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Military operations in urban areas

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Abstract

Armies have traditionally avoided cities and siege operations. Fighting for and in cities is costly, slow, and often inconclusive. But sometimes they are unavoidable, either because they are located on main road or rail junctions or because of their value as political and/or economic prizes. Urban expansion in both north and south has made cities today the main theatres of military and humanitarian operations.

Armies' structures, equipment, and doctrines are undergoing a process of adaptation. Manoeuvre has given way to fire power and protection for the troops as the decisive elements of military power. While heavy fire power does considerable damage and causes civilians to flee their homes, operations using protection techniques are only suitable for stabilization. Moreover, their success depends essentially on the willingness of troops to make sacrifices, and on support from the public.

Throughout history, armies have been reluctant to fight in cities and conduct siege operations. Fighting in such conditions is generally devastating and costly. Struggles of attrition frequently ensue, and the outcome tends to be less than conclusive. Centralized command and technical superiority face serious limitations.

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Yet the proliferation of dense urban sprawl, alongside the infrastructure and way of life that go with it, is forcing armies to return to the drawing board. In 1900, 29% of the world's population lived in cities. By 1950, the proportion had reached 49%, according to the United Nations' (UN) conservative estimates.[1] In 2010, 75% of the world's inhabitants live in urban areas.[2] It is therefore no longer realistic for armed forces to avoid cities. Because of the complexity of the urban environment, fighting in cities calls for adaptations in military doctrine, structures, training, and equipment.

In this article, we shall begin by focusing on the city, its importance and characteristics as a military environment, and the concomitant risks. We shall then go on to examine the military consequences, both technical and tactical, of fighting in and around cities. Finally, we shall try to distil some conclusions for military combat, stabilization, and peace-keeping operations today.

The city from a military viewpoint

Cities have often played key roles in armed conflicts, but more so in political than military terms. Starting in the late fifteenth century with the end of the Hundred Years' War, siege warfare gave way to clashes between armies in open country. Field battles were generally fought several kilometres from the cities from which they took their names. During World War I, the front and most of the heavy fighting were on rough ground in rural areas. Most inhabited areas affected by fighting were evacuated or declared open cities.[3]

World War II marked a turning point in terms of urban combat. At the start of the conflict, armies tried to move quickly, using motorized columns. Although some cities (for example Warsaw, Amsterdam, and Sedan) were bombed, field armies generally avoided built-up areas, so as not to get bogged down. Unfortunately, however, this phase was short-lived.

The Germans had the advantage in terms of tanks and tactical aviation, and the Allies soon realized that they would not be able to hold their ground in open country. In addition, from 3 July 1941 onwards, the Soviets implemented a scorched-earth strategy. While it is true that major cities were targets of symbolic value, both the Germans and the Allies carried out strategic bombing raids on cities mainly because of the high concentrations of industrial capacity they contained. Finally, as the armies on both sides found themselves increasingly dependent on motor vehicles, avoiding cities – with their major road and rail junctions – became more and more difficult, particularly when it came to supplying forward units.

1 UN, Department of Economic and Social Affairs, Population Division, *World Urbanization Prospects: The 2005 Revision*, available at: http://www.un.org/esa/population/publications/WUP2005/2005wup.htm (last visited 14 March 2010).
2 Antonin Tisseron, *Guerres urbaines: nouveaux métiers, nouveaux soldats*, Economica, Paris, 2007, p. 3.
3 Daniel Postec, 'Vers une nouvelle approche doctrinale des actions dans les zones urbanisées', in *Doctrine*, No. 3, June 2004.

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From 1942 onwards, cities in the East and subsequently also in the West gradually became fully fledged targets and the theatres of decisive battles: for example Stalingrad, Kharkov, Caen, Arnhem, Aachen, Budapest, and Berlin.

During the cold war years, the challenge of co-ordinating operations in a maze of streets – compounded by heavy casualties, massive destruction, and the appalling toll on the inhabitants – led to a tacit consensus that fighting in cities should be avoided. Urban communication nodes and decision-making centres were, in any case, largely considered as possible targets of atomic weapons. As a result, troops tended to be stationed in the countryside.

The majority of clashes in urban areas in the second half of the twentieth century were associated with stabilization operations (Suez, Northern Ireland) or restoring and upholding law and order (Budapest, Prague, Tiananmen), rather than with high-intensity battles. But from the 1980s onwards, rapid urbanization in developing countries changed this state of affairs. On several occasions, Saigon was the theatre of bloody armed engagements. United States (US) operations in Beirut (1983), Grenada (Urgent Fury, 1983), Panama (Just Cause, 1989), and Mogadishu (Restore Hope, 1993) attest to the growing need to prepare for military operations in urban areas. The operations in southern Lebanon (1982, 2006), Gaza (2009), the Balkans (1994–1999), Chechnya (1994–1996 and 1999–2000), and Iraq (since 2003) show that, in both north and south, it is no longer possible to shun cities.

