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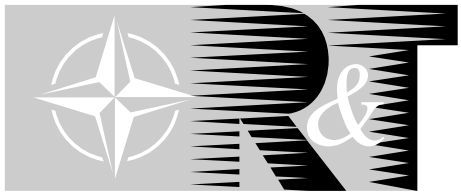


RESEARCH AND TECHNOLOGY ORGANISATION

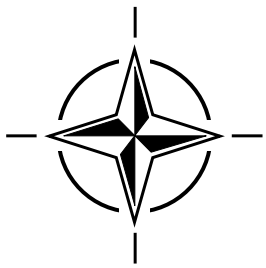
BP 25, 7 RUE ANCELLE, F-92201 NEUILLY-SUR-SEINE CEDEX, FRANCE

RTO TECHNICAL REPORT 71

Urban Operations in the Year 2020

(Opérations en zone urbaine en l'an 2020)

Report by the RTO Studies, Analysis and Simulation Panel Study Group SAS-030.



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Abstract
This is the final report by the SAS-030 Study Group into Urban Operations in the year 2020. In this study recommendations are given to RTA and NATO. The recommendations are based upon the approach as explained underneath. The study group examined the future urban environment, stresses the growing importance of Urban Operations and derived capabilities needed at the operational level to successfully operate in such an environment. In the study the conceptual framework USECT (Understand, Shape, Engage, Consolidate, Transition) was analysed and future and more traditional operational concepts were developed and selected. Based on the operational level capabilities, new System Concepts were developed and these materiel solutions were analysed during an Urban Seminar Wargame where also non-materiel solutions were examined. During the study extensive ranking was helpful to determine the most promising System Concepts and other solutions.

Subject Terms
Buildings Operations research Builtup areas Scenarios Critical technologies Tactical warfare Gaming models Threat evaluation Force structure planning Trends Infantry Urban Conceptual Framework Interoperability Urban operations Joint operations Urban System Concept Military doctrine Urban warfare Military operations USECT (Understand, Shape, Engage, Military planning Consolidate and Transition) Military training USW (Urban Seminar Wargame) Models War games NATO forces

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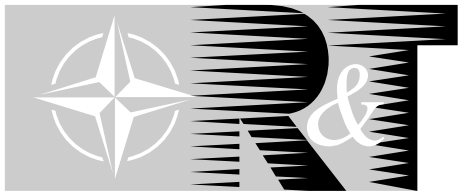

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Urban Operations in the Year 2020

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The Research and Technology Organisation (RTO) of NATO

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

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

The total spectrum of R&T activities is covered by the following 7 bodies:

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

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

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

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Urban Operations in the Year 2020

(RTO TR-071 / SAS-030)

Executive Summary

1. Introduction

The NATO Research and Technology Organisation's 1999 Technical Report Land Operations in the Year 2020 (LO2020) concluded that in the future it is likely that NATO forces will have to conduct operations in urban areas, i.e. where physical structures, non-combatants and infrastructure will be significant characteristics. Furthermore LO2020 concluded that such operations will pose significant challenges for the Alliance. Present capabilities for operating in urban areas are essentially those of World War II, which are characterised by high levels of casualties and extensive collateral damage. Currently NATO commanders have very few military options which would avoid serious damage and casualties when dealing with an enemy in urban areas. Such effects are unacceptable, particularly at the lower levels of conflict, where NATO forces are more likely to become involved. Therefore, it is essential that NATO provides its commanders with a range of capabilities for dealing with the varying conditions of operations in urban areas.

To follow up on these findings, SHAPE established a Military Application Study to examine the need for joint and combined doctrine and concepts for operations in urban areas. Seven NATO nations agreed to provide members for the Study Group, and the Studies, Analyses and Simulation (SAS) panel agreed in May 2000 that the UK should provide the Director. The Study Group examined the requirements of the SAS panel and prepared this Report for further consideration. The results are intended to identify directions for further research and to contribute to the NATO Defence Planning Process, the Defence Capabilities Initiative, and the Concept Development Experimentation Process.

2. Approach

The Study Group adopted a staged approach. It began with an examination of the future urban environment. It then outlined an overall conceptual framework for urban operations and operating guidelines. This identified a number of desired operational level capabilities needed to conduct such operations successfully.

These capabilities were themselves refined against further operational parameters then tested in a controlled Urban Seminar Wargame (USW) using two scenarios: one of a crisis response operation and the other a war fighting situation. Finally this led to the identification of mission needs/needed capabilities and a potential "roadmap" to address them.

3. The Future Urban Environment

The Study Group began by outlining a description of the likely nature of the future urban environment. It observed that urban areas will continue to increase in number and size and are likely to become focal points for unrest and conflict. The physical and human complexity of this environment presents unique challenges for a NATO commander which are not adequately addressed by those military capabilities designed for open environments.

4. The Manoeuvrist Approach to Urban Operations

The Study Group then identified an emerging overarching approach to urban operations that holds the promise of leading to significantly improved capabilities. The more traditional approaches to improving urban capabilities are focused at the tactical, single-Service level. These aim to help tactical forces better cope with the conditions of uncertainty, close proximity to the enemy and vulnerability that characterise tactical engagements. Initiatives include improved personal protection, wall breaching techniques, etc.

Emerging doctrinal approaches could enable a NATO commander to employ manoeuvre at the operational level in an urban environment in order to "Shape" (not just cope with) the conditions of the tactical fight. Initiatives include the use of joint surveillance assets to better focus the tactical engagements against the

enemy's critical points, and remote strike assets to reduce the amount of close combat required or to control information, mobility and the support available to the enemy's tactical forces.

"USECT" is a conceptual framework that can be used to describe the manoeuvrist approach. (This framework was first introduced by the US in a doctrinal publication dealing with joint operations in an urban environment.[1] It stands for Understand, Shape, Engage, Consolidate, and Transition. These components can be employed separately, sequentially or simultaneously.

The traditional approach to urban operations lacks the ability to gain information and knowledge regarding enemy locations, movements and status in an urban environment. Tactical information is frequently gained only when an enemy has been engaged, emphasising the "Engage" portion of the framework. This generally results in the application of overwhelming force to defeat an enemy.

In contrast, the manoeuvrist approach seeks to "Understand" the nature of the enemy, his locations and intentions before engagement by employing ISTAR and other assets, and to use the information gained to "Shape" the urban battlespace. This emphasises the "Understand" portion of the framework, and will allow a NATO Commander to employ a manoeuvrist approach at the operational level to "Shape" the tactical combat actions to advantage and "Engage" an enemy with precision effects, thereby reducing casualties and collateral damage.

Since tactical engagements will continue for the foreseeable future, a co-ordinated programme including both tactical and operational-level improvements is needed. Initiatives at the operational level, however, hold the promise of dramatic improvement.

Recommendation

The Study Group recommends NATO adopt the USECT framework as the basis for all further development of concepts and doctrine for urban operations

5. Operational Concepts

In order to achieve an overall manoeuvrist approach, a NATO commander has to have improved capabilities to Understand, Shape, and Engage in an urban environment. In order to identify and develop these capabilities, the Study Group first reviewed the full range of urban missions and identified operational concepts that a NATO commander might employ to conduct each mission successfully. These concepts are of two types: a traditional type in which the ability to "Understand" within an urban area is very limited (siege, destruction, frontal assault), and an emerging type in which improved doctrine and capabilities are utilised to Understand, Shape, and Engage with precision effects within the battlespace (precision strike, nodal isolation and capture, segment and capture, etc.)

Recommendation

The Study Group recommends that NATO adopt the mission types and emerging operational concepts identified as the basis for further study, investigation and experiment.

6. Capability Requirements

The capabilities required by each operational concept were identified by the Study Group and presented using the USECT framework. The "Capabilities Assessment Seminar" (CAPS) held in September 2001 resulted in a consolidated list of 42 operational-level capabilities (recorded in Chapter 5.) All of these capabilities would be necessary for a NATO commander to conduct successfully operations in an urban environment. To allow a more detailed examination of the most important capabilities, only 15 were designated as "key capabilities." Two principal criteria used for this selection were: military significance and the extent of the capability gap, as judged by the Study Group.

Recommendations

The Study Group recommends that NATO develop capabilities for use in urban areas by focussing on the key requirements identified in this study.

It is also recommended that all the 42 capabilities identified merit further examination but that the initial focus should be on the 15 key capabilities.

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[1] U.S. Department of Defense. Joint Staff. *Doctrine for Joint Urban Operations.* Joint Publication -3-06. 2nd Draft, October, 2000

It is further recommended that NATO should relate all future urban specific materiel developments to the 42 capabilities.

7. Potential Solutions

The final part of the study was to determine actions that could develop the key capabilities. These actions were classified into the types of initiatives that might be taken and were separated into four categories: Doctrine, Organisation, Training and Materiel. Although more than half of the capabilities were driven by Materiel, a significant number had drivers in the areas of Doctrine, Organisation and Training.

To gain further insight into the nature of potential solutions, an Urban Seminar Wargame (USW) was conducted by the Study Group in November 2001. For this activity twelve "System Concepts" were identified that could provide the required capabilities. Specific representative systems were then examined in the Wargame and their military attractiveness, technical attractiveness, technical risk and research cost were assessed by the Study Group. Three different vignettes were considered in this process.

Both the CAPS and USW assessments show that the essential capabilities are to collect, communicate, process, fuse, assimilate, and distribute information from many different sources, especially HUMINT, in a responsive manner. The sensors and platforms that support these capabilities emerged as the most valued by USW participants.

The ability to exploit effectively the information gained to "Shape" and "Engage" also received high priority. Key systems included unmanned vehicles and non-lethal weapons to reduce casualties, and precision delivery to limit collateral damage.

Recommendations

The Study Group recommends that NATO should focus on potential solutions for enhanced capabilities in urban areas at the operational level of command.

It is also recommended that NATO give priority to Concept Development and Experimentation in order to determine potential solutions across all aspects of Doctrine, Organisation, Training, Materiel, Leadership, Personnel and Facilities (DOTMLPF). This should include:

- Identifying those modelling and simulation requirements for operational analysis and training.
- Addressing policy implications for issues such as the employment and use of NLW, unmanned systems/robots, cyber ops, etc.
- Promoting interoperability.

