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CANADIAN FORCES COLLEGE / COLLEGE DES FORCES CANADIENNES

CSC 29

EXERCISE NEW HORIZONS

TRANSFORMING THE BELGIAN FIELD ARTILLERY FOR THE 21ST CENTURY

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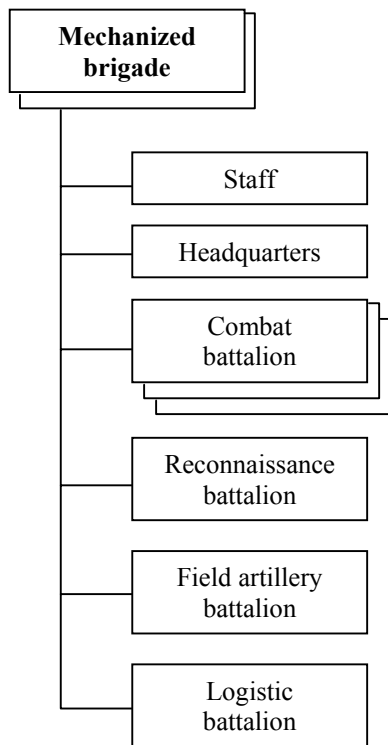
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“Preparing for the future will require new ways of thinking, and the development of forces and capabilities that can adapt quickly to new challenges and unexpected circumstances. The ability to adapt will be critical in a world defined by surprise and uncertainty.”¹

Donald H. Rumsfeld
United States Secretary of Defence

The collapse of the Soviet Union and the end of the Cold War have given rise to a new politico-international environment where threats are both diffuse and uncertain, and conflict is inherent yet unpredictable. This has presented the military forces around the world with a significant challenge. Policy makers were forced to re-evaluate old



strategies and reassess how the forces could remain relevant across the spectrum of conflict. For the Belgian Forces, this reassessment resulted in the development of a reorientation and restructuring plan, also referred to as Vision 2015, to meet the changes in anticipated threats, possible operational environments, as well as future advanced military technologies.² Vision 2015 created a land force organization with three brigades; two of which are mechanized and one is airmobile. The scope of this essay will be limited to the artillery indirect fire support of the mechanized brigades (see figure 1). By 2015, each

Figure 1: Structure of a mechanized brigade

¹ United States Joint Forces Command, *Joint Operational War Fighting Manual: Thoughts on the Operational Art of Future Joint War Fighting* (Washington: US Joint Forces Command, 2002), p 1.

² Andre Flahaut, *The Strategic Plan for the Modernisation of the Belgian Defence Forces 2000 - 2015: Concrete Proposals to enter the 21st Century* (Brussels: DND Belgium, 2001), p 44.

mechanized brigade will be composed of three combat battalions³, one reconnaissance battalion, one combat support (CS) unit (a field artillery battalion), and one combat service support (CSS) unit or logistic battalion. Every combat battalion will have at its disposal an organic indirect fire support capability delivered by a mortar platoon equipped with six 120mm mortars. Next, within the framework of the plan Vision 2015, the field artillery kept its traditional missions of target acquisition, close support to combat and reconnaissance units in contact with the opponent, and deep fires, including counter battery fires.⁴ To be able to carry out all of these missions, a field artillery battalion structure consisting of three batteries, each with six to eight lightweight wheeled tube artillery systems⁵ and a small target acquisition radar section⁶, integrated by command, control, communications and computer (C4) networks, was created. However, this planned military force structure still reflects the historical realities of the Industrial Age and the Cold War. Replacing the actual tracked tube artillery guns by high-technological lightweight wheeled ones, while maintaining the same military doctrine and operational and organizational concepts, will not exactly allow the Belgian field

³ Each mechanized battalion will be structured around two infantry companies and one Mobile Gun System (MGS) squadron.

DND Belgium. "Restructuring of the Belgian Defence Forces: Vision 2015." [<http://www.mil.be>]. No date.

⁴ Deep fires are meant to prohibit to the enemy any liberty of action, to break its offensive power, to limit its capacity of command and logistics. Deep fires will shape the battlefield to allow 10.02 235.58455 223.8 230965064 212.

artillery to effectively accomplish all of its missions in future operations. This essay will demonstrate that, if the Belgian field artillery wishes to be prepared for operations in the new operational environment, additional primary equipment and a more flexible organizational structure are required. The ideas put forward in this paper will not be bound by limiting criteria, such as fiscal and political constraints, rather, they will only be bound by the limits of the possible.

This essay will begin with describing some elements of the potential battle space and prospective operations that are fundamental to any consideration on the future use of the field artillery. Next, it will examine the effects sought by the field artillery in the new operational environment. Finally, this essay will study how these effects can be achieved by the field artillery.

The Twenty-First Century has already demonstrated that the operational environment has irrevocably changed and new threats have challenged the current paradigm of military operations. In the future, the most common military activity will likely be relatively small wars of choice. Such wars will be expeditionary in nature and demand the rapid strategic deployment of military forces. For this purpose, light forces may not be capable enough and heavy forces would need to be more deployable than they are today.⁷ Consequently, medium forces are more likely to fill the role of expeditionary forces. To shield the initial entry forces, they will require organic artillery indirect fire

⁷ William H. Moore, "U.S. Army Transformation: The U.K. View," *Military Review*, May – June, 2002, p 68.

support, consisting of sensors and counter strike capabilities together with responsive techniques of employment.⁸

Once projected to a theatre of operations, the land forces will likely face a battle space that will be characterized by distributed operations with non-linear, non-contiguous, smaller, widely dispersed formations.⁹ The land forces will therefore need to be tactically mobile and capable of achieving lethality against all target sets.¹⁰ To support this kind of manoeuvre warfare, the field artillery units must be able to shoot and reposition rapidly – “shoot and scoot” – thereby minimizing exposure time and susceptibility to enemy counter fire.