Urban areas

In military terms, a city can be one or more of the following:

- a target for political, symbolic, propaganda, economic, or logistical reasons;
- a passage that cannot be avoided on the way to somewhere else;
- a communication node or a road/rail junction.

In principle, a city is a geographical entity, as it is generally built on a particular spot chosen for a crossroads, for access to water or other resources, or for a dominant or defensive location. However, over the past two centuries, cities have tended to develop concentrically, beyond their original boundaries. Since the 1970s, urban sprawl has created a network of increasingly interconnected built-up areas. The proliferation of key centres of attraction (stations, airports, government and business districts, etc.) has caused cities to develop around a number of centres.

A city may give the impression of a single mass, but in fact it can be broken down into different geographical areas, each with its own characteristics. These areas are divided into three types:

1. The old inner city, which is often built on one or more hills (with elevations of between 100 and 200 metres) overlooking the outlying districts. The streets are often narrow and built of stone or brick, and visibility is limited to short distances (50 to 300 metres). For historical and practical reasons, few city

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centres have a diameter larger than seven kilometres. Population density is generally higher than 150 inhabitants per square kilometre.

2. The periphery – beyond the old fortifications, which were frequently pulled down in the mid-nineteenth century and transformed into boulevards – generally contains high buildings (three to six storeys), built in stone or brick after the 1880s and around steel or concrete frames from the 1920s onwards. Residential and business districts are generally interspersed with large wooded parks occupying a good few acres. This part of a city often contains infrastructure and other features of urban life that have been 'overtaken' by the expanding city: passenger or goods stations, airports, markets, commercial and industrial centres, firms and factories, and cemeteries. Major utilities, communication and transport facilities such as avenues, parking lots, railways, telephone exchanges, and power stations tend to be concentrated here. The periphery is frequently separated from the outermost band of urban development by motorways or outer ring roads, which sometimes pass under or above ground to save space and avoid creating obstructions. This band is characterized by observation and firing distances of between a few dozen metres and several kilometres. It is often overlooked by the old town centre, which is generally on higher ground, and also by surrounding hills, which generally limit its expansion to a radius of between seven and fifteen kilometres. Population density is generally higher than 100 inhabitants per square kilometre.
3. City approaches and suburbs are generally found within a radius of thirty to forty-five kilometres of the centre. This band is generally not circular but spread along both sides of the main road and rail routes that serve commuter flows. These areas tend to be open, but they may engulf older towns and villages. The buildings they contain are usually large and made of steel. Industrial estates and shopping centres, blocks of rented flats, and low-rent housing estates are found here, alongside residential suburbs. Most of these estates cover a number of acres. Large parks and agricultural land are also found in this band. The firing distances are generally greater than 300 metres. Shanty towns and slums, where they exist, are also generally found here. Population density varies from one district to another but on average it is between 50 and 100 inhabitants per square kilometre.

What these features mean for fighting forces

Before embarking on a military operation in an urban area, it is vital to analyse the terrain. In open country or in mountain areas, the main factors to be considered are cover, the relief of the terrain, and lines of communication. In cities, however, other factors may be critical. First of all, the size and surface area of the city will determine the number of troops needed: it is generally estimated that a combat formation of between 1,000 and 1,500 troops can guard or defend a town with

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100,000 inhabitants. An offensive will require a detailed analysis of the terrain, precise intelligence on military positions, and a superiority for the attacker of at least five to one. This number is twice as high as the ratio generally agreed upon for an attack in open country.

Any analysis of the terrain must take into account the three-dimensional geography of the town or city. High buildings can provide posts for observers, fire controllers, and snipers. These objects have to be taken, or at the very least the enemy must be prevented from gaining access to them. The upper floors of buildings can serve as positions for dominating a sector, while basements, cellars, and sewers can provide cover for the troops who control them, enabling them to move and regroup rapidly and effectively.[4] Over several years of intense fighting and systematic destruction operations, the Russian army never succeeded in destroying or entirely clearing the underground passages of the Chechen capital.

The type of construction, too, plays an important role. Buildings in the centre are generally solid and provide effective protection against small arms and shrapnel. A house with thick masonry walls, a basement, and several storeys can be transformed into a genuine fortress in only a few hours by a group of between four and ten men with suitable equipment. It will take five to ten times as many soldiers to get them out.

Recent constructions, however, particularly office buildings, transport sheds, warehouses, and factories built of corrugated iron or prefabricated walls, provide only very limited protection from impacts. Their main asset is the possibility of dissimulation. Generally, troops are advised to use the lower and upper floors, as the middle floors have few advantages and expose the soldiers to too many risks, particularly that of ceilings or walls collapsing.