8. Principal Recommendations

The Study Group recommends that:

- The operational concepts, capability requirements and potential solutions offered in this Study should be expended and further investigated using the USECT framework. This should include concept development and experimentation. This should also consider modelling and simulation tools to support the process.
- The capabilities described in this study, and solutions developed are reflected in NATO's Defence Planning Process as Long Term Requirements.
- NATO should establish a Branch level lead within SHAPE to provide oversight and be the focal point for future urban activities.
- Points of Contact should be nominated in other appropriate HQs and offices to co-ordinate urban related efforts.
- NATO should establish an Urban Operations Working Group with a lead nation[2] to serve as a focal point in support of SHAPE, to co-ordinate NATO and member nations' urban related efforts and to build a plan based upon directions identified in this study.

Finally the Study Group recommends that RTB should endorse this study and its recommendations and forward them to the Military Committee, the Conference of National Armaments Directors (CNAD) and the Strategic Commands.

[2] In May 2002 Germany and the Netherlands indicated a willingness to provide this lead.

Opérations en zone urbaine en l'an 2020

(RTO TR-071 / SAS-030)

Synthèse

1. Introduction

Le rapport technique de 1999 sur les opérations terrestres en l'an 2020 (LO 2020), établi par l'Organisation OTAN pour la recherche et la technique, concluait qu'à l'avenir, l'OTAN devrait vraisemblablement mener des opérations dans des zones urbaines, où les aménagements et les infrastructures ainsi que la présence de non-combattants seront des caractéristiques importantes à prendre en compte. Le rapport précisait en outre que ce type d'opérations constituerait un défi majeur pour l'Alliance. En effet, les moyens actuellement disponibles pour des opérations en zone urbaine sont essentiellement ceux de la deuxième guerre mondiale et se caractérisent par des pertes élevées et des dommages collatéraux étendus. Aujourd'hui, les commandants OTAN disposent d'un nombre très limité d'options militaires leur permettant d'éviter des dommages et des pertes trop importantes lorsqu'ils interviennent en zone urbaine face à un ennemi. De tels effets sont inacceptables, surtout aux premiers stades d'un conflit, où la probabilité d'une implication des forces de l'OTAN est plus élevée. Il est donc essentiel que l'OTAN mette à la disposition de ses commandants un éventail de moyens leur permettant de s'adapter aux conditions changeantes des opérations en zone urbaine.

Suite à ces conclusions, le SHAPE a lancé une étude en vue d'applications militaires afin d'évaluer la nécessité de doctrines et de concepts conjoints et combinés pour les opérations en zone urbaine. Sept pays de l'OTAN ont accepté de désigner des membres pour former le groupe de travail; la commission SAS (Etudes, analyse et simulation) a décidé pour sa part, en mai 2000, que le Royaume-Uni fournirait le directeur. Le groupe d'étude a étudié les besoins recensés par la commission SAS et a établi le présent rapport en vue d'un examen complémentaire. Les résultats de ce travail doivent permettre de définir des orientations pour les futures activités de recherche et d'apporter une contribution au processus d'établissement des plans de défense de l'OTAN, à l'initiative sur les capacités de défense et au processus de développement et d'expérimentation de concepts.

2. Approche

Le groupe d'étude a adopté une approche comportant plusieurs étapes. Il a tout d'abord analysé le futur environnement urbain. Il a ensuite défini un cadre conceptuel général pour les opérations urbaines ainsi que des lignes directrices pour l'action à mener. Le groupe a recensé un certain nombre de capacités opérationnelles souhaitées qui sont nécessaires au succès de telles opérations.

Ces capacités ont ensuite été définies plus précisément en fonction d'autres paramètres opérationnels avant d'être mises à l'essai dans le cadre d'une simulation contrôlée de combat en zone urbaine au moyen de deux scénarios portant respectivement sur une opération de réponse à une crise et sur une situation de combat. Ce travail a permis d'identifier les besoins relatifs à la mission et les capacités requises ainsi que d'établir un « plan de marche » possible en vue d'apporter les solutions.

3. Le futur environnement urbain

Le groupe d'étude a d'abord entrepris de décrire la nature probable du futur environnement urbain. Il a noté que le nombre et la taille des zones urbaines vont continuer d'augmenter et que ces zones pourraient devenir des foyers de troubles et de conflits. La complexité matérielle et humaine de cet environnement fait que les commandants de forces OTAN sont confrontés à des défis inédits auxquels les capacités militaires conçues pour des environnements « ouverts » ne permettent pas de répondre de manière adéquate.

4. L'approche manœuvrière des opérations en zone urbaine

Le groupe d'étude a mis en évidence une approche globale nouvelle des opérations en zone urbaine qui permettrait d'améliorer notablement les capacités dans ce domaine. Les approches plus traditionnelles visant à améliorer les capacités utilisées en zone urbaine privilégient l'échelon tactique et ne concernent qu'une seule arme. Leur but est d'aider les forces tactiques à mieux réagir face aux conditions qui caractérisent le combat tactique, à savoir l'incertitude, la proximité immédiate de l'ennemi et la vulnérabilité. Les nouvelles perspectives concernent l'amélioration de la protection individuelle, les techniques d'ouverture de brèches, etc.

Grâce aux nouvelles approches doctrinales, un commandant OTAN pourrait employer les forces de manœuvre à l'échelon opérationnel dans un environnement urbain pour « modeler » les conditions du combat tactique (et non pas

seulement y faire face). Parmi les solutions envisagées, on peut citer l'utilisation de moyens de surveillance interarmées afin de mieux diriger les actions tactiques sur les points névralgiques de l'ennemi et l'emploi de moyens de frappe à distance afin de limiter le recours au combat rapproché ou de contrôler l'information, la mobilité ainsi que le soutien dont disposent les forces tactiques de l'ennemi.

Le concept américain d'USECT peut être utilisé pour décrire l'approche manœuvrière. (Ce concept, né aux Etats-Unis, est apparu pour la première fois dans une publication sur la doctrine traitant des opérations en zone urbaine[1]. USECT, pour « Understand, Shape, Engage, Consolidate and Transition », consiste à « comprendre », « modeler », « prendre à partie », « faire la synthèse des informations » et « assurer la transition ». Ces aspects peuvent être utilisés séparément, successivement ou simultanément.

L'approche traditionnelle des opérations en zone urbaine ne prend pas en compte la capacité de recueillir des informations et des données sur les positions, les mouvements et l'état des forces ennemies dans un environnement urbain. Bien souvent, les informations tactiques ne sont recueillies qu'après la prise à partie d'un ennemi, l'accent étant alors mis sur la phase correspondante du concept. C'est ainsi que, pour mettre l'ennemi en échec, on a généralement recours à des forces beaucoup trop importantes.

A l'opposé, l'approche manœuvrière consiste à « comprendre » la nature de l'ennemi, ses positions et ses intentions avant de le prendre à partie en utilisant la capacité ISTAR et d'autres moyens et à exploiter les informations recueillies pour « modeler » l'environnement de combat urbain. Ces activités, réunies sous le concept USECT, permettront à un commandant OTAN d'utiliser une approche manœuvrière à l'échelon opérationnel pour « modeler » les aspects du combat tactique en les tournant à son avantage et « prendre à partie » l'ennemi avec des armes de précision, réduisant ainsi les pertes et les dommages collatéraux.

Dans la mesure où, dans un avenir proche, les actions tactiques vont se poursuivre, il faut mettre sur pied un programme d'améliorations à l'échelon tactique et à l'échelon opérationnel. Les nouvelles perspectives qui se dessinent à l'échelon opérationnel devraient amener une amélioration spectaculaire.

Recommandation

Le groupe d'étude recommande que l'OTAN adopte le concept USECT comme base pour l'élaboration ultérieure des concepts et de la doctrine applicables aux opérations en zone urbaine.

5. Concepts opérationnels

Afin de mettre en œuvre une approche manœuvrière globale, un commandant OTAN doit avoir à sa disposition des capacités améliorées lui permettant de « comprendre », de « modeler » l'environnement et de « prendre à partie » l'ennemi dans un environnement urbain. Dans le but de recenser et de développer ces capacités, le groupe d'étude a tout d'abord passé en revue la gamme complète des missions en zone urbaine et défini des concepts opérationnels qu'un commandant OTAN pourrait appliquer pour que chaque mission soit une réussite. Ces concepts sont de deux types : l'un, traditionnel, dans lequel l'aptitude à « comprendre » l'environnement urbain est très limitée (siège, destruction, attaque frontale) et l'autre, nouveau, dans lequel l'amélioration de la doctrine et des capacités est mise à profit pour « comprendre » et « modeler » l'environnement et « prendre à partie » l'ennemi en utilisant des armes de précision dans l'espace de combat (frappe de précision, isolement et prise de centres nodaux, segmentation et prise, etc.).

Recommandation

Le groupe d'étude recommande que l'OTAN adopte les types de mission et les nouveaux concepts opérationnels ainsi définis pour qu'ils servent de base aux études, aux recherches et aux expériences futures.

6. Capacités requises

Les capacités nécessaires à chaque concept opérationnel ont été recensées par le groupe d'étude et présentées dans le cadre du concept USECT. Le séminaire sur l'évaluation des capacités (CAPS) tenu en septembre 2001 a permis d'établir une liste de 42 capacités de niveau opérationnel (chapitre 5). Un commandant OTAN devrait pouvoir disposer de l'ensemble de ces capacités pour mener à bien des opérations dans un environnement urbain. Afin de permettre un examen plus détaillé des principales capacités, quinze « capacités essentielles » ont été définies sur la base de deux grands critères : l'importance sur le plan militaire et l'ampleur des lacunes, selon l'avis du groupe d'étude.

Recommandations

Le groupe d'étude recommande que l'OTAN développe des capacités à utiliser dans des zones urbaines en se concentrant sur les besoins essentiels mis en évidence dans la présente étude.

Il recommande en outre que les 42 capacités recensées soient analysées plus avant, mais que l'accent soit mis dans un premier temps sur les 15 capacités essentielles.

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[1] U.S. Department of Defense. Etat-major interarmées. *Doctrine for Joint Urban Operations*. Publication interalliée-3-06. 2e version, octobre 2000

Il recommande aussi que l'OTAN mette en relation tout développement futur de matériel destiné aux opérations en zone urbaine avec les 42 capacités recensées.