Future tactical units will also be confronted with rapidly changing and variable operational environments. Asymmetric operations¹¹ will be more probable. This will see opponents increasingly inhabiting and seeking to operate in complex terrain,¹² such as urban terrain, thus protecting their high value targets by shielding them amongst non-

⁸ William H. Moore, “U.S. Army Transformation: The U.K. View,” *Military Review*, p 69.

⁹ Toney Stricklin, “Fires: The Cutting Edge for the 21st Century,” *Field Artillery Journal*, May – June, 1998, p 24-25.

¹⁰ Robert Killebrew, “The Army After Next: Defining Future Land Power Challenges,” *Army*, February, 1998, p 28.

¹¹ The major characteristics of asymmetrical warfare are: the enemy is a quasi state (regime) in formation; the enemy army consists of a combination of regular units and militiamen; the enemy is not adhering to the traditional rules of war; the enemy is supported or at least not internally opposed by the indigenous population; the enemy quasi state (regime) has better knowledge of local traditions, area and roots; the enemy has international contacts and some international support; the enemy is familiar with your tactics, unit structures, equipment conditions,
Ivan Safranchuk, “Chechnya: Russia’s Experience of Asymmetrical Warfare,”
[<http://www.cdi.org/terrorism/Chechnya.cfm>], November 2002.

¹² Mountainous and jungle terrain are other examples of complex terrain.
United States Army, TRADOC pamphlet 525-3-91 *Objective Force: Tactical, Operational and Organizational Concept for Manoeuvre Units of Action* (Virginia: United States Training and Doctrine Command, 2001), p 23.

combatants. This multifaceted environment will greatly complicate targeting and dictates the development of automated acquisition and recognition systems. Restricting casualty levels, as well as striving to keep collateral damage to an acceptable level,¹³ could affect the future conduct of a campaign.¹⁴ Close combat is likely to be avoided whenever possible and there will be an increased emphasis on fighting from a distance in order to protect and preserve the force.¹⁵ Moreover, the ability to pre-emptively strike the enemy will be maximized.¹⁶

Furthermore, land forces will rarely fight as a single component in the future battle space. The expansion of this battle space and the opportunity for integration provided by digitization mean that an important part of the land firepower will be the contribution from joint capabilities.¹⁷ This will allow the land force commander to truly project power where it is most needed and achieve operational synergy against an opponent.¹⁸

In the field of the combined arms battle, the most important relationships over the last century have probably been between artillery, armour and aircraft. In the close

¹³ Toney Stricklin, "Fires: The Cutting Edge for the 21st Century," *Field Artillery Journal*, p 24.

¹⁴ R. Applegate, "Some Thoughts on the Future of Field Artillery," *The Journal of the Royal Artillery*, Spring, 2001, p 13.

¹⁵ *Ibid*, p 14.

¹⁶ William F. Engel, "Transforming Fires for the Objective Force," *Field Artillery Journal*, November – December, 2001, p 12.

¹⁷ The future will be characterized by a joint battle. This covers the attack of land tactical targets by a variety of means, including surface-to-surface firepower, naval fire support, air manoeuvre (principally attack helicopters) and close air support (CAS).
UK MoD, "Equipment, Training and Support news: The Future of British power," [http://www.ets-news.com/fire_power.htm], No date.

¹⁸ R. Applegate, "Some Thoughts on the Future of Field Artillery," *The Journal of the Royal Artillery*, p 17.

battle, artillery and aircraft have, at different times, proved the most adept at supporting armour. In deep battle, these same weapons, including attack helicopters¹⁹, have, in effect, assumed part of the role of armour for achieving deep penetrations. However, since the Second World War, aircraft have become increasingly inefficient systems when operating in heavily defended airspace.²⁰ To reduce their vulnerability, aircraft are progressively becoming indirect fire weapon platforms using standoff munitions. Moreover, aircraft have very limited operational ability in unfavourable weather conditions, thereby decreasing the efficiency of air power.²¹ At the same time, surface-to-surface indirect fire systems, directed by a variety of sensors, could reach farther into the battle space, which was previously the preserve of aircraft. As a result, in the future, a greater emphasis may be put on achieving field artillery effects deep in the battle space. Likewise, ground-based indirect fire support platforms are more efficient against mobile targets, including small enemy groups,²² as they provide a more rapid reaction to enemy manoeuvring, than aviation does.

By 2015, the battle space could reach huge dimensions and a divisional area of operations might extend to an area of 300 kilometres by 200 kilometres. In such an area of operations, subordinate brigades will have to operate more autonomously than hitherto

¹⁹ Attack aviation will focus in the future more and more on the close fight, usually within the range of supporting rocket artillery systems, rather than on the deep fight. H.B. Janney, "Attack Aviation Fires for the Close Fight: A New Approach," *Field Artillery Journal*, January – February 2003, pp 10-13.

²⁰ J.B.A. Bailey and M.D. Wentworth, "United Kingdom Field Artillery Aspirations for the Future," *The Journal of the Royal Artillery*, Spring, 2002, p 23.

²¹ Ivan Safranchuk, "Chechnya: Russia's Experience of Asymmetrical Warfare," [<http://www.cdi.org/terrorism/Chechnya.cfm>], November 2002.