Although the periphery affords favourable terrain for mechanized forces, historic town centres and inner cities are not compatible with heavy vehicles. The fighting force must therefore constantly adapt its structure. At the very least, soldiers and vehicles move in pairs (France) but, in most armies, personnel form squads of four soldiers each. These squads are organized in platoons of sixteen to twenty soldiers, generally backed up by three to five armoured vehicles. If troops are to be split up and regrouped in response to circumstances, and combined inter-arm groupings are to be set up below platoon level, suitable preparation and training are needed. This will slow down operations and, even once the troops are operational, the question of co-ordination remains.

There are also logistical challenges, as units may consume two or three times the quantity of supplies needed to fight in open country. A typical infantry unit – from a squad to a company – will run out of ammunition in just thirty to sixty minutes of fire fight, and will need to be resupplied or relieved, often under

4 Tanguy Struye de Swielande (ed.), *Les interventions militaires en zones urbaines: paradigmes, stratégies et enjeux*, Bruylant, Brussels, 2008, p. 11; Centre de Doctrine d'Emploi des Forces (CDEF), Division Recherche et Retour d'expérience (DREX), 'Géographie et combat en zone urbaine', in *Cahier de la Recherche Doctrinale*, January 2005; Jean Serveille, 'L'agencement de l'espace terrestre', in *Doctrine*, No. 3, June 2004.

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fire. Troops need large concentrations of fire to keep the enemy at bay. Also, supplies may be lost and it is very difficult to deliver these to the forward units. Estimates range between thirty and fifty tonnes of supplies per infantry battalion per day of combat. This figure will be double in the case of motorized units.

Medical care is particularly challenging in view of the high casualties. Logistics units have to work without the benefit of centralized facilities and also simultaneously need to take the needs of civilians into account.

Finally, the most salient feature of a city is its population. All operations must take that into account. The population may be supportive or hostile, supply intelligence to one or both sides, or even take part in the fighting. Specific rules of engagement/behaviour (ROE/ROB) and guidelines for information dissemination and psychological warfare are required to avoid alienating the populations. Armed forces must take into account the vulnerability and expectations of the civilians at all stages of their planning, communication, intelligence, and logistics operations.[5]

Doctrines

During World War II, lack of experience and political circumstances caused widely varied tactics to emerge for defending or taking urban centres. For the sake of simplicity, we can divide them into two categories: concentric attacks and clean-up operations. An example of the first type is the Battle of Berlin, where the Soviet Marshals Zhukov and Konev frantically raced each other on opposite sides of the river Spree. Zhukov and his army took the north of Berlin while Konev took the south. Attacks were conducted simultaneously throughout the city. But this exceptional situation was only possible because of political necessity and the crushing superiority of the Soviet troops: 2.5 million soldiers, 6,250 tanks, 7,500 aircraft, and 41,600 artillery pieces.[6]

In principle, an attack on a city follows the traditional siege doctrine, which consists of encirclement, establishment of a bridgehead, then systematic clean-up district by district. Pockets of resistance are isolated and eliminated one by one. US doctrine for *Military Operations in Urban Terrain* comprises four phases:

1. Air, ground, and human reconnaissance (scouts, special forces, snipers, human intelligence (HUMINT) agents) are used to map the terrain in detail and in three dimensions, identifying the enemy's military positions, its equipment, and its intentions. The state and opinion of the population are of particular interest. Psychological operations begin at this stage.

5 Sébastien Segarra, 'La logistique', in *Doctrine*, No. 3, June 2004.

6 Earl Ziemke, *The Battle for Berlin: End of the Third Reich*, Macdonald & Co., London, 1969, p. 71; Williamson Murray and Allan Millett, *A War to be Won: Fighting the Second World War*, Harvard University Press, Cambridge, MA, 2000, p. 482.