7. Solutions possibles

La dernière partie de l'étude est consacrée aux mesures permettant de développer les capacités essentielles. Ces mesures sont groupées en fonction des types d'initiatives qui pourraient être prises et rangées dans quatre catégories : doctrine, organisation, entraînement et matériel. Plus de la moitié des capacités sont liées au matériel, mais nombreuses sont celles qui dépendent aussi de la doctrine, de l'organisation et de l'entraînement.

Afin de mieux connaître la nature des solutions possibles, le groupe d'étude a organisé en novembre 2001 un séminaire sur la simulation d'opérations en zone urbaine (USW). Dans ce but, douze « concepts de systèmes » pouvant fournir les capacités requises ont été répertoriés. Le groupe d'étude a ensuite analysé différents systèmes représentatifs lors de la simulation et a évalué leur intérêt sur le plan militaire et sur le plan technique, le risque technique qu'ils présentent et le coût de la recherche associée. Trois « vignettes » différentes ont été étudiées dans le cadre de ce travail.

Les évaluations menées lors des séminaires CAPS et USW montrent que les capacités essentielles consistent à recueillir, communiquer, traiter, fusionner, assimiler et distribuer, de manière adaptée, des informations provenant de sources multiples, notamment le renseignement humain. Selon les participants au séminaire USW, les capteurs et les plates-formes à l'appui de ces capacités présentent le plus grand intérêt.

L'aptitude à exploiter efficacement les informations recueillies lors des phases « modeler » et « prendre à partie » a également été jugée hautement prioritaire. Parmi les principaux systèmes considérés, on peut citer les véhicules sans pilote et les armes non létales, qui permettent de réduire les pertes, ainsi que les dispositifs de largage de précision, dont le but est de limiter les dommages collatéraux.

Recommandations

Le groupe d'étude recommande que l'OTAN mette l'accent sur la recherche de solutions permettant d'améliorer les capacités pour les opérations en zone urbaine à l'échelon du commandement opérationnel.

Il recommande aussi que l'OTAN donne la priorité à l'élaboration et à l'expérimentation de concepts afin de définir des solutions possibles pour tous les aspects concernant la doctrine, l'organisation, l'entraînement, le matériel, le commandement, le personnel et les installations (DOTMLPF). Ces tâches devraient notamment consister à :

- recenser les besoins de modélisation et de simulation en ce qui concerne l'analyse opérationnelle et l'entraînement;
- étudier les incidences sur le plan de l'action dans des domaines tels que l'emploi des armes non létales, des systèmes sans pilote/robotisés, les opérations de guerre électronique, etc.
- favoriser l'interopérabilité.

8. Recommandations principales

Le Groupe d'étude fait les recommandations suivantes :

- Les concepts opérationnels, les capacités requises et les solutions possibles qui sont proposés dans la présente étude devraient être développés et analysés plus avant en utilisant le concept USECT. Cela devrait donner lieu notamment à un travail de développement et d'expérimentation. Il conviendrait aussi d'envisager l'emploi d'outils de modélisation et de simulation à l'appui de ce processus.
- Les capacités décrites dans la présente étude et les solutions proposées sont reprises en tant que besoins à long terme dans le processus d'établissement des plans de défense de l'OTAN.
- L'OTAN devrait mettre en place, au sein d'un service du SHAPE, une « Branche » ayant une mission de contrôle et servant de point focal pour les activités qui seront menées en zone urbaine.
- Des points de contact devront être désignés dans d'autres QG et services concernés en vue de coordonner les activités en rapport avec les opérations en zone urbaine.
- L'OTAN devrait créer un groupe de travail sur les opérations en zone urbaine qui, sous la direction d'un pays pilote[2], servirait de point focal à l'appui du SHAPE et serait chargé de coordonner les activités de l'OTAN et des pays membres concernant les opérations en zone urbaine et d'élaborer un programme de travail en se fondant sur les orientations définies dans la présente étude.

Enfin, le groupe d'étude recommande que le RTB entérine la présente étude et les recommandations qui y sont formulées et les transmette au Comité militaire, à la Conférence des Directeurs nationaux des armements (CDNA) et aux commandements stratégiques.

[2] En mai 2002, l'Allemagne et les Pays-Bas ont fait savoir qu'ils étaient disposés à jouer le rôle de pays pilotes.

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CHAPTER 1

INTRODUCTION

1.1 Background

Asymmetric threats, emerging technologies and operations in urban areas have been identified by an RTO (Research and Technology Organisation) Technical Report *Land Operations in the Year 2020* (LO2020)[1] as major features and potential challenges for Alliance Operations in the future. Increasing urbanisation is such that NATO forces may well continue to conduct urban operations in the future. Current NATO military concepts do not address this general trend in sufficient detail and there is no agreed Allied doctrine for operating in an urban environment.

Following the LO2020 study which identified the impact of emerging technologies in future land operations, SHAPE Headquarters requested RTO to establish a Military Application Study (The Study Group) to study the joint and combined doctrine and concepts for operations in urban areas. Seven NATO nations (CA, FR, GE, IT, NL, UK, US) agreed to provide members for this Study Group. The SAS (Studies, Analyses and Simulation) panel agreed at their meeting in Lillehammer (May 2000) that the UK should provide the director for this Study Group and the first meeting took place in Washington (June 2000). Seven subsequent meetings have taken place in various NATO countries to examine the requirements of the SAS panel and to prepare a report for further consideration.

1.2 Purpose

The purpose of the Study Group has been to develop a conceptual framework for operations in an urban area that will support future NATO missions and tasks in 2020.

To provide an appropriate understanding of what this conceptual framework would encompass, the Study Group has addressed, in the first instance, the strategic operational and tactical aspects of conflict across the whole spectrum of warfare in generic urban environments. The force structure considered in this examination is a NATO / coalition joint force operation which might consist of a Combined Joint Task Force headquarters (CJTF) leading a corps sized land component, supported by an air and maritime component.

The intent is to provide a concept that may prove to be the basis from which forces can respond to the challenges inherent in coalition operations in urban areas. When agreed, this concept should allow NATO military forces to respond to the challenges inherent in coalition operations in urban areas. This Report is to contribute to the NATO Defence Planning Process, the Defence Capabilities Initiative, the Concept Development Experimentation Process and provide direction for further research.

1.3 Objectives

The specific objectives for the Study Group to examine have been:

- A description of the urban environment in the future (up to 2020).
- The construction of a conceptual framework for urban operations.
- An identification of the operational level for missions and tasks when conducting operations in an urban environment.
- A listing of the required urban operational capabilities for 2020. This, by implication, provides SHAPE with an awareness of the potential gaps in and between these capabilities.
- To offer potential solutions for SHAPE to consider based on the detailed conclusions and recommendations of this Study Group.

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[1] *Land Operations in the Year 2020* (LO2020); RTO-TR-8; A-323(SAS)TP/5; Published March 1999.

1.4 Study Group Approach

The Study Group adopted a staged approach. It began with an examination of the future operating environment. It then outlined an overall conceptual framework for urban operations (Chapter 3) and operating guidelines (Chapter 4). This identified a number of desired operational level capabilities needed to conduct such operations successfully (Chapter 5).

These capabilities were themselves refined against further operational parameters then tested in a controlled Urban Seminar Wargame (USW) using two scenarios: one of a crisis response operation and the other a war fighting situation. Finally this led to the identification of mission needs/needed capabilities (Chapter 6) and a potential “roadmap” to address them (Chapter 7).

1.5 Definition of Urban Operations

For the purposes of this study operations in an urban area, or urban operations, are defined as those military and other activities in an area of operations where significant defining characteristics are man made physical structures, associated urban infrastructures and non-combatant populations.

CHAPTER 2

THE FUTURE URBAN ENVIRONMENT

2.1 Background

Since NATO's inception in 1949 there have been no large scale operations involving substantial NATO military ground forces fighting in urban areas. It appears to have been assumed that the experience gained from such operations during World War 2 would remain useful if urban operations became necessary. These assumptions should be re-considered not least because military operations are now constrained by legal, social and moral imperatives that did not apply previously and because technology promises military commanders new and potentially relevant capabilities.

Demographic trends indicate that the further urbanisation of towns and cities will continue, and that future military operations of all types could be expected to have an urban dimension. Such operations will invariably involve political, diplomatic, economic and social considerations as well as strictly military ability. Future operations in urban areas are to be integrated with other government and non government agencies, particularly at the strategic and operational levels and that the process of decision making with an enlarged chain of command will reflect this.

2.2 The Urban Environment

2.2.1 The Nature of the Urban Area

The urban environment is complex and diverse and ranges from sophisticated, metropolis-style superstructures within a well-developed infrastructure, to high and low density urban shantytowns with very poor infrastructure. It includes towns and cities that may themselves contain commercial, industrial and manufacturing areas, as well as a variety of communication and energy production facilities. The complexity of the current urban environment is perhaps best defined as the cumulative effect of a series of interconnected layers of society and infrastructure. These comprise different sized groupings of cultural, ethnic and social groupings living in differing conditions and with many diverse views about their role in the community.

The commercial, industrial, administrative and residential areas may each need individual analysis. Indeed, today's urban environment represents the centres of industry, commerce and social activities and, because of the size and the presence of different groups within it, is the probable area where tensions and perhaps conflicts are most likely to arise in the future. They could also continue to be very attractive to terrorist groups.