²² *Ibid.*

has been the case and troop densities will be lower than before.²³ Due to their wide dispersion however they may be unable to provide mutual support with direct fire weapons. Hence, there will be a need for indirect fire support to have greater reach in order to apply effects throughout the brigade's area of operations with the appropriate timeliness. A commensurate increase in the reach of C4 and target acquisition to support the delivery of effects throughout the battle space will also be required.

Field artillery will continue to be needed along the whole spectrum of operations.²⁴ War fighting will remain the most challenging role, not only in high intensity scenarios, but also in asymmetric operations, like those currently conducted in Afghanistan.²⁵ Nevertheless, experience in Kosovo and Bosnia has supported the requirement for field artillery in operations other than war.²⁶ While war fighting and peace enforcement scenarios demand the use of field artillery for primarily lethal indirect fire support, operations other than war will put the emphasis on deterrence, force protection, and the will to use these indirect fire support assets. Despite the limitations on the use of indirect fire imposed by the rules of engagement, and the avoidance of collateral damage and casualties, artillery still proved its utility.²⁷

²³ R. Applegate, "Some Thoughts on the Future of Field Artillery," *The Journal of the Royal Artillery*, p 17.

²⁴ UK MoD, "Equipment, Training and Support news: The Future of British Power," [http://www.ets-news.com/fire_power.htm], No date.

²⁵ Anthony H. Cordesman, *The Lessons of Afghanistan: War Fighting, Intelligence, Force Transformation, Counter Proliferation, and Arms Control* (Washington: Centre for Strategic and International Studies Press, 2002), pp 5-95.

²⁶ These operations include peace support operations, peace enforcement, peacekeeping, peace building, crisis response operations, supervision of cease-fires, assisting in the maintenance of law and order, protecting the delivery of humanitarian assistance, guaranteeing rights of passage, and enforcements of sanctions.
Robert S. Bridgford, Neil S. Hersey and James E. Varner, "Lessons Learned from Operation Allied Force in Kosovo," *Field Artillery Journal*, January – February, 2000, pp 10-17.

Future operations will certainly place a greater emphasis on information gathering. Information is, and will always be, the greatest need of a commander on any type of operation. The exact location and identification of targets will be crucial, particularly in areas of high sensitivity. Consequently, both in fighting wars as well as in operations other than war, appropriate surveillance and target acquisition (STA) assets will provide the best means of achieving these requirements and will develop as essential elements of indirect fire systems.

Having put into context some elements of the potential battle space and prospective operations, it has become clear that the re-equipping and restructuring plan for the Belgian field artillery was based on the old paradigm of military operations rather than on the new one. Let us further study the effects sought by the field artillery in the new operational environment in order to subsequently define in more detail the capabilities required for the Belgian field artillery.

The emphasis in the future will shift from massing forces to massing and integrating effects.²⁸ Direct fire has the disadvantage of placing the platform close to the target to achieve its effect. Indirect fire has always obviated this vulnerability as it has not been necessary to mass platforms geographically to mass their effects. Long-range precision munitions will increase this advantage still further. In the future, however, the distinction between direct and indirect fire will become harder to discern. For example,

²⁷ Jon D. Holdaway, "The Law of War and Fire Support: A Primer for Fire Supporters," *Field Artillery Journal*, May – June, 2001, p 43.

²⁸ Jerry C. Hill and Carl R. Trout, "Effects-Based Fires: The Future of Fire Support Coordination and Execution," *Field Artillery Journal*, November – December, 2000, p 6-8.

with the sense and destroy armour artillery projectiles (SADARM)²⁹, it will be possible to fire indirect munitions that are themselves a platform capable of firing sub-munitions directly at the target. The merit of this new form of direct attack is that it avoids positioning manned platforms close to the target.

Next, the field artillery core effects of harassment, suppression, neutralization, and destruction will not disappear in the future.³⁰ However, to these should be added effects more applicable to operations other than war such as demoralization, deterrence, coercion and the demonstration of potential, in order to protect one's own forces.

Field artillery must also be capable of providing three different types of ammunition effects in the target area: point effects, area effects and special effects. Point effects can either be obtained by using precision, smart and/or discriminating munitions.³¹ Fielding these new types of artillery munitions will reduce the number of rounds required to neutralize a given target. This, in turn, will have a major impact on logistic support. Especially for future operations, indirect fire support will need to be

²⁹ The SADARM projectile is a 155mm carrier projectile, which ejects two sub munitions over the target area at an altitude of 1000 meters. Next, the sub munitions pinpoint armoured targets using three different target-locating systems: active millimetre wave, passive millimetre wave and infrared. Each of the sub munitions then fires an explosively formed penetrator (EFP) to defeat the target from above. DND Belgium. "Restructuring of the Belgian Defence Forces: Vision 2015." [<http://www.mil.be>]. No date.

³⁰ Department of National Defence, *Setting out for the Land Component 2015* (Brussels: DND Belgium, 2002).

³¹ Precision munitions are capable of self-locating and manoeuvring to a specific location with accuracy sufficient to yield a high probability of destruction within its inherent capabilities. Smart munitions have a self-contained capability to search, detect, acquire, and engage individual targets by detecting the general target characteristics in order to provide terminal guidance for the munitions or sub-munitions. Discriminating munitions have a self-contained capability to search, detect, acquire, and engage individual targets by distinguishing specific characteristics of the target to selectively identify and engage only the desired target types. Mike Cuff, *Transforming Fires for the 21st Century*, Report of the 7th International Artillery and Indirect Fire Symposium, June 20, 2002 (Washington: Future Development Integration Centre of the U.S. Army Field Artillery, 2002), pp 1-18.

accurate to be effective and to reduce the risk of collateral damage and casualties, which may give rise to adverse political and legal consequences. Nevertheless, the requirement for large area effects will remain extant.³² Many targets contained within an area could be best suppressed by destroying each target precisely, although this is not necessarily the most cost effective way. Weapons delivering a point effect will neither be available in large numbers, nor be able to attack all target sets. Furthermore, if there would be a total reliance upon these munitions, an enemy having more targets than the opponent has precision munitions could emerge as the victor. Consequently, a balance will need to be struck between the financially expensive point effect munitions and relatively cheap, but logistically expensive, conventional area effect munitions. Besides point and area effects, also special effects, such as smoke, illumination and counter mobility, using field artillery scatterable mines (FASCAM), will endure.