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2. In urban terrain, the combat area should be encircled and isolated swiftly. Mechanized formations are generally needed because they can move fast and hit hard. Thanks to their mobility and ability to bring large numbers of troops to bear, they can also consolidate peripheral areas already taken if there is a counter-attack from inside or outside. The lack of an impermeable cordon around Grozny in 1995 had disastrous consequences for the Russian army: international combatants joined the defenders, who were able to have contact with the media and receive intelligence from informers and external sources. The defenders were also able to get out of the firing line and even rotate their combatants. Depending on the size of the town or city, this phase may last several days or even weeks. Siege warfare tactics again come into their own. The resulting time is used to test the adversary's defences, to plan in detail, and to organize rehearsals for assault troops. Cordoning off a city allows psychological operations to encourage the population to come out, be checked, and receive relief. Enemy combatants who wish to surrender must be guaranteed an honourable way out. During this phase, operations are carried out to intimidate the adversary and demonstrate force. For example, fighter aircraft or attack helicopters may over-fly the area or limited offensives may be carried out.
3. A combined arms attack, generally along a penetration axis, enables the troops to gain a foothold in the city and establish a bridgehead. The targets may be bridges, junctions, passages, vantage or key points, or political centres. This operation also aims to tie down the adversary's troops and encourage civilians to leave the area by means of corridors set up for the purpose. This is generally the most destructive phase, as it involves heavy combat. Diversionary operations are also necessary, generally in the form of artillery fire, in order to prevent the defender from adapting his plans and concentrating his forces.
4. Finally, combined arms units enter the city and systematically clean up the districts. Their advance is synchronized and 'marked' by smoke bombs or phase lines clearly visible on the ground, to enable the land units operating in close proximity to co-ordinate their actions or to enable fire support to be used. The example of Grozny shows the difficulties of advancing in a pincer movement because of the high risk of friendly fire.[7]

To these four phases, one can add a last stage of disarmament, demobilization, and reintegration (DDR), to use the UN's terminology. At this point, civil–military co-operation, both on the ground and in terms of psychological and law-and-order operations, gradually replaces military combat operations proper.

7 Training and Doctrine Command (TRADOC), Department of the Army, *Field Manual FM90-10, Military Operations on Urbanized Terrain* (*MOUT*), Washington, DC, 1979.

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Lessons learned

In a special issue of the magazine *Raids*, Jean-Louis Promé and Erich Micheletti give accounts of recent conflicts in urban areas: Beirut 1982, Mogadishu 1993, Los Angeles 1992, and Grozny 1995.[8] Further examples are provided by experiences in Iraq, particularly in Baghdad and Fallujah.[9] Without going into detail, we shall attempt here to extract the most significant lessons from these engagements.

Combined arms engagements

It takes time to set up combined arms battlegroups; however, well-organized and timely training can considerably improve their cohesion and their combat value. In the second battle for Grozny, the Russian army rediscovered the merits of this type of combined formation, but it took several days and serious casualties before they were able to constitute consistent and effective units.

Although considerable planning and co-ordination are needed at brigade level, and sizable forces have to be made available at battlegroup level, it is the smaller combat formations – companies, sections, and groups – that see action and take initiatives on the ground. Rotation and debriefing systems must be set up. As the adversary will try to use the weaknesses of each arm or system, each has to provide cover for each other and fight in a co-ordinated way.

Tanks and infantry

Infantry is good at infiltration, but lacks cover. Troops on foot cannot move quickly from attack to defence and have limited autonomy. Tanks, on the other hand, are well protected and have heavy fire power, but they are easy to identify and can be attacked from their blind spots, either from close up (less than ten metres) or from above (more than thirty degrees). Their munitions are generally not suitable for fighting around housing. This has led, traditionally, to the use of artillery guns and howitzers at close range and in direct fire, to destroy reinforced positions or prevent the enemy getting to the upper floors of buildings.

Urban guerrilla warfare and American casualties in Somalia and Iraq have demonstrated the limits of non-armoured or lightly armoured vehicles. As in the Vietnam War, trucks were reinforced with sandbags and corrugated steel to enable a group of infantrymen to fight in porcupine formation. Today, the trend is to deploy armoured vehicles and to put armoured turrets and weapon stations on as many vehicles as possible, including construction machines and supply trucks.[10]

8 Jean-Louis Promé, 'Le combat urbain: analyses et perspectives', in *Raids*, Hors-série No. 11, 2003.
9 CDEF, DREX, 'Les fantômes furieux de Falloujah: Opération Al-Fajr/Phantom Fury (juillet–novembre 2004)', *Cahiers du Retex*, April 2006.
10 Alexandre Vautravers, 'Les brigades Stryker', in *Revue Militaire Suisse*, No. 3, 2010.

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Statistically, the biggest threats are snipers and artillery projectiles, followed by improvised explosive devices (IED) and booby traps.[11] Despite their vulnerability, armoured vehicles help to limit casualties and get munitions and other supplies to forward units. An example is the Merkava main battle tank, whose ammunition racks were removed to enable them to transport four infantrymen or a stretcher.