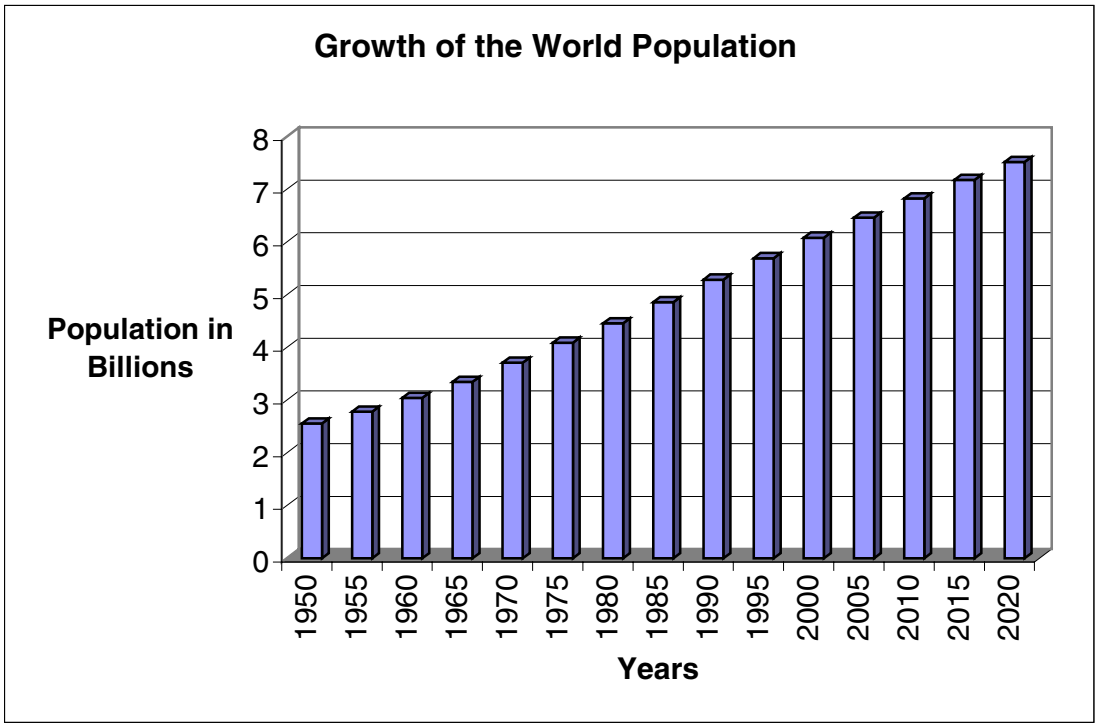
2.2.2 Trends in the Urban Environment

Demographic trends indicate that populations are expanding, in some cases exponentially. Population growth leads inexorably to an increased urbanization as people move towards areas where jobs, some form of housing, basic resources and facilities are perceived to be available. However this may be a cause of tension where poverty, slums and poor living are a result of inadequate urban infrastructure. The Study Group considered that this trend would increase in significance and may in future lead to unrest, civil disorder and security threats which will compel local authorities to respond.

2.2.3 Globalisation

Technical innovation and development particularly in the areas of communication and economic growth have improved significantly over the last decade. Extensive travel and the free flow of information around the world has brought the world into a much more inter-related community, and in doing so has exposed to international attention matters of local or national concern. National sovereignty issues are often highlighted in the international arena, sometimes in an awkward or unfavourable light.

There are undoubted benefits from this increased globalisation of world affairs but there are also unwanted side effects, which may confront traditional customs, religious values and the use of natural resources that could easily result in increased tensions, misunderstandings and possible conflict. Census figures also indicate that over half of the world's population in 2020 will be living in urban areas, and thus the potential side effects of globalisation will probably be manifested initially in urban areas of the world.



- **Figure 2-1 Population Growth[2]**

2.2.4 Population Migration

In addition to the increasing population growth in the world there are noticeable sub- trends for populations, or large groups of people to move from less developed areas to more developed areas, predominantly urban, seeking economic and social improvement. Such migration can be the cause of national concern, increased tension and perhaps conflict, as resources become depleted, economic conditions and separate customs become intermingled and become the cause of resentment in the local and regional community.

2.2.5 Natural Resources

The trends described above will, in their separate ways, have a direct effect on the use or abuse of natural resources in the world. In an ideal world there would be enough natural resources to satisfy all requirements, including projected population growth. In reality, though, in many parts of the world, it is anticipated that unequal population pressures, together with existing mismanagement and corruption, will lead to the exhaustion of natural resources sooner rather than later. Lack of water, especially, could well cause tensions and possible conflict particularly at the local level. Technical industrial developments and improvements in the agrochemical industry may well mitigate these problems. However it is estimated that the lack or abuse of natural resources will continue to be a growing concern to nations which have large populations in urban areas and who need natural resources from elsewhere to sustain life and livelihood (agriculture and industry).

[2] US Census Bureau facts extracted from the Bureau's Web Site. [URL – http://www-census.gov/ipc/www]

2.3 Military Considerations for the Urban Environment

The Study Group considers that the following military considerations will be significant when planning operations in urban areas. These also reflect the enduring factors and trends described in LO2020, and are slanted towards operations in urban areas.

2.3.1 The Nature of Conflict in Urban Areas

The fundamental character of conflict in urban areas will continue to present a serious physical and moral challenge for the soldier: a combination of extreme danger, rapidly changing circumstances and conditions of chaos and uncertainty, with severe physical demands placed on individuals. The capacity and mental outlook of a soldier to conduct aggressive close combat operations and to overcome the friction inherent in combat will remain paramount. The application of military force, particularly in urban areas, is likely to be influenced dramatically by current moral and social development. Changes could have their effect in making Rules of Engagement more complicated to apply and the timing of any application of military force more difficult to judge.

Populations could well have a greater influence on future campaigns. This influence might start at the home base and could affect the sea, air and ground deployment corridors to the theatre of operations, from supportive (e.g. soldiers' families, general public), dependent (e.g. refugees) to hostile (e.g. disaffected civilians in theatre and other pressure) groups. There will also be many official and unofficial agencies whose views will need to be considered and heeded where and when appropriate. The need to influence perceptions and public awareness reinforces the requirement for information to be handled in a systematic and coherent manner across the stages of an operation, including conflict and post-conflict activities. Information Operations are likely to undergo radical changes, but it is considered that these changes will probably have a direct and perhaps strategically decisive bearing on the conduct of future operations. These considerations will also have significant resource implications, which should be addressed now.

2.3.2 The Nature of the Enemy

In recent years ethnic, tribal, social and political issues have re-emerged and provide the basis for tension and conflict in many areas around the world. Several instances of these tensions and conflicts have occurred already and this is likely to continue in the period under review.

Many of these conflicts have not been of the View 1 type of scenario[3], although the two separate campaigns in Grozny were. The large majority of conflicts and sources of tension have followed more closely the View 2 scenario, or have resulted in some types of peacekeeping operations being conducted by either NATO or a coalition of other forces. The patterns of insurgency and counter insurgency around the world in the last few decades are that these have become urban in nature, and deliberately so in order to take advantage of the perceived weakness of counter insurgency forces to operate effectively in urban areas. It has for many years been recognised that by using an asymmetric approach an insurgent can operate more freely and effectively in crowded urban areas to harass the forces of law and order with a much reduced risk to himself. Guerrillas, insurgents and other non-state groups have all taken advantage of the benefits (to them) of operating in such an environment and will no doubt continue to do so.[4]

Military commanders will have to recognise that organisations, groupings, command and control arrangements and training will have to be reshaped, possibly in a radical manner, to deal effectively with these

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[3] Annex I to *Land Operations in the Year 2020*. (RTO AC/323(SAS)TR/5 Nov 98). View 1 represents warfare between two modern, well equipped, well trained, mechanised forces; while View 2 represents modern force opposed by organisations that do not necessarily represent states nor are they structured in the manner of most armies.

[4] For example: Belfast, Mogadishu, and Bogota.

developments. View 1 and View 2 operations are not likely to be easily and separately identified. It is more likely that all operations will contain activity characterised by both types of view.

2.3.3 Future Technology

The principal technological trends include those characterised by the opportunities available through advances in information collection and handling, miniaturisation of components, longer operational reach and greater clarity in intelligence and precision munitions, robotics, and non-lethal weapons. Picking the technological "winners" - those most likely to overcome the inherent complexity of modern day conflict - was the purpose of the NATO "Land Operations in the Year 2020" (LO2020) Study. That study identified ten technologies[5] on which to focus, many of which have relevance in an urban environment. Other technologies and innovations could, however, be available to friend or foe alike and could also be "potential winners" in conflict in urban areas.

2.3.4 Nuclear, Biological, Chemical (and Toxic) Hazards

There is already evidence that information and technical knowledge concerning NBC weapons and toxic hazards are available to nations and non-state parties not subject to Arms Control agreements. Nuclear weapons technology is being acquired by potentially hostile states and perhaps non-state actors. Novel explosives and specialised chemical agents are becoming more generally available and there is growing interest in development of biological and bacteriological agents.

The use of these weapons and devices would represent the extreme limit of military and civilian risk and may be applied to civilian as well as military targets. The likelihood of the presence, and potential use by adversaries, of NBC weapons and industrial or natural NBC agents in future conflict is increasing. The use of these weapons in an urban environment would magnify many times the difficulties of military operations.

2.3.5 The Use of Space

The exploitation of space will become more important for military commanders. It will be necessary to integrate space capabilities with sub-space capabilities, including the manned and unmanned surveillance capabilities of land, air and maritime forces. Space-based systems will include: precision global navigation, communications, ISTAR, command and control warfare including counter ISTAR activities, the use of electronic warfare, and the early warning for, and counter to, ballistic missile attack.

These systems, if they can overcome the urban "clutter" and line of site difficulties, will be of increasing importance and significance when dealing with potential enemies in urban areas.

2.4 Conclusions

2.4.1 General

The US Bureau of Census projections for the world population growths show that these growths will increase by 25% from now until 2020 and that the vast majority of this increase will be located in urban areas. In many areas there will be more demand for limited natural resources and, coupled with the benefits and side-effects of globalisation there are bound to arise misunderstandings, tension and mismanagement of issues resulting

[5] High power electrical technologies, directed energy weapons, computing technologies, communication technologies, electronic/information warfare technologies and electronic devices, biotechnology, structural materials technology, human factors and man-machine interfaces, precision attack technologies, automation and robotics.

from the use or abuse of these limited resources. Urban areas are therefore likely to become the principal arenas for these disputes and conflicts.

2.4.2 Implications for Military Commanders

Operations in urban areas have always been difficult and hazardous for those involved and hitherto military commanders avoided such operations where this was possible. In the future these operations are likely to be unavoidable, difficult and complicated to conduct. The military commander will increasingly have to integrate military planning within an overall campaign plan prepared by national or international authorities and executed with multinational partners. Linked to this will be the problems associated with Rules of Engagement (ROE) and complex chains of command, all of which should be taken into account before operations start.

Added to the traditional military hazards of operating in urban areas, there will be the extra complications associated with large extended urban and sub-urban areas, high rise buildings and underground areas. This will be further complicated by crowd control issues, cultural and racial differences, movement of non-combatants, operating in a three dimensional environment and the prospect of collateral damage to the infrastructure. The consequences of not dealing with these hazards appropriately could be immense for allied forces and non-combatants alike.

