes	Find and geo-locate roads, subway systems, underground motorways, etc.
Identification	Identify personnel, vehicles, and equipment – Is it a T72 or an M1?
Classification	State object class – Is it a tank or a truck? Is it a tree or a person?
Detection	Find “stuff” on the battlefield. This could be anything from military forces to civilian assemblies.
Tracking	Know where an item has moved to. Keep track of it.

In September 2006 a 3-day workshop was held which was identified as SET-090. It was aimed at identifying the most promising sensor technology areas for urban operations, as well as the urban operations sensor requirements that are the least addressed. This workshop had a strong relation with SET-076.

### Reference

SET-076, *Technical Activity Proposal*, 2003

**D.11 Workgroup SET-100 Sensing Through the Wall Technologies****Workgroup data**

Begin: 01-06-2005

End: 01-12-2008

**Objective(s)**

To produce state of the art technology assessment and trade studies for through wall imaging, identify shortfalls, and conduct cooperative work for system improvement.

Major system enhancements should address the following:

- provide high resolution 3 D imaging of objects and humans behind walls;
- detect and identify motion and breathing behind different types of walls;
- devise potential solutions to resolve wall ambiguities;
- maintain high system performance at various stand-off distances;
- design systems suitable for portable, hand held and platform based applications;
- detect concealed weapons and explosives;
- provide anti-jamming and interference resistant capabilities –EMI/EMC robustness;
- optimise system performance in terms of high probability of detection and low probability of false alarms.

**Reference**

SET-100, *Technical Activity Proposal*, 2005

**D.12 Workgroup SET-114 Urban, Indoor and Subterranean Navigation Sensors and Systems****Workgroup data**

Begin: 15-4-2006

End: 01-12-2009

**Objective(s)**

The group will assess and forecast advances in the field of navigation sensors (e.g. position, velocity, orientation, and time sensors) applied to operations in urban, indoor, subterranean, and other Global Navigation Satellite System (GNSS) degraded environments for the NATO community. Advances in low cost, very small micro-electromechanical sensors are expected to continue in the foreseeable future. In addition improvements in GNSS receivers and space systems, and new and innovative positioning systems such as networked navigation, ultra-wideband, map making/matching systems and various distance and velocity measurement devices, etc., continue to evolve. The group will identify recent advances as well as new applications and potential benefits to military operations and operational concepts. The group will also hold a symposium on these topics and possibly conduct a lecture series as well.

**Reference**

SET-114, *Technical Activity Proposal*, 2006

### **D.13 Workgroup SET-118 3D Modelling for Urban Terrain**

#### **Workgroup data**

Begin: 01-06-2007

End: 01-12-2010

#### **Objective(s)**

The objectives of the SET-118 are based on 3D-modeling of urban structures and are focused on the following research areas: data exploitation techniques; data preparation and fusion; extraction of 2D and 3D geospatial data (information) for urban terrain; automatic 3D model reconstruction.

The sensor technologies studied in SET-118 include but are not necessarily limited to LIDAR, EO, and SAR. The research work will be carried out with using primarily datasets from high resolution LIDAR-sensors (e.g. Toposys), image sequences from high resolution VIS sensors, and from multiaspect InSAR.

#### **Reference**

SET-118, *Technical Activity Proposal*, 2007

### **D.14 NATO Urban Operations Working Group Website**

#### **Objective(s)**

This website is a product of the Urban Combat Advanced Training Technology Working Group (UCATT) and the NATO Urban Operations Working Group.

This website is produced to help the user of NATO and Partnership for Peace (PfP) countries help to find information of FIBUA/MOUT installations.

In addition to an overview of different FIBUA/MOUT training sites all over the world the site provides the user with information about tactics and training in the participating countries and information about new technology for training in urban areas. The provided information is NATO UNCLASSIFIED.

#### **Reference**

[www.fibuamoutside.info](http://www.fibuamoutside.info)



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