It is generally held that tanks are not suitable for fighting in urban areas. However, the successful use of tank destroyers by the Wehrmacht to defend cities demonstrated how effective they could be. Moreover, tanks are an indispensable component of any offensive operation. During operation Iraqi Freedom, most of the Iraqi tanks entrenched themselves in towns and cities, where they attempted to spring surprise attacks on the US tanks at distances of between 10 and 200 metres.[12]

The battle of Fallujah, for example, where thirteen US tactical groups from the 1st cavalry and the 2nd infantry divisions, backed up by Iraqi troops, 'cleaned out' the town in December 2004, demonstrated that modern armies can win an engagement in urban territory. Meticulous preparation and psychological operations made it possible to evacuate most of the population. US forces used raids and diversionary operations to isolate groups of fighters, who were then crushed by a methodical, linear progression. The death toll was 71 on the US side against 1,000 on the side of the insurgents.[13]

Mechanized formations lack accompanying infantry. For the same total number of 4,000 men, a Stryker brigade combat team has 2,000 infantrymen, an infantry brigade team 1,060, and a heavy brigade team only 760.[14] Paradoxically, it has been demonstrated that forces lacking infantry call more often for artillery back-up. One example of this was the forces of the Republika Srpska in Bosnia-Herzegovina, whose use of artillery had notorious results.[15]

Infantry must advance ahead of the vehicles, at a distance of 100 to 200 metres, so as to prevent the enemy from using short-range anti-tank weapons. The infantry allows the tanks to move forward or calls for their back-up by using radio, field telephones fitted to the vehicles, or hand signals. It can also be used to clear obstacles. In Beirut, the armour on the M113 (ten tons) was not adequate, so the Israeli Defense Force had to develop infantry fighting vehicles and combat-engineer vehicles on up-armoured T-55 (forty tons) or Centurion (fifty tons) tank chassis. Infantry fighting vehicles specially designed for urban terrain and with

11 For more information on grenades, mines, and booby traps, see Lex Perevelli, 'Grenades, mines and boobytraps', available at: http://www.lexpev.nl/ (last visited 14 March 2010).

12 Robert Burik and Eric Olson, *Thunder Run: The 3rd Infantry Division's Drive to Baghdad*, Concord, Hong Kong, 2005; Alexandre Vautravers, 'Les bataillons lourds américains', in *Revue Militaire Suisse*, No. 1, 2010.

13 Michel Goya, *Irak: les armées du chaos*, Economica, Paris, 2009.

14 Carl Schulze and Ralph Zwilling, *Stryker Interim Armored Vehicle*, Concord, Hong Kong, 2007.

15 Alexandre Vautravers, 'Bosnia Herzegovina 1995: Srebrenica', in Alexandre Vautravers (ed.), *Identity and Conflict: Security Forum 2008 Proceedings*, Webster University Press, Geneva, 2010.

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several upwards firing turrets are now available on Merkava or T-80 chassis, for example the Namer and the Russian BMPT.[16]

In Grozny, many Russian BMPs served alternately as fire support and as armoured ambulances. The BTR-70 and -80 proved technically quite unreliable, despite their robustness and other qualities. The option of fighting from inside the vehicles was practically never used, as the vehicles were considered 'death traps'. Infantrymen preferred to sit on the roof to avoid being trapped in the vehicle if it hit a mine. As the BTR's engine was in the rear, it could not protect the crew. Moreover, the access doors on the sides make entry and exit more difficult than the rear ramp found on Western vehicles such as the Piranha.

Casualties

During the First Battle of Grozny, in January 1995, the Russian tanks revealed major flaws. Some went into battle without their removable reactive armour. Because of manpower shortages, some armoured personnel carriers entered the city without infantrymen on board. Moving in columns without cover, they used crude tactics. Finally, the equipment proved inadequate, as did the co-ordination between the various units and services: land army, special forces, and services attached to the Ministry of the Interior.

As a result, 225 armoured vehicles were rendered permanently unusable, including 62 T-72 and T-80 tanks. Another 217 were repaired by the maintenance units and 404 were repaired in the rear. All in all, 846 of the 2,221 armoured vehicles available were put out of service. Despite systematic use of heavy armaments – aircraft and artillery – and the destruction they wrought, Russian military casualties were terrible. After only three days of fighting, the group formed around the 131st brigade had lost 800 soldiers, 20 out of 26 tanks, 102 out of 120 armoured vehicles, and its 6 ZSU-23-4 air-defence systems. Seventy-four Russian soldiers had been taken prisoner. The 503rd regiment had lost a quarter of its men. The toll of the Battle of Grozny on the Russian side totalled 2,805 dead, 393 soldiers missing in action, 10,319 wounded, and 133 taken prisoner. On the Chechen side, 3,500 combatants were killed and there were 30,000 civilian dead.[17]

Communications

VHF radio links are impaired by walls and geographical features such as embankments. A typical tactical communication system such as the SE-235/PR4G, which transmits at 50 watts and has a range of over twenty kilometres on flat ground in fair weather, will at times, in practice, carry only a few hundred metres in towns.

16 Pierre Razoux, 'Tsahal au combat', in *Raids*, Hors-série No. 24, 2007; Marc-Ariel Zacharia, 'La famille *Merkava*, chars de combat israéliens', in *Revue Militaire Suisse*, No. 1, 2009.