The presence of significant numbers of non-combatants remains one of the defining characteristics of operations in an urban area. The military commander may have his freedom of action reduced by legal constraint. The attitude of the local populace, whether hostile, compliant or supportive, will be an important factor in planning an appropriately scaled and resourced force structure.

The urban environment may both ease and amplify the operations and scrutiny of the media. Information operations will remain crucial. This will have implications on the organisation of HQs and staffs.

2.4.3 Implications for NATO

The complexity of the urban environment will be a major factor in future operations. For NATO to succeed it has to have the appropriate concepts, doctrine, organisation, training and materiel for the future operating environment.

A general deduction from these implications is that NATO, as an Alliance, may have to examine its current decision-making arrangements closely to take account of these emerging environmental developments. More complex judgements and decisions will have to be taken in what are likely to be fast moving military situations within a campaign complicated by concerns over casualties to allied forces, non-combatants and damage to critical infrastructure.

Especially for contingencies that do not necessarily threaten NATO survival but require NATO military action, restrictive ROE may be imposed. For NATO civilian leaders, integration of the military campaign into overarching diplomatic, economic and informational lines of operation becomes paramount. This will necessarily involve deeper co-ordination with other international and regional organisations, non-governmental organisations and private volunteer groups.

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CHAPTER 3

THE MANOEUVRIST APPROACH TO URBAN OPERATIONS

3.1 Background

Traditional approaches to urban operations have been characterised by slow and linear progress, firepower solutions, significant casualties among non-combatants and the destruction of much infrastructure. There are many reasons for this approach to operations in urban areas; the desire to avoid own casualties, the lack of technical means to prevent wide scale destruction, an indifference to the needs of the local population and a desire to prevent enemy forces escaping.

Today the effects of this type of approach could risk the strategic or operational objectives of the campaign and lose support from Allies in multinational operations. There is no formalised NATO doctrine for operating in urban areas and only the experience of the 2nd World War is available for allies to make use in conducting such operations. Hitherto it has generally been assumed that urban areas would be bypassed or vacated in any major conflict in Europe.

More recently NATO forces have been involved with Non Article 5 operations – particularly in the Balkans and in areas that are either industrialised or urban in nature, and it is perceived that this trend will continue to grow in the next 20 years.

All NATO nations train their forces to operate in open terrain adopting the manoeuvrist approach in their plans to defeat the enemy. This approach has now to be adapted to suit the terrain and conditions of urban areas.

3.2 Scope

This chapter examines tenets of the manoeuvrist approach to operations and their applicability to urban operations. The Study Group approached this through the application of an emerging conceptual framework of Understand, Shape, Engage, Consolidate and Transition (USECT) that assists the design and development of a new operational framework for military tasks in urban areas. Major characteristics of this concept are that:

- The manoeuvrist approach to operations is adopted.
- The concept is pitched at the operational level.
- The concept applies across the spectrum of conflict.

3.3 The Manoeuvrist Approach

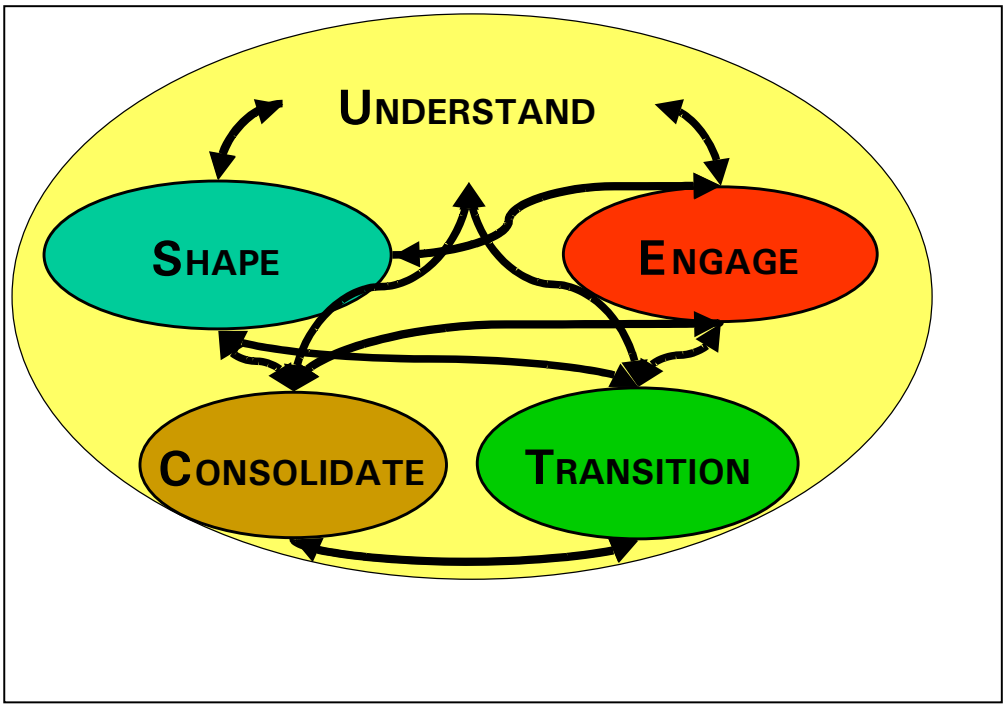
The manoeuvrist approach is defined as an approach to operations in which shattering the enemy's overall cohesion and will to fight is paramount. It calls for an attitude of mind in which doing the unexpected, using initiative and seeking originality is combined with a ruthless determination to succeed. The principles and thought process that underpin the manoeuvrist approach apply to all operations including Operations Other Than War (OOTW). This is because the successful application of the manoeuvrist approach inspires a particular attitude of mind and a method of analysis that is relevant to any circumstances involving the use of military force to resolve conflict.

The intent is to enable an operational commander to understand and shape the urban battlespace and engage targets with greater precision. NATO forces operating in the open can exploit sensor capabilities and firepower to good effect. In the future it is hoped that NATO will also achieve superiority in an urban environment by developing urban-specific capabilities to engage the enemy with precision and effect. This would be based on sound intelligence and consolidating their position effectively in order to pass authority for the control of urban areas back to civilian authorities.

3.4 Conceptual Framework

Operations in urban areas demand a subtle blend of tempo, surprise, simultaneity and firepower that will differ in nature to high tempo operations in open terrain. A number of factors will influence this approach. There will be a need for selective destruction of certain targets and areas and this may mean close combat as an alternative to firepower if this is not effective. However, the more traditional street-by-street, house-by-house clearance method will require modification. Within close combat operations there will continue to be a need for stand-off attack to avoid closer combat. However, there will always be a need for forces to have the ability to operate in very close proximity with an enemy who may be fighting on familiar ground. Manoeuvring to defeat enemy forces in urban terrain will be more difficult. The urban terrain channels and restricts movement, routes can be blocked and ambushes and defensive strong points can prevent movement in an unrestricted manner. While air platforms are vulnerable, an ability to move 3 dimensionally will be necessary in order to achieve surprise and simultaneity, attacking an enemy at a time and place of one's own choice with decisive results. Conventional operations that aim to clear whole areas have become unrealistic and probably unnecessary. It should not be the aim to engage the enemy in a close fight wherever he is found but rather, for decisive effect, to target the source of the enemy's strength. However, locating particular objectives becomes difficult when an enemy chooses not to defend specific points but to remain mobile and has an unconventional C2 structure and few logistic resources. At the operational level, the selection of objectives and targets should aim to disrupt, through a concentration of effects, not only an enemy's physical resources but also his morale and fighting spirit.

Using the manoeuvrist approach as a foundation, a conceptual framework for planning and conducting urban operations can be constructed from the interrelated activities of USECT. Although outlined sequentially in this Chapter, these activities function together in an interdependent and simultaneous manner. USECT activities may be sequential or concurrent; they may often overlap. The point where one stops and another begins is often difficult to define. In some cases, the use of all five may not be necessary. For example, in some urban areas a commander may conduct Understanding and Shaping activities so effectively that he may be able to shift directly to Transition activities and hand over the operation to follow-on forces or other organisations, whereas in an adjacent neighbourhood, forces may be fully engaged. This illustrates the complexity of urban operations and the vital need to understand in order to allow shaping, engaging or consolidating activity. This is reflected in the diagram below.



- **Figure 3-1 The USECT Construct**

3.5 The Use of USECT for Operations in Urban Areas

The manoeuvrist approach moves the focus from the traditionally predominant Engagement element – reflective of attrition – to the Understand element (usEct to Usect). By developing a better capability to Understand the urban battlespace, the enemy's decisive points can be effectively targeted and the desired endstate achieved. The precepts for each of the five elements of USECT are summarised in this section.

3.5.1 Understand (U)

The need to 'understand' will continue throughout any operation. It is critical to creating and maintaining an advantage in the tempo of any operation. An enemy may choose to operate in an urban environment to diminish the effect of NATO's military capabilities and resources.

While armed forces will have a range of technical equipments, weapons and other platforms to assist the acquisition of intelligence and information, the major overriding factor in the conduct of operations in urban areas is the population itself. NATO forces need to ensure that, wherever possible, it has the diplomatic, economic, social and cultural means to understand and influence the situation in urban areas.

The requirement to understand the battle space includes evaluation of physical terrain, buildings, cultural centres and critical infrastructure such as utilities, transportation systems and hospitals. Threat analysis extends beyond conventional enemy forces to criminal gangs, vigilantes or insurgents operating among, and indistinguishable from the local population. The situation may be complicated by the presence of international non-military governmental departments. Intelligence Preparation of the Battlespace (IPB) remains a valid tool but it is more complicated by the human factors present. Fighting in urban areas requires a great deal of specialised training and suitable equipment coupled with experience and confidence, which may not always be available.

When preparing the Estimate a commander will need to evaluate all relevant forces, groupings, cultural and religious factors and to identify critical nodal points in the urban area not all of which are physical.

Finding the enemy within the urban area is particularly difficult and is without guaranteed communications, yet a commander requires reliable information to maintain a proper awareness of the situation in order to manoeuvre troops with safety and to target systems with precision.

The establishment of the intelligence, surveillance, target acquisition and reconnaissance (ISTAR) systems is therefore fundamental to understanding. This should include the use of air and space sensors coupled with HUMINT sources and Special Operations Forces. Ground reconnaissance will also be required to complement this activity and probe areas where airborne and other remote sensors are unable to penetrate.