Over the past decades, technological advances have made it possible to introduce non-lethal weapons on the battlefield. A combination of lethal and non-lethal effects will give the commander a broader range of choices with which to attack a target.³³ Non-lethal systems will enable him to persist to impose an effect where the continued use of lethal systems may be unacceptable, specifically, they offer tremendous potential in situations where collateral damage must be minimized.³⁴ Notwithstanding this, lethal

³² UK MoD, "Equipment, Training and Support news: The Future of British Power," [http://www.ets-news.com/fire_power.htm], No date.

³³ Michael D. Maples, "Field Artillery essential to Current and Future Force Success," *Field Artillery Journal*, May – August, 2002, p 3.

³⁴ Non-lethal munitions could provide incapacitating effects, such as stunning the opponent, inhibiting foot and platform movement, interrupting his communications, or neutralizing his optical, thermal and electronic sensors.
Toney Stricklin, "Fires: The Cutting Edge for the 21st Century," *Field Artillery Journal*, p 24.

effects are expected to remain the predominant coercive force and means of deterrence. Even in operations other than war, lethal force may be used to non-lethal effects.³⁵ For example, belligerents may be deterred by a demonstration of non-lethal effects, such as smoke, and the implication that lethal effects may follow.

Field artillery must also continue to have an effect throughout the battle space. A distinction has usually been drawn between firepower in close support of the combat units and firepower in deep battle, usually independent of manoeuvre. However, in the future, the effects required for close support and deep fire are likely to be similar. Indirect firepower could be in support of manoeuvre, conducted for its own ends, or supported by manoeuvre.³⁶

Field artillery alone cannot be relied upon to provide the full range of required effects throughout the battle space.³⁷ Fires from a variety of air and maritime delivery systems will be available to the land force commander.³⁸ Although this will give him a greater flexibility, not all of these systems can provide the speed of response necessary in a fast-moving manoeuvre battle. Even if, in the future, measures may be introduced to improve their timeliness, operational and tactical targeting priorities and bad weather are likely to restrict their availability and degree of guarantee of effectiveness. Moreover, the number of high value targets that the land force commander needs to attack will likely be

³⁵ Richard L. Gonzales and Marc J. Romanych, "Non-Lethal Targeting Revisited: The Kosovo Experience," *Field Artillery Journal*, May – June, 2001, pp 6-10.

³⁶ R. P., "UK Research Objectives for Land Depth Battle laid out," *Jane's International Defence Review*, January, 2003, p 8.

³⁷ Edward G. Anderson, "Redefining Jointness for the 21st Century," *Field Artillery Journal*, November – December, 1999, pp 2-4.

³⁸ Robert Killebrew, "The Army After Next: Defining Future Land Power Challenges," *Army*, p 28.

in excess of the capacity of the other components' systems. Therefore, the required effects can probably only be achieved by indirect fire support systems under the direct command of the land force commander. This will guarantee him indirect fire support that is both precise and has sufficient reach to apply effects throughout his battle space. The question remains then how the Belgian field artillery can generate the required effects and what changes to the plan Vision 2015 will therefore be required?

The first way for the field artillery to create the effects is purely physical, by having the necessary equipment and capabilities at its disposal. Indirect firepower is commonly described as a system of systems. In addition to strike systems (otherwise referred to as shooters or delivery systems), this system also comprises a range of target acquisition systems or sensors and C4 systems or deciders.³⁹ To achieve all the required effects, shooters must be supported by adequate sensors.⁴⁰ Effective engagement of enemy platforms by only using reactive sensors, such as counter battery target acquisition radars, is becoming more difficult because of the increased mobility of these platforms.⁴¹ Thus a greater emphasis should be placed on the pro-active engagement of these platforms. For this purpose, continuous, real-time surveillance and target acquisition systems, which are omni-directional and pro-active in providing detection, location, and

³⁹ The aspect of indirect fire supporters (meteorology, survey and other systems) was not taken into consideration for this essay.

Kenneth Jones, "Field Artillery and Fire Support systems," [http://sil-www.army.mil/TNGCMD/mat/tcmc.htm], March 2000.

⁴⁰ UK MoD, "Equipment, Training and Support news: The Future of British Power," [http://www.ets-news.com/fire_power.htm], No date.

⁴¹ Michael D. Maples, "Field Artillery essential to Current and Future Force Success," *Field Artillery Journal*, p 3.

positive identification, will be necessary. Certainly in the more populated battle space, with a greater risk of collateral damage, a better situational awareness is needed. Furthermore, the need for precise location is particularly critical when the force is operating on a fluid, non-linear battlefield.⁴² As a result, the need for Tactical Unmanned Aerial Vehicles (TUAV) will increase in future operations.

The TUAV will be key to the deep fight⁴³ and the shaping of the battlefield.⁴⁴ TUAV are, by far, the most flexible and dynamic targeting asset for pro-active counter fire operations to be executed by the field artillery delivery systems.⁴⁵ Often the TUAV will be able to locate enemy artillery within the range of one's own systems before the enemy artillery can begin to fire on one's own forces. This will allow friendly artillery to pre-emptively strike the indirect fire support assets of the opponent.⁴⁶ Additionally, TUAV have the capability to follow moving targets at a great distance until these targets stop to be engaged.