17 Jean-Louis Promé, 'Les trois batailles de Grozny', in *Raids*, Hors-série No. 11, 2003.

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It is essential that radio communications be coded to maintain the element of surprise. In Grozny, the Russian army learned to use the terrain to maintain its radio links. VHF waves ricochet off walls and, by choosing suitable places for the antennae, it is possible to reach receivers by emitting along main roads or by ricocheting signals off walls and steel buildings, which act like Faraday cages.[18]

Adapting armies to urban environments

Hardware

Martin Van Creveld writes of the gap between the 'true war' for which armies prepare and the 'real war' with which they are then confronted.[19] In World War II, armies had to adapt to the terrain, as the hardware in use had not been designed with urban warfare in mind. Sub-machine-guns, automatic rifles, and hand grenades took over from repeating rifles. Precision marksmen, who made their first appearance in the trenches of World War I, again went into action. Anti-tank guns and rockets as well as mortars proved agile and effective in difficult terrain.

In cities, infantry and engineers generally bear the main brunt of the fighting. Fighters on foot can pass through sewers and over walls and roofs and can hold buildings. But without back-up, infantry lacks cover and fire power. Classic artillery is hampered because the artillery observers' sights and the curved trajectories are often obstructed by high buildings. The engagement ranges (generally under 1,000 metres) are incompatible with the safety distances of indirect fire. The best support is therefore provided by mortars and grenade-launchers.

The hardware developed for long-range field warfare is generally poorly suited to fighting in modern cities. Wire-guided anti-tank devices become virtually useless because of the short distances or the fleeting visibility of targets (under ten seconds). World War II hand grenades are considered too powerful today: the explosive charge (380 grams of trotyl) is so strong that the users themselves are exposed to danger in buildings that are increasingly not built of masonry. Modern hand grenades, by contrast, contain only half that amount, or up to 155 grams of RDX/TNT.

Conversely, the improvised explosive devices (IEDs) used by defenders or insurgents contain strong explosive charges and cannot generally be thrown at the enemy. The devices are fashioned from tank or artillery shells that contain between 3 and 30 kg of TNT. To blow up heavily armoured tanks, buried charges of between 100 and 200 kg of explosive are needed. They are of limited effectiveness against a vehicle weighing more than forty tons but can severely shake up its crew or overturn a lighter vehicle.

18 Jean-Marie Wasielewski, 'La télématique', in *Doctrine*, No. 3, June 2004.
19 Martin Van Creveld, *Technology and War: From 2000 BC to the Present*, The Free Press, London, 1989, p. 297.

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Tanks and infantry fighting vehicles have been provided with additional protection kits based on passive or explosive-reactive armour. These add 10 tons or so to the combat weight. An 8 × 8 drive M1126 Stryker armoured personnel carrier therefore rises from 11 to 19 tons,[20] an M2 Bradley infantry fighting vehicle from 32 to 40 tons and an M1 Abrams main battle tank from 55 to 64 tons.[21] Moreover, the vehicle crews – often the preferred targets – are protected by armoured shields and roofs.[22] This resulting extra weight also has disadvantages, however. The vehicles are so wide and ponderous that they have difficulty passing one another or manoeuvring in narrow streets. Worse still, wheeled vehicles run the risk of sinking under their weight if they leave the road. Even vehicles designed to withstand mines and ambushes[23] are heavy and therefore generally underpowered. Their high silhouette presents a large target to direct-fire weapons and makes them unstable on rough ground, where they can easily roll over.[24]

Generally speaking, the efficacy of weaponry is hampered by buildings and features such as embankments, which act like field fortifications. A study conducted by the *Bundeswehr* (German army) in the late 1990s revealed that the munitions in service at the time were no longer fit for modern combat conditions. The 20-mm gun on the Marder infantry fighting vehicle lacks penetration power, while the multipurpose (MZ)[25] 12-cm hollow-charge shell on the Leopard tank cannot blast a hole big enough (one metre in diameter) to penetrate a building. Old munitions designs found a new life: fragmentation shells (high explosive surrounded by a steel mantel) and CANISTER pre-fragmented (steel shrapnel) shells can be used against personnel and materiel at over and under 500 metres, respectively. The Russian army now equips most of its devices with 'thermobaric' munitions that work by overpressure; the round disperses fuel vapours that are ignited by a delay fuse, in order to maximize the anti-personnel and minimize the anti-materiel effects.