At the same time civil-military links with suitable groups, agencies and institutions such as religious and community leaders, local government officials, public utilities personnel and local emergency services organisations will be important. A CIMIC plan to deal with non-combatants, refugees, displaced persons and injured civilians will be a fundamental part of the military campaign plan without necessarily compromising military security and freedom of action.

3.5.2 Shape (S)

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

One aspect of Shaping is the strategic movement of forces into theatre and their positioning forces for operations. Depending on the situation and objectives to be achieved, forcible entry may be required. Shaping also includes actions to maximise mobility, force protection and establishing air and maritime superiority. At the same time, establishing refugee camps or sanctuaries for non-combatants, providing safe passage for them, and arranging emergency services, which as shaping activities at the highest level may be the early focus of tactical military activity. Information operations are an essential contributor to shaping. Enabling capabilities such as combat service support, are also part of shaping operations.

Shaping will involve activity to isolate portions of the battle space. Isolation has both an external aspect (i.e. of cutting off outside support), and an internal aspect (i.e. of cutting off mutual support). Isolating the adversary may also preclude his withdrawal. The physical isolation of a large urban area could have serious implications for the identification and control of the movement of personnel, equipment and non-combatants.

Isolating an urban area in terms of information is also a very desirable part of the shaping process. A military commander should have the capability to achieve and sustain some form of information superiority over adversaries. Information passing into and out of the urban area may well be able to be managed in such a way as to cut off or prevent adversary communications, and establishing influence over indigenous radio, television and other media sources. As with all military operations, the Information Operations aspect of a campaign is to be integrated fully with other lines of operation such as civil affairs and psychological operations. Additionally, it has to be co-ordinated with national and perhaps international agencies so that all actions remain consistent with the overall strategic aim. The presence of international media and charitable organisations could make this task more difficult. Nevertheless, if efforts are properly co-ordinated, their application can multiply any advantage.[6]

At the operational level, shaping a campaign often requires the seizure, disruption, control or destruction of critical nodes (power grids, communication centres, etc) which have been previously identified during the IPB process in line with the requirements of International law. This may involve controlling key terrain, critical infrastructure and cultural centres unhinging an adversary's decision cycle process, cutting or controlling inter-city and intra-city mobility links and communications, deliberately triggering an adversarial response or positioning forces to accomplish yet further phases of the operation.

3.5.3 Engage (E)

The Shaping activities described above set the conditions for the engagement of adversarial forces. For the commander, engagement activities are those that directly address decisive points on the line of operations aimed at the adversary's centre of gravity (see Fig 3-2). These will be those actions taken by the commander against a hostile force, a political situation, or natural or humanitarian predicament that will most directly accomplish his mission. At this point, the commander brings all available capabilities to bear in order to accomplish operational objectives. Engagement can range from large-scale combat operations in war to humanitarian assistance and disaster relief in military operations other than war. In all cases where an enemy is confronted, recognition of his centres of gravity and identification of his decisive points will be critical to the success of one's own operations.

Integration and synchronisation of forces coupled with a clear knowledge of rules of engagement are critical when employing weapons in urban areas. Precision effects are required to deny the adversary the protection that could be gained from the urban environment. These engagements have to provide reasonable certainty of achieving the desired effect on the adversary – but with reduced risk of injury to non-combatants, collateral damage, or fratricide.

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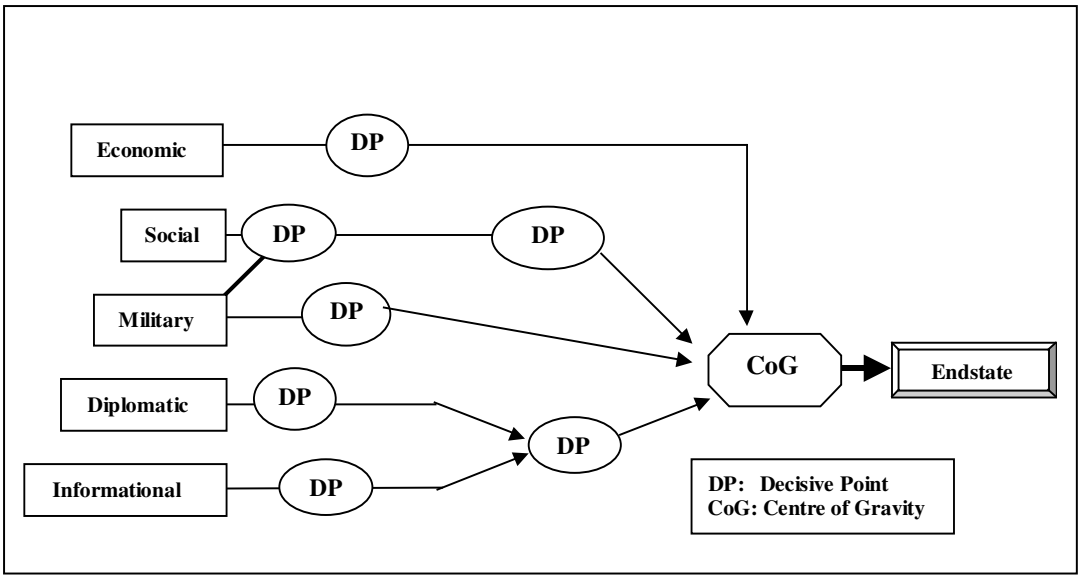
6 AJP-3 p.5-4/5.



- **Figure 3-2 llustration of Integrated Lines of Operations**

However, there are limitations on the effects of firepower (limited ranges, narrow fields of fire and the use of building materials) that may make it necessary to engage the enemy in close combat. A commander should allow for these contingencies in planning, bearing in mind that the aim is not just to seize and hold positions inside an urban area, but to apply strength against the enemy's weakness using tempo as a controlling mechanism to shatter his organisational command and cohesion completely.

3.5.4 Consolidate (C)

The focus of consolidation is on protecting what has been gained and retaining the initiative to continue to disorganise the adversary. Consolidation thus requires an ongoing process of organising and strengthening an advantage in tempo (spatial, psychological, informational) over the adversary. Consolidation also requires activities geared at mopping up adversarial forces that have been bypassed and processing prisoners. Civil affairs, public affairs and psychological operations activities will continue to be especially critical in this phase of the operation, as will engineering efforts which could range from demolition, repairs, clearing routes, bridge construction and water supply.

During this stage of operations an adversary faced by conventional defeat may resort to terrorist activities to frustrate consolidation. A military commander will need to consider this possibility and make contingencies for this in the early stages of planning. At this stage also it is important to expand on the use of liaison and co-operation with local authorities and other agencies and there will be major challenges associated with infrastructure collapse, humanitarian assistance, and the movement of non-combatants. A commander has to address such tasks and possibly the problems associated with the effects of a weapon of mass destruction or an outbreak of disease.

3.5.5 Transition (T)

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

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

An exit strategy is usually thought of in terms of military redeployment. However until the local authorities have established a relatively safe and secure environment, law enforcement units, a judicial presence, and a recognised and functioning governmental office with oversight of civilian reconstruction efforts, NATO capabilities (both military and non-military) will continue to be required. The evidence gained so far is that this is usually far longer than first anticipated and that NATO does not have a specific strategy/doctrine for this phase.

3.6 Application of the USECT Framework

The USECT framework is designed to assist the operational commander in a complex urban environment. It provides the basis for coherence and unity of purpose between subordinate components, and co-operation with non-military organisations. However, as an operational tool, it may not necessarily translate vertically down to tactical activity in every case. It is possible for instance, to see tactical units to be engaged, for example in a close battle, in order to achieve a shaping or consolidation task for the operational commander.

3.7 Conclusions

The aim of the manoeuvrist approach to operations in urban areas, as described in this Chapter, is to achieve objectives with fewer casualties, less collateral damage to urban infrastructure, and reduced harm to the non-combatant population. The interrelated military and non-military activities described in the USECT process form the framework to achieve the aim. This general approach will enable NATO forces to function more effectively in the uncertain and often chaotic operations of an urban environment.

Current NATO doctrine features the manoeuvrist approach to operations. It does not address in sufficient detail the complexities associated with the full spectrum of operations in urban areas. USECT provides a framework within which a commander can apply the manoeuvrist approach more effectively to urban operations.

3.8 Recommendations

The Study Group recommends NATO adopt the USECT framework as the basis for all further development of concepts and doctrine for urban operations.

CHAPTER 4

OPERATIONAL CONCEPTS

4.1 Aim and Scope

This Chapter identifies a range of operational concepts that could enable a future commander to carry out effective operations in an urban environment with reduced casualties and collateral damage. The operational concepts embody the manoeuvrist approach to operations which have been described in Chapter 3, and provide a basis for the identification of desired military capabilities for operating in urban areas that are addressed in Chapter 5.

4.2 Guidelines for Urban Operational Concepts

In general, there are two guiding themes which will govern the selection of an operational concept for any given mission and scenario. These are to apply the manoeuvrist approach at the operational level, and to minimise the amount of close combat activities.

4.2.1 The Manoeuvrist Approach

The application of the manoeuvrist approach to operations was described in the previous Chapter under the five headings of USECT. This approach applies at all levels of conflict and to all levels of ground-force involvement. Understanding and shaping the battle space before engaging, and controlling the tempo of operations are essential to the operational concept.

4.2.2 Minimise Close Combat Activities

The most direct way of reducing friendly casualties is to reduce the amount of close combat required. There are three levels of ground-force activity that may be described as: None, Temporary and Sustained.

No Ground-Force Activity. Examples of "No ground-force activity" include the isolation of an urban area, a blockade, or a standoff engagement. When applicable, this can be effective, but the range of tasks and the conditions to which this could apply is very limited.

Temporary Ground-Force Activity. A number of tasks require at least a temporary, ground-force presence. Those cases include a limited offensive action against, e.g. an industrial facility or chemical industrial site (where stand-off destruction could release toxic materials), and non-combatant evacuation operations.

Sustained Ground-Force Presence. Finally, a number of key tasks will require a sustained ground-force activity. These tasks include peace support operations, humanitarian assistance and CIMIC operations (OOTW), destroying a small isolated hostile force within an urban area (COIN, CIMIC, OOTW, CT activity) and capturing or defending an urban area (war fighting).

Examples of operational capabilities that reduce the number of close-combat engagements include those that enable the isolation of sectors of the battlespace, interrupt the opponent's lines of support, those that take advantage of remote sensing and engagement, and those that employ unmanned systems.