Equally important are the developing new roles for TUAV. Unmanned Combat Aerial Vehicles (UCAV) have already been able to designate targets and to fire missiles at high-value targets. Furthermore, the TUAV can be employed to deliver a battle damage assessment (BDA), this not only to assess the effectiveness of an engagement,

⁴² John Costello, "Space and Fires = Nowhere to hide in 21st Century Land Force Operations," *Field Artillery Journal*, September – October, 1999, pp 12-15.

⁴³ Franklin L. Hagenbeck, "Afghanistan: Fire Support for Operation Anaconda," *Field Artillery Journal*, September – October, 2002, p 11.

⁴⁴ William J. Lennox, "Advice to Field Artillerymen: Making Fires Key to Objective Force Success," *Field Artillery Journal*, September – October, 2001, p 33.

⁴⁵ Kevin E. Finch, Henry S. Larsen, and Vincent J. Bellisario, "Counter Fire for the ICBT," *Field Artillery Journal*, November – December, 2001, p 19.

⁴⁶ Thomas J. Roth and Richard G. Cardillo, "Fighting with Force XXI Fires: A Brigade FSCOORD's Perspective at the DAWE," *Field Artillery Journal*, May – June, 1998, p 21.

but also to prove that the actions undertaken were legal. The Law of Armed Conflict requires the ability to distinguish between combatants and civilians, and to ensure that loss of life or damage is proportionate to the military advantage to be gained.⁴⁷

Besides an effective surveillance and target acquisition system, the future fire support system will also require a mix of shooter capabilities in order to operate in all environments, in all possible scenarios, and to deliver a lot of different effects throughout the battle space.⁴⁸ No one system can be seen as meeting all requirements.⁴⁹ It is also not possible to apply fires from the same system to two places at once, simultaneously close and deep; otherwise the need arises to sequence the operations.⁵⁰ A mix of tube and rocket artillery systems, all on a common wheeled platform⁵¹, will offer unique capabilities and, likewise, have system-specific limitations that must be understood and considered.⁵² For land forces, this mix of systems provides the greatest flexibility and mitigates the individual shortcomings of each delivery means and renders it possible to attribute the right indirect fire ground systems to each operational environment.

⁴⁷ Department of National Defence, B-GG-005-027/AF-021 *The Law of Armed Conflict at the Operational and Tactical Level* (Ottawa: DND Canada, 2001).

⁴⁸ Michael D. Maples, "Field Artillery essential to Current and Future Force Success," *Field Artillery Journal*, p 3.

⁴⁹ UK MoD, "Equipment, Training and Support news: The Future of British Power," [http://www.ets-news.com/fire_power.htm], No date.

⁵⁰ N.A. Clissitt, "Doctrine – What does it mean for the Artillery," *The Journal of the Royal Artillery*, March, 1997, p 29.

⁵¹ Compared to their tracked counterparts, wheeled artillery guns offer a number of advances, notably in strategic mobility. They are also claimed to have lower procurement and operating costs, and a reduced logistic burden. Next, heavy equipment transporters normally carry tracked artillery systems over long distances, while wheeled systems can be rapidly deployed under their own power. Andre Flahaut, *The Strategic Plan for the Modernisation of the Belgian Defence Forces 2000 - 2015: Concrete Proposals to enter the 21st Century* (Brussels: DND Belgium, 2000), p 50.

⁵² R. Applegate, "Some Thoughts on the Future of Field Artillery," *The Journal of the Royal Artillery*, p 15.

Although tube and rocket artillery systems are described here as weapons, they are actually only delivery systems of the projectiles fired to achieve the different effects.⁵³

Tube artillery systems will continue to be required to deliver both precision and non-precision fires and also as the primary delivery system of a wide variety of special purpose munitions. Likewise, they offer a wide range of trajectory options, from direct fire to high-angle fire, to support the diversity of battlefield and terrain requirements. These shooters are therefore more suited for close supporting operations than rocket systems.

In the future there may be proportionally fewer tube artillery systems and more rocket artillery systems, as the requirements for greater range and precision increases.⁵⁴ The increased range of the rocket system enables this weapon to cover a larger portion of the enemy target array. Consequently, this type of shooter can engage targets in distributed operations throughout the battlefield, while still massing fires, and is even capable of providing indirect fire support to neighbouring formations.⁵⁵ Another advantage of rocket systems is their high rate of fire. Rockets with their sub-munitions give the ability to maximize the number of rockets that can be placed on a mobile, fleeing target, and this will enhance the ability to attack moving targets greatly.⁵⁶ In addition, medium weight rocket artillery systems are uniquely capable of supporting early entry

⁵³ Erik H. Biass, Terry J. Gander, and Scott Gourley, "Artillery Mainstays: The Field Howitzers," *Armada International*, Augustus – September, 2001, p 3.

⁵⁴ Donald E. Gentry and Cullen G. Barbato, "HIMARS (High Mobility Artillery Rocket System): Firepower for Early Entry Forces," *Field Artillery Journal*, January – February, 1999, p 17.

⁵⁵ William F. Kernan, "XVIII Airborne Corps: Fires for Forced-Entry Operations," *Field Artillery Journal*, January – February, 1999, p 2-4.