In order to protect their forces and enable them to operate in complex environments, NATO's armies have developed individual combat systems such as the US's *Land Warrior* deployed in Iraq in 2008 and France's *Félin*. These are supposed to enhance the efficacy of the infantry. Most fighting vehicles now have weapons that can shoot upwards: for example, the Norwegian Kvaerner RDS remote-controlled turret, armed with a 12.7-mm machine gun or a Mk 19 40-mm automatic grenade launcher. These systems can be linked to sensors that indicate the source of incoming fire. The possibility of programming automatic return fire is under consideration, but this poses some ethical questions.[26] Indeed, soldiers need to be aware of their responsibilities, even when the weapons operate in fully automatic mode. Incidents have occurred at sea with the automatic

20 A. Vautravers, above note 10.
21 A. Vautravers, above note 12.
22 Alexandre Vautravers, '10 inventions de l'US Army en 2008', in *Revue Militaire Suisse*, No. 3, 2010.
23 A generation of vehicle has been designed, in 2003–2008, to be 'mine-resistant, ambush-protected' (MRAP). Ambushes refer to IEDs or short-range anti-tank grenade attacks.
24 Alexandre Vautravers, 'MRAP: une fausse bonne idée?', in *Revue Militaire Suisse*, No. 3, 2010.
25 *Mehrzweck*.
26 Ian Kemp (ed.), *Complete Guide: Urban Warfare*, in *Armada*, Compendium, No. 4, 2008, p. 22.

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air-defence Phalanx system;[27] since 2009, such a system has been deployed on land in Iraq, to defend against mortar/artillery or missile attacks, renamed the Centurion.

Modern technical developments in Western armies are focusing on robotized remote-control systems, for example for the destruction of explosives. Large amounts of money are also being invested in developing drones and mini-drones for intelligence-gathering and combat.[28] However, these are more expensive than armour and do not solve the problem of protecting soldiers.

Training

After years of neglect and denial, most Western armies have now acknowledged the need to train their forces to fight in urban terrain and to develop new doctrines and new hardware accordingly.[29] In the United States, the National Training Centre (NTC) at Fort Irwin, California, has been preparing troops for this combat environment since 1980, while the Joint Readiness Training Centre (JRTC) was set up at Fort Polk, Louisiana, in 1993. The Fort Irwin centre trains mechanized units in a 1,600-square-kilometre area of semi-desert, while the Fort Polk facility is used to train light armoured and infantry units in the entire spectrum of operations, in particular in built-up areas. The seven US Stryker brigade combat teams are trained there.[30]

In June 2005, the French army opened a centre in Sissones (CENZUB) to train troops for operations in urban areas. Its mission is to conduct technical and tactical experiments, to draw up doctrine, and to dispense specific instruction. The first groups to use the centre were the 11th parachute brigade and the 1st mechanized brigade – both part of the rapid deployment force – in 2005. Between 2006 and 2008, the centre was used by the 3rd mechanized brigade, the 27th marine infantry brigade, and the 6th light armoured brigade.

French military doctrine provides for the creation of combined arms tactical battlegroups.[31] These are ad hoc forces made up of a thousand men and capable of controlling a town with a population of 100,000. In principle, they are made up of an armoured squadron, three or four infantry companies reinforced with regimental components – anti-tank, reconnaissance, and command sections – and a company of engineers. Depending on their mission, battlegroups may be given specialized resources: military police, intelligence services, interpreters, special forces, air force liaison officers, snipers, and so forth. The responsibility for

27 Gulf Link, Friendly Fire Incidents, available at: http://www.gulflink.osd.mil/du_ii/du_ii_tabh.htm (last visited 31 May 2010).
28 Ian Kemp (ed.), *Complete Guide: Urban Warfare 2009*, in *Armada*, Compendium, No. 4, 2009, p. 4.
29 See Jean-Marie Veyrat (ed.), 'Armées: faire campagne en ville', in *Doctrine*, No. Spécial 1, 2006; Ministère de la Défense, *Manuel d'emploi des forces terrestres en zone urbaine*, Paris, 22 July 2005.
30 A. Vautravers, above note 10.
31 *Groupements tactiques interarmes* (GTIA).

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setting up a combined group will depend on the density of the urban terrain: infantry in confined areas and armoured cavalry in peripheral areas.[32]

There are similar facilities in other countries. Switzerland, for example, recently inaugurated two simulators for urban terrain (SIMUG) and house-to-house fighting (SIMKIUG) facilities at the Walenstadt (2009) and Bure (2010) military training grounds. Infantry and tank battalions will train there every two years.[33]

The vulnerability of urban populations

Because resources, power, and people are concentrated in and around them, cities are by definition vulnerable entities. The European Union is currently conducting a study on the technological risks engendered by the presence of factories and power stations close to major cities.

In the Middle Ages, cities were regarded as death traps because high-density living and personal mobility exposed their inhabitants to a high risk of epidemics.[34] Meanwhile, rural life and poverty have been associated in popular beliefs; on the contrary, however, the most vulnerable population groups are now those living in cities.