4.3 Missions in Urban Areas

Those missions that have to be carried out in areas where manmade structures, non-combatants and infrastructure are significant features can be split into nine general categories grouped according to the mission's objective.

If the objective is the urban area itself in whole or in part, the missions could be to:

- Capture the urban area
- Defend the urban area
- Isolate/neutralise the urban area

If the objective is within urban terrain, but not the urban area itself, the missions could be to:

- Capture or destroy an enemy force operating within the urban area
- Attack a node[7] within the urban area
- Defend or create a node within the urban area

If the objective is to protect or assist people in an urban area, the missions could be to:

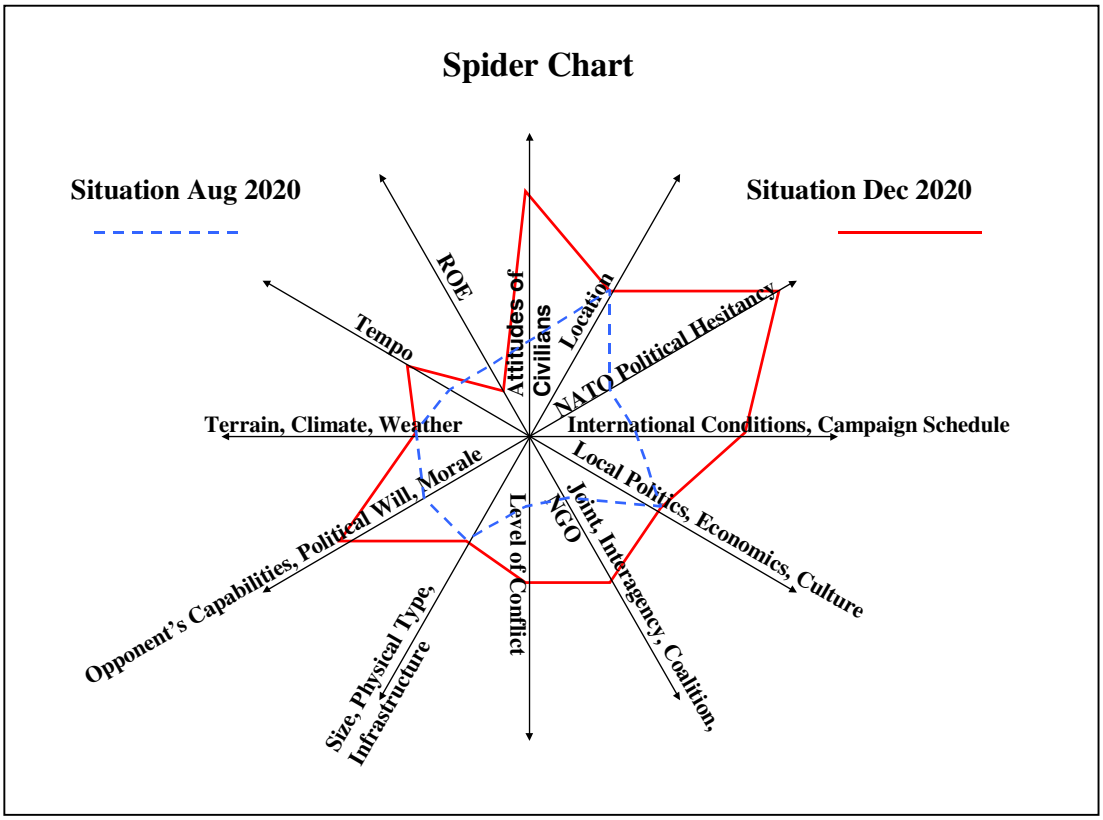
- Neutralise combatants (e.g. peace-enforcement and peacekeeping operations)
- Provide humanitarian assistance
- Conduct CIMIC operations

4.4 Assessing a Mission in an Urban Area

This will be driven by the particular conditions surrounding the mission. The value of a capability can be measured by its effectiveness across a wide range of conditions. The types of conditions and the degree of challenge presented by each are illustrated by the following "spider chart" (Figure 4-1).

Each leg or axis represents a separate dimension of "condition space," and one can (at least qualitatively) represent the degree of difficulty posed by each condition according to the distance from the origin along its axis. Thus, a specific warfighting scenario may be represented by a polygon that intersects the axes at various distances from the origin. "Easier" cases are close to the centre point and more difficult cases are further out. As an example, Figure 4-1 illustrates the changing conditions during two phases of a possible NATO action in an urban area. The attitude of civilians, the increase in the level of conflict, the increase in NATO's political hesitancy, and the increase in the opponent's political will are the major changes.

[7] A "node" could be an element that is critical to the success of an operation. It includes not only physically localised critical points such as a command centre or WMD-facility, but also more general features such as a logistics system or even the mindset of an ethnic group.



- **Figure 4-1 Example of Changing Conditions Affecting Urban Capabilities**

Note that the axes are not independent. For example, when the "Attitude of Civilians" is favourable (close to the centre point) the ROE tend to be more stringent (far from the centre point).

The sets of missions and conditions outlined above broadly characterise the challenges that could be faced by a future military Commander. Any combination of changes could occur literally "overnight" in any portion of the urban environment. Such is the extreme complexity of urban operations. A "toolkit" of capabilities has to be designed and developed to enable the commander to succeed under realistic conditions.

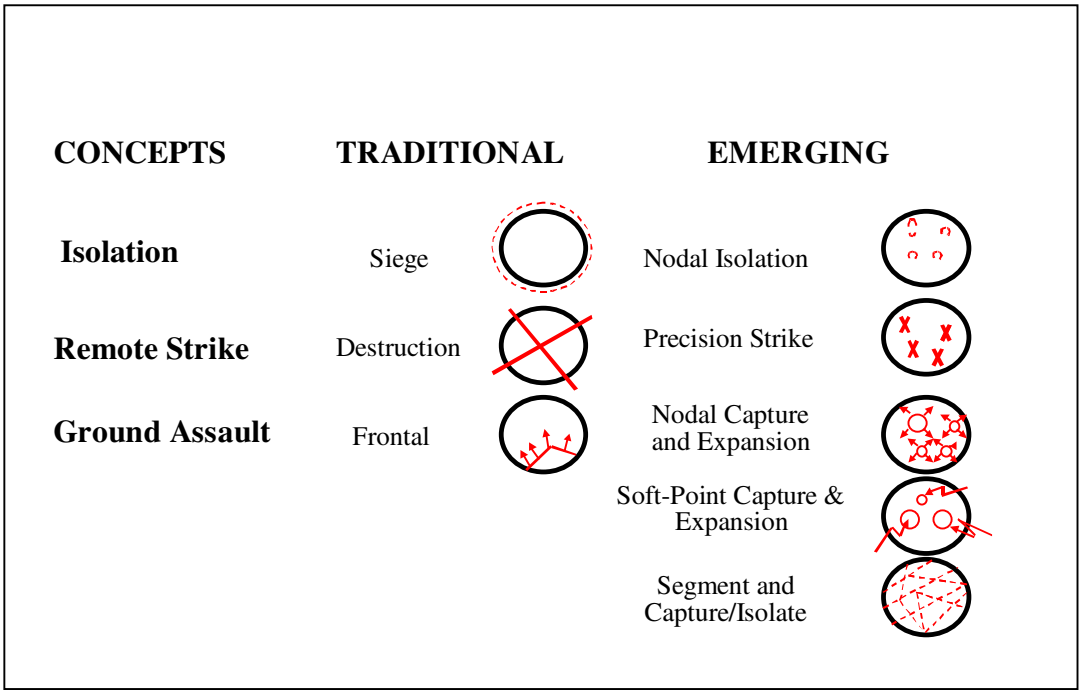
4.5 Operational Concepts

A future commander has to be able to develop an effective concept of operations for any given mission and set of conditions. In order to determine the operational capabilities that would enable him to do this, each mission has to be considered and a range of possible operational concepts identified. The Study Group initiated this process by examining one of the most complex and challenging missions, that of capturing an urban area. This mission was selected because it was considered that the set of capabilities needed to support a range of operational concepts for this mission would, in general, also support the other missions. For example, to capture a city a commander has to be able to defeat smaller elements of an opposing force within urban terrain; to attack, create or defend nodes; to deal with various aspects of the population; and to defend urban areas after they are captured (consolidation). This encompasses many of the capabilities needed for the other missions as well.

A number of general types of operational concepts that might be employed to capture an urban area are listed in Figure 4-2. Several of these concepts might be used in combination in a given scenario, e.g., in different areas, or at different times. They are separated here for clarity.

Figure 4-1 distinguishes the operational concepts between those that are "traditional" and those that are "emerging" (or "new"). The principal methods associated with each concept are listed as Isolation, Remote Strike, or Ground Assault. Isolation and Remote Strike concepts may not require penetration of the urban area by a sizeable ground force whereas the Ground Assault concepts do.

Isolation is aimed at denying an opponent any advantages of occupying the urban area. Dependent upon the level of the operation this can include isolating him physically, politically, electronically or psychologically. This multi-track approach can fix an opponent on both the moral and physical planes and achieve much more than freedom of manoeuvre on the physical plane. Freedom of action politically, morally and psychologically may also follow. Siege can isolate an opponent's forces from the rest of a campaign and thereby neutralise their potential contribution, or, as in many past instances, siege can be used to "starve them out." Siege requires a willingness to accept responsibility for the effects on the civilian population unless it could be evacuated to safety. Depending on the size of the urban area, siege may also require large numbers of forces (50,000 Russian troops were required to isolate Grozny during the second Chechen campaign) and this sort of concept may not be feasible with large, sprawling urban areas. Siege also takes time to achieve success, and for that reason alone may be precluded in a number of scenarios.



- **Figure 4-2 Some Types of Operational Concepts: Capture the Urban Area**

Nodal Isolation is an emerging concept that denies an occupying force access to, or use of, critical facilities within the urban areas. Elements of this approach may include: information operations to control facilities such as power stations, or communication networks; the creation of "keep-out" zones using remote surveillance, remote generation of precision, non-lethal effects, or deployed robotic sentries; or the similar control of transportation routes and facilities. Again, the idea is to deny the utility of the urban area to an opponent's forces with a minimum of civilian casualties or collateral damage.