⁵⁶ William J. Lennox, "Advice to Field Artillerymen: Making Fires Key to Objective Force Success," *Field Artillery Journal*, p 33.

operations by expeditionary forces or intra-theater operations, because they provide a deep strike capability that early entry forces previously were unable to attain without first securing airfields for greater aircraft to bring in the necessary heavy field artillery guns.⁵⁷

The rocket systems meet the challenges of a non-linear battlefield and greatly complement the tube artillery fires ability to attack in the tactical and operational deep zones and to strike at counter fire, air defence and other high value targets.⁵⁸

All these systems, sensors as well as shooters, will need to be enabled by C4 systems (deciders) processing very large quantities of information. But in a world characterized by the flow of information on the Internet and the predominance of commercial satellite systems, it will be rather unlikely to expect information dominance. Therefore, conditions should be created that engineer or arrange the shortest possible sensor-to-shooter link. As with any other sighting system, it can be believed that it is best if the weapon and the target acquisition method are slaved to each other for a particular engagement.⁵⁹ Moreover, a balance must be achieved between shooters that are capable of striking at far ranges and the acquiring ranges of the STA assets. It is unlikely that a perfect balance will ever be achieved, but an effort should be made to synchronize these two assets.⁶⁰

⁵⁷ Toney Stricklin, "State of the Field Artillery 2000: Looking Ahead to the Objective Force," *Field Artillery Journal*, November – December , 2000, pp 1-5.

⁵⁸ *Ibid*, pp 1-5.

⁵⁹ R. Applegate, "Some Thoughts on the Future of Field Artillery," *The Journal of the Royal Artillery*, p 15.

⁶⁰ N.A. Clissitt, "Doctrine – What does it mean for the Artillery," *The Journal of the Royal Artillery*, p 18.

Besides the physical way, the second way in which field artillery units can create decisive effects throughout the battle space is organizational, by mixing different systems within a single formation. Historically, technology and new methods of delivering effects have changed the way wars were fought and the structures that military forces adopted as a result. This trend should be expected to continue. Issues such as command and control and survey have been important determinants of structures in the past. Battery size had depended upon the number of guns that can be commanded by one command post, given the dispersion possible with the type of platforms available and their communications.⁶¹ This may become less significant as the autonomy of an individual platform increases.

As previously mentioned, brigades will have to operate more independently than they have until now in the new operational environment. Although the brigade commander will have the possibility to depend more and more on joint fires, he will still require organic or direct support artillery.⁶² This essay suggests that something like a battalion organization at brigade level should be maintained. But this field artillery battalion may be very different from the planned battalion organization in the plan Vision 2015 and may not be organized around a finite number of weapons systems as it is today. In order to truly capitalize on mobility, survivability and effects, the current and planned rigid field artillery formations must be broken. This new field artillery battalion should be considered as a pool of capabilities in which dynamic force tailoring would be key.

⁶¹ Thomas J. Brown, "Field Artillery Conversions to 3x6," *Field Artillery Journal*, January – February, 1999, pp 12-16.

⁶² John M.D. Shalikhvili, "Army in Transition: Keep your Eye on the Ball," *Field Artillery Journal*, July – August, 2000, pp 3-7.

Force tailoring would begin upon deployment notification and be driven by the specific contingency and its mission. These enhancements will reduce layers of command by tailoring force packages into task force-like command, control and sustainment organizations.⁶³ These structures will be more adaptable to different situations and more tactically and operationally agile.⁶⁴ For example, the ability to rapidly deploy a force package of a pair of tube artillery systems, a rocket artillery launcher, linked to TUAV and counter fire radar by C4 networks, in order to support a battle group in operations other than war, is a very powerful capability.⁶⁵

To be prepared for a wide variety of operations in the new operational environment, it is therefore recommended that the Belgian field artillery makes some major decisions. First of all, it should acquire additional primary equipment, such as TUAV and rocket artillery systems, to complement the target acquisition radars and lightweight tube artillery guns foreseen by the plan Vision 2015. Secondly, the Belgian field artillery should adopt a more flexible organizational structure, able to perform effects-based tailoring, thereby mixing the capabilities of different systems,⁶⁶ and, in this way, broadening the spectrum of effects.

⁶³ William F. Engel, "Transforming Fires for the Objective Force," *Field Artillery Journal*, p 12.

⁶⁴ Example: US Task Force Hawk, part of NATO's operation Allied Force.
John W. Hendrix, "Transforming the Army to meet the 21st Century Threat," *Field Artillery Journal*, May – June, 2000, p5.

⁶⁵ Toney Stricklin, "State of the Field Artillery 2000: Looking Ahead to the Objective Force," *Field Artillery Journal*, pp 1-5.

⁶⁶ Toney Stricklin, "Fires: The Cutting Edge for the 21st Century," *Field Artillery Journal*, p 25.

Conflict will remain commonplace in the modern world with little clear distinction between war and peace. In this context, uncertainty and unpredictability will continue as major factors in conflicts over the coming years. Preparing for this future will require the development of dynamic-tailored forces and effects-based capabilities that can adapt quickly to any operational environment. As a result, a wide spectrum of firepower capabilities, existing of target acquisition assets as well as delivery systems, must be retained to meet that variety of challenges. Additionally, new military technologies will allow the field artillery to detect, accurately locate and identify more targets than previously possible and provide it with more adequate delivery means and munitions to attack those.