Because they are vulnerable to any interruption of utilities (water, electricity, gas) or supplies (food, coal, information), city dwellers are more dependent on and more harshly affected by things beyond their control than people living in the country. The impact of a natural or technical disaster in a city will be more serious both because of the number of people affected and also because of the degree of their dependence and distress.[35] Urban populations are also generally harder to reach than rural ones. The situation is made worse by high population density. Large-scale operations to supply urban populations with food, evacuate them, or transfer them elsewhere are major challenges from a humanitarian, logistical, and law-enforcement point of view, as demonstrated by the US military operations in 2005 following hurricane Katrina.

As an official of Médecins du Monde cynically observed on French radio recently, the greatest change we have seen over the past thirty years of humanitarian action has been the shift from delivering food in the African countryside to the delivery of food to today's towns and slums. Jeff Crisp's work has demonstrated that, today, the majority of refugees are from towns and cities, and they find refuge

32 See 'Le combat en zone urbaine', in *Terre Information Magazine*, No. 177, September 2006; Jean-Louis Promé, 'La France et le combat urbain: une perspective incontournable', in *Raids*, Hors-série No. 11, 2003; Frank Nicol, 'La formation aux actions en zone urbaine', in *Doctrine*, No. 3, 2004; Alexandre Vautravers, 'L'armée française et les zones urbaines', in *Revue Militaire Suisse*, No. 5, 2007.

33 Hervé de Weck, 'Nouveau centre d'instruction au combat sur la place d'armes de Bure', in *Revue Militaire Suisse*, No. 6, 2009.

34 Philippe Arriès, *Essai sur l'histoire de la mort en Occident: du Moyen-Age à nos jours*, Seuil, Paris, 1977, p. 38.

35 T. Struye de Swielande, above note 4, p. 135.

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in other towns and cities, a fact that causes a number of challenges for the UN High Commissioner for Refugees.[36] Humanitarian operations, from the Berlin airlift to operations in Afghanistan and Haiti, have therefore increasingly focused on cities.

Our thinking in the fields of international relations, politics, security, and civil defence needs to factor in the development of large-scale urban expanses and concomitant factors such as concentration and globalization, economic and social influence, and growing vulnerability. Peace-keeping operations are by nature essentially city-based.[37] In Bosnia-Herzegovina, for example, half of the United Nations Protection Force (UNPROFOR) troops were stationed in the Sarajevo enclave.

Conclusions

In open country, tactical manoeuvring usually determines the outcome of a battle. In cities, however, fighting forces put most of their efforts into fire power and troop protection.[38] Examples of the fire-power scenario are the operations by Russian forces in Chechnya and the Israeli armed forces in southern Lebanon and Gaza. Military victory is possible, but the cost is generally a high casualty toll on both sides, as well as a devastating impact on the civilian population, which is considered *a priori* to be hostile. This type of fighting is hardly compatible with international humanitarian law. Furthermore, unilateral use of such force generally proves counterproductive for the subsequent course of operations: mobility is hampered, logistics channels are hard pressed, and the security situation worsened because of the hostility of the population.

The second option, practised for example by the US and British forces in Iraq, relies heavily on protection for the troops to enable them to resist the insurgents' initial fire. Effort is mainly put into developing heavy protection systems and effective integrated intelligence-gathering based on the use of sophisticated technologies – drones and robots. More finely targeted responses are then possible. Danger areas can be cordoned off to allow the civilian population to dissociate itself from the insurgents or be evacuated, a tactic that has an impact on the morale of both the troops and the public.[39] But the effectiveness of such tactics may only yield rewards after several years. It is perhaps too early to say whether they will fulfil the hopes vested in them.

In the longer term, the question arises whether modern armies can fight efficiently and win engagements in cities. Today, for most conventional forces and

36 Jeff Crisp, 'Access to urban refugees', in Alexandre Vautravers (ed.), *Access to Resources: 15th International Humanitarian Conference Proceedings*, Webster University, Geneva, forthcoming 2011.
37 Patrick Bazin, 'Le chemin de la paix passe par les villes', in *Doctrine*, No. 3, 2004.
38 Alexandre Vautravers, 'Strategy at a crossroads', in Gyula Csurgai (ed.), *Methods in Geopolitics*, L'Âge d'Homme, Genève, 2008, p. 100.
39 Christophe Barthélémy, 'Le degré d'acceptabilité collective de la mort distingue les sociétés', in *Revue Militaire Suisse*, No. 3, 2010.

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armed groups, defensive fighting in urban terrain is a given. The future will tell whether stabilization operations are possible in metropolises without considerable collateral destruction and whether casualties can be kept at acceptable levels. At the same time, it is clear that, for modern Western armies, taking a city by sheer fire power, as armies did in World War II or the Russian army attempted to do with its assaults on Grozny, is no longer a viable option.

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