Remote Strike concepts employ area destruction or precision strikes to defeat opposing forces and deny them advantages that the urban area provides (cover, supplies, information, and utilities). Destruction of an area can be achieved as a last means when accurate targeting information and accurate weapon delivery systems are not available. In any given situation the effectiveness of this concept would depend on NATO's willingness to accept responsibility for civilian casualties and collateral damage, and the level of the opponent's determination to remain in the urban area. For example, it may be to NATO's advantage for the military commander to leave an escape route open for an opponent to encourage his withdrawal.

However, emerging capabilities in targeting and weapon delivery offer the promise of enabling more surgical ("precision") strikes. With such strikes, unintended casualties and collateral damage may be reduced making the use of this concept a more acceptable option for a military commander.

A ground assault concept involves forces entering urban areas. These could include frontal sweeps through the area (which maintain access to supplies through controlled territory), and the capture of nodes by vertical assault and/or ground penetration and depending on the situation a further expansion out from those nodes. The nodes chosen could be critical elements of the opponent's defences or soft points in his defences that could be exploited as a base for subsequent expansion.

"Segment and Capture/Isolate" is another ground assault concept that uses remote isolation techniques or penetration by ground forces to divide the urban area into segments. Segments that are critical to the opponent may then become the focal points of subsequent military action while sparing less critical areas.

Three of these types of operational concepts correspond to traditional approaches to capturing a city: Siege, Destruction, and Frontal Assault. These approaches may be necessary because of the lack of a capability for gaining information, caused by technological or political restrictions, in an urban environment. A military force either avoids entering the urban area (Siege or Destruction) or enters it with ground forces and gains more information of enemy positions and capabilities by establishing contact by means of combat and then responding with overwhelming lethal force. Under most conditions these three operational concepts could easily result in high levels of non-combatant casualties. Destruction and frontal assault will also result in extensive collateral damage, and in the case of the latter can be expected to result in high friendly casualties as well.

The five "emerging" operational concepts (listed in Figure 4-2) are more surgical in nature than the traditional concepts and offer the prospect of significantly reducing both friendly and civilian casualties, and collateral damage. They also may be better able to achieve success and require fewer military forces than the more traditional methods.

4.6 Operational Capabilities Needed to Enable the Concepts

In general, the more focussed operational concepts require much higher levels of military capabilities to conduct the first 3 stages of USECT than the traditional concepts. For example, they require military capabilities to:

- Identify nodes that support facilities within the urban area or important elements of the enemy force.
- Strike those nodes with limited or no collateral damage.
- Penetrate with an assault force to interior points of the urban area and to sustain them there.
- Isolate sectors of the urban area.

Having identified a range of operational concepts, the next step is to identify the set of capabilities needed to enable the concepts to operate effectively. These are addressed in more detail in Chapter 5.

4.7 Conclusions

Operational level commanders can be expected to accomplish a range of missions within the urban environment. Of the nine missions identified, the "Capture the Urban Area" mission encompasses a sufficiently wide range of operational concepts with implied capabilities that apply to the other urban missions as well.

The operational concepts fall into two general categories, a "traditional" group (siege, destruction, frontal assault) that would emphasise the "Engage" component of USECT, and an "emerging" group (nodal isolation and capture, precision strike, segment) that would emphasise the "Understand" and "Shape" components. The latter group holds the promise of significantly reducing casualties and collateral damage but also requires that new war fighting capabilities be available to a military commander.

4.8 Recommendations

The Study Group recommends that NATO adopt the mission types and emerging operational concepts identified as the basis for further NATO studies, investigations and experiments into urban operations.

It is further recommended that NATO develop the operational concepts in greater detail.

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CHAPTER 5

CAPABILITY REQUIREMENTS

5.1 Aim and Scope

Given the complexity and the challenges of operations in urban areas a commander needs new means to accomplish the variety of operational tasks that he may encounter. This Chapter aims to identify the operational level capabilities required to carry out the full spectrum of concepts. These capabilities have been structured in line with the USECT process. This Chapter also lists the identified operational capabilities in order of importance for operations in urban areas. These capabilities form the basis for either Materiel (M) solutions or Non-Materiel solutions described in the areas of Doctrine, Organisation, Training, Leadership, Personnel and Facilities (DOTLPF). These are described in more detail in Chapter 6.

5.2 Background

In 2020, a NATO commander should be capable of conducting operations in urban areas across the full spectrum of conflict, from crisis response to war fighting operations. Not withstanding the level of conflict, there is a view that a generic task to capture and hold an urban area is a most complex and difficult one. This task may involve a wide range of different operational concepts, from which a military commander may chose one or more to accomplish his task. The operational concepts explained in Chapter 4 for such a mission formed the starting point for an initial set of 53 capabilities necessary to conduct operations in urban areas compiled from national views.

At the Capability Assessment Seminar (CAPS) held in September 2001, these capabilities were re-examined and subsequently revised, resulting in a consolidated list of 42 capabilities (See Annex C - CAPS). It should be pointed out that all of these capabilities are necessary for a military commander to successfully accomplish operations in an urban environment. However, to allow a more detailed examination of the most important operational level capabilities, some 15 were identified as the “key capabilities” and subsequently used in the Urban Seminar Wargame later in the year (November 2001).

5.3 Operational Level Capability Requirements

Although the concepts proposed for operations in urban areas vary considerably from concepts designed for other environments, a detailed examination resulted in the conclusion that at the operational level capabilities required are very similar for whatever type of operational concept envisaged. The capabilities are defined by utilising the USECT framework described in Chapter 3. Of the 42 capabilities identified 7 support “Understand”, 18 support “Shape”, 10 support “Engage”, 5 support “Consolidate” and 2 support “Transition”. Some capabilities support more than one element of USECT. To avoid repetition each capability is only listed once in the list. There is no relationship between the number of capabilities supporting a particular aspect of USECT and its importance.

5.3.1 Understand (U)

At the operational level “Understand” (U) continues to apply throughout all phases of an operation in urban areas. The following 7 capabilities provide a military commander with the collection, assimilation, management and distribution of information necessary to overcome the complexities of the urban battlespace. Further definition of the capabilities is detailed at Annex C**.**

NUMBER	CAPABILITY REQUIREMENT
U 1	Process, format and distribute large scale data and information aimed at improving the acquiring and decision making process
U 2	Know the location and status of own forces
U 3	Have an overall understanding of the international, regional and local situation and in context with other factors such as population, ethnic, cultural, political factions, other agencies, NGOs and groupings.
U 4	Establish a clear understanding of own forces capabilities and limitations
U 5	Establish a psycho-sociological profile of the potential enemy, neutrals, key players and the population
U 6	Determine intent, aim, location, movement, status, capabilities, support structure of potential enemy forces, neutrals, key players and population
U 7	Acquire an accurate understanding of the infrastructure, the systems and the dynamics of the designated urban area and their impact on operations (identify the key nodes and vulnerabilities)

- **Table 5-1 Understand Capabilities**

5.3.2 Shape (S)

"Shape" includes all actions taken to set favourable conditions for campaign success. The required capabilities enable a military commander to minimise enemy capabilities, neutralise or leverage local population effect(s) on the operation, influence the media impact on an operation and enhance own forces ability to win. The following 18 capabilities are required:

NUMBER	CAPABILITY REQUIREMENT
S 1	Monitor and control crowds within urban areas
S 2	Selective control of infrastructure, utilities and non-military communications
S 3	Restrict the effect of chemical, biological and radiological hazards on own troops and non-combatants
S 4	Restrict enemy movement/logistics/intentions
S 5	Provide the appropriate level of mobility (surface/above surface/sub-surface, including under water) to operate effectively in urban areas
S 6	Provide own forces with adequate protection against the entire threat
S 7	Manage and influence the media's impact on operations
S 8	Isolate an urban battle space
S 9	Influence the local population
S 10	Establish, secure and maintain own forces support systems (logistics, medical, etc)
S 11	Enable a force to use the battlespace within the urban environment to best advantage
S 12	To utilise the combined arms effects on operations at the lowest level
S13	Detect, identify and assess rapidly chemical, biological and radiological threats (this includes toxic threats)
S 14	Deny the enemy from operating effective C4ISTAR systems
S 15	Deceive enemy as to own force intentions and actions
S 16	Co-ordinate joint/interagency/coalition activities
S 17	Control (stimulate/prevent) non-combatant mass movement
S 18	Assure C4 interoperability for own forces

- **Table 5-2 Shape Capabilities**

5.3.3 Engage (E)

"Engage" represents those actions taken by a military commander to defeat decisively an enemy in urban areas with minimum casualties and collateral damage, while at the same time being in a position to deal with

local populations and providing humanitarian assistance for others. In addition, a commander should plan to operate with dispersed/isolated own forces. The following 10 “Engage” capabilities are needed:

NUMBER	CAPABILITY REQUIREMENT
E 1	Destroy or neutralise in a timely manner, fixed or mobile point targets in the urban environment with minimum casualties and collateral damage
E 2	Provide and sustain combat power and maintain tempo of own forces
E 3	Being in a position to conduct operations across the spectrum of conflict
E 4	Operate with dispersed/isolated forces
E 5	Provide for displaced populations and non-combatants
E 6	Establish a reliable Friend-Foe-Civilian Identification
E 7	Ensure basic provision for the non-combatants within any sieged area
E 8	Dominate the EM spectrum
E 9	Destroy wide-area targets in all dimensions[8]
E 10	Conduct cyber operations

- **Table 5-3 Engage Capabilities**

5.3.4 Consolidate (C)

During “Consolidate” , the emphasis at the operational level lies in the establishment of a secure urban area, the assessment of urban battle damage and the provision of humanitarian support for local population (where appropriate). The military commander needs the following five capabilities:

NUMBER	CAPABILITY REQUIREMENT
C 1	Establish a secure environment in an urban area
C 2	Take account of the effects of WMD and other environmental hazards where appropriate
C 3	Ensure swift and effective medical support, food, water, etc. for the population
C 4	Re-establish the civil administration
C 5	Control displaced persons and non-combatants

- **Table 5-4 Consolidate Capabilities**

5.3.5 Transition (T)

“Transition” is the transfer of control of an urban area to local military and civil authorities or international organisations as appropriate while at the same time reducing the levels of own forces with a view to redeployment elsewhere. A military commander needs the following two capabilities:

NUMBER	CAPABILITY REQUIREMENT
T 1	Conduct “exit” operations for the force
T 2	Return control of urban areas to civil authorities

- **Table 5-5 Transition Capabilities**

All capabilities mentioned above are