Future war fighting and operations other than war will also continue to demand the engagement of high value targets throughout the battle space, by responsive field artillery support guaranteed to the land force commander. Field artillery must continue to offer the ability to guarantee indirect fire support while executing its traditional missions, abiding by the rules of engagement. However, surveillance and target acquisition, long-range fires, and the integration of joint effects will become the dominant factors in future warfare. From an artillery perspective, there will be a greater emphasis on the engagement of high value targets at increased ranges and relatively less emphasis on the support of close operations. The business of close support will initially fall more upon ground manoeuvre forces, which dispose of assets such as 120mm mortars as their immediate indirect fire combat support system. Nevertheless, this would not prevent field artillery delivery systems being used for complementary support of the close battle. But rather than emphasizing the close battle, the future artillery systems should have a

discreet and more operationally significant role in taking apart the enemy at a distance and as early as possible. Key to a credible capability in this domain are, firstly, proactive sensor and surveillance systems, such as TUAV, to prevent surprise attack in peacetime and provide necessary surveillance and targeting in wartime. Secondly, different delivery systems (tube and rocket artillery) with sufficient range, accuracy and lethality are required to hold enemy follow-on forces at risk in peacetime and to attack them successfully in wartime. Thirdly, this requires C4 systems sufficient to integrate the acquisition information and to provide that targeting information to the shooters in near real-time. If the Belgian field artillery wishes to be prepared for operations in the new operational environment, then it should consider the acquisition of TUAV and rocket artillery systems to complement the foreseen primary equipment in the plan Vision 2015.

It is also clear that there has to be a link between the change in equipment and organizational behaviour. The actual planned inflexible structures need to be broken. All the field artillery equipment should be integrated in a battalion-like organization in a force pool at brigade level allowing mission dynamic force tailoring. The military complexities of the Twenty-First Century require that we adapt our current capabilities and structures to meet a different form of threat, while at the same time, prepare for the challenges of the future. Integrating tube and rocket artillery systems together with modern surveillance, target acquisition and fire control systems into task-configured forces will challenge many potential opponents in future operations.

BIBLIOGRAPHY

- Anderson, Edward G. "Redefining Jointness for the 21st Century." *Field Artillery Journal*, November – December, 1999, pp 2-4.
- Antal, John F. "The End of Maneuver." *Army*, July, 1998, pp 40-46.
- Applegate, R. "Some Thoughts on the Future of Field Artillery." *The Journal of the Royal Artillery*, Spring, 2001, p 12-19.
- Bailey, J.B.A., and Wentworth, M.D. "United Kingdom Field Artillery Aspirations for the Future." *The Journal of the Royal Artillery*, Spring, 2002, pp 22-26.
- Bailey, Steven L. "Fires for the IBCT: A Mobile Infantry-Centric Force." *Field Artillery Journal*, November – December, 2001, pp 5-8.
- Belgium, Department of National Defence. *Setting out for the Land Component 2015*. Brussels: DND Belgium, 2002.
- Bell, Burwell B.; Bourn, G.M.; Likowski, P.; and Agron, G.A. "Legal Issues with Fires in the Contemporary Operational Environment Populated Areas." *Field Artillery Journal*, January – February, 2003, pp 29-32.
- Bentley, Christopher F. "Afghanistan: Joint and Coalition Fire Support in Operation Anaconda." *Field Artillery Journal*, September – October, 2002, p 12-16.
- Biasm, Erik H.; Gander, Terry J.; and Gourley, Scott. "Artillery Mainstays: The Field Howitzers." *Armada International*, Augustus – September, 2001, pp 4-8.
- Bridgford, Robert S.; Hersey, Neil S.; and Varner, James E. "Lessons Learned from Operation Allied Force in Kosovo." *Field Artillery Journal*, January – February, 2000, pp 10-17.
- Brown, Thomas J. "Field Artillery Conversions to 3x6." *Field Artillery Journal*, January – February, 1999, pp 12-16.
- Canada, Department of National Defence, B-GG-005-027/AF-021 *The Law of Armed Conflict at the Operational and Tactical Level*. Ottawa: DND Canada, 2001.
- Canada, Department of National Defence, B-GL-300-007/FP-001 *Firepower*. Ottawa: DND Canada, 1999.

Canada, Department of National Defence, B-GL-383-002/PT-007 *Battle Task Standards: Field Artillery*. Ottawa: DND Canada, 1998.

Canada, Department of National Defence, B-GL-371-001/FP-001 *Field Artillery Doctrine*. Ottawa: DND Canada, 1999.

Canada, Department of National Defence. *Canadian Defence Beyond 2010 The Way Ahead: An RMA Concept Paper*. Ottawa: DND Canada, 1999.

Clissitt N.A. "Doctrine – What does it mean for the Artillery?" *The Journal of the Royal Artillery*, March, 1997, pp 27-35.

Cook, Nick. "UAV: Armed and Dangerous." *Jane's Defense Weekly*, January, 2003, pp 22-27.

Cordesman, Anthony H. *The Lessons of Afghanistan: War Fighting, Intelligence, Force Transformation, Counter Proliferation, and Arms Control*. Washington: Centre for Strategic and International Studies Press, 2002.

Costello, John. "Space and Fires = Nowhere to hide in 21st Century Land Force Operations." *Field Artillery Journal*, September – October, 1999, pp 12-15.

Cuff, Mike. *Transforming Fires for the 21st Century*. Report of the 7th International Artillery and Indirect Fire Symposium, June 20, 2002. Washington: Futures Development Integration Centre of the U.S. Army Field Artillery Centre, 2002.

DND Belgium. "Restructuring of the Belgian Defence Forces: Vision 2015." [<http://www.mil.be>]. No date.

Engel, William F. "Transforming Fires for the Objective Force." *Field Artillery Journal*, November – December, 2001, pp 9-13.

Engel, William F.; Blum, Mark; and Torres, Rafael. "Report to the Field: Tactical/Operational Fire Support Conference." *Field Artillery Journal*, May - June, 2000 p 31-35.

Finch, Kevin E.; Larsen, Henry S.; and Bellisario, Vincent J. "Counter Fire for the ICBT." *Field Artillery Journal*, November – December, 2001, pp 14-22.

Flahaut, Andre. *The Strategic Plan for the Modernisation of the Belgian Defence Forces 2000 - 2015: Concrete Proposals to enter the 21st Century*. Brussels: DND Belgium, 2000.

Gentry, Donald E., and Barbato, Cullen G. "HIMARS: Firepower for Early Entry Forces." *Field Artillery Journal*, January – February, 1999, pp 17-19.

Gonzales, Richard L., and Romanych, Marc J. "Non-Lethal Targeting Revisited: The Kosovo Experience." *Field Artillery Journal*, May – June, 2001, pp 6-10.

Gourley, Scott R. "Fire Power." *Army*, May, 1998, pp 45-48.

Hagenbeck, Franklin L. "Afghanistan: Fire Support for Operation Anaconda." *Field Artillery Journal*, September – October, 2002, pp 7-11.

Hendrix, John W. "Transforming the Army to meet the 21st Century Threat." *Field Artillery Journal*, May – June, 2000, pp 4-6.

Hewish, Mark. "Unmanned, Unblinking, Undeterred: UAV Payloads." *Jane's International Defense Review*, September, 2002, pp 47-55.

Hewitt, R.W. "Asymmetrical Wa

- Maples, Michael D. "Field Artillery essential to Current and Future Force Success." *Field Artillery Journal*, May – August, 2002, pp 3-4.
- Maples, Michael D. "The Field Artillery and the Objective Force: An Uncertain but Critical Future." *Field Artillery Journal*, September – October, 2002, pp 3-6.
- Moore, William H. "U.S. Army Transformation: The U.K. View." *Military Review*, May – June, 2002, p 3-6.
- Po, Enrico. "Lightweight and High Firepower." *Military Technology*, July, 2000, pp 51-58.
- Prochniak, Scott E., and Yates, Dennis W. "Counter Fire in Afghanistan." *Field Artillery Journal*, September – October, 2002, pp 17-20.
- Richardson, R.S. "Artillery Fires in Support of Aviation in the Close Attack." *Field Artillery Journal*, January – February, 2003, pp 22-24.
- Roth, Thomas J., and Cardillo, Richard G. "Fighting with Force XXI Fires: A Brigade FSCOORD's Perspective at the DAWE." *Field Artillery Journal*, May – June, 1998, pp20-23.
- R. P. "UK Research Objectives for Land Depth Battle laid out." *Jane's International Defense Review*, January, 2003, p 8.
- Safranchuk, Ivan. "Chechnya: Russia's Experience of Asymmetrical Warfare." [<http://www.cdi.org/terrorism/Chechnya.cfm>]. November 2002.
- Schneider, Jochen. "German Field Artillery on its way into the Future." *Field Artillery Journal*, March – April, 1998, pp 16-18.
- Shaliskashvili, John M.D. "Army in Transition: Keep your Eye on the Ball." *Field Artillery Journal*, July – August, 2000, pp 3-5.
- Sloan, Elinor. *The Revolution in Military Affairs: Implications for Canada and NATO*. Montreal, Kingston, London: McGill-Queen's University Press, 2002.
- Stricklin, Toney. "State of the Field Artillery 2000: Looking Ahead to the Objective Force." *Field Artillery Journal*, November – December , 2000, pp 1-5.
- Stricklin, Toney. "Fires: The Cutting Edge for the 21st Century." *Field Artillery Journal*, May – June, 1998, pp 24-29.
- Stricklin, Toney. "World Fires for the 21st Century." *Field Artillery Journal*, January - February, 2000, pp 1-3.

Toffler, Alvin, and Toffler, Heidi. *War and Anti-War: Survival at the dawn of the 21st Century*. Boston, New York, Toronto, London: Little, Brown and Company Press, 1993.

UK MoD. "Equipment, Training and Support news: The Future of British Power." [http://www.ets-news.com/fire_power.htm]. No date.

United States, United States Joint Forces Command. *Joint Operational War Fighting Manual: Thoughts on the Operational Art of Future Joint War Fighting*. Washington: US Joint Forces Command, 2002.

United States, Department of the Army. TRADOC pamphlet 525-3-91 *Objective Force: Tactical, Operational and Organizational Concept for Maneuver Units of Action*. Virginia: United States Training and Doctrine Command, 2001.

United States, Department of the Army. FM 3-09.222 *Tactics, Techniques, and Procedures for Corps Artillery, Division Artillery, and Field Artillery Brigade operations*. Washington: Department of the Army, 2001.

United States, Department of the Army. FM 6-121 *Tactics, Techniques, and Procedures for Field Artillery Target Acquisition*. Washington: Department of the Army, 1990.

United States, Department of the Army. FM 6-20 *Fire Support in the Air Land Battle*. Washington: Department of the Army, 1988.

United States, Department of the Army. FM 6-20-30 *Tactics, Techniques, and Procedures for MLRS Operations*. Washington: Department of the Army, 1989.

United States, Department of the Army. FM 6-121 *Fire Support for the Combined Arms Commander*. Washington: Department of the Army, 1994.

United States, Department of the Army. FM 6-60 *Tactics, Techniques, and Procedures for Fire Support for Corps and Division Operations*. Washington: Department of the Army, 1989.

Wynne, Peter. "Special DoD Briefing on Future Technologies for Indirect Fires." [http://www.defenselink.mil/news/May2002/t05152002_t0515a1.html]. May 2002.

Zielinski, Peter J. "Doctrine for Fire Support: What comes after Air Land Battle?" *Field Artillery Journal*, September – October, 2001, pp 40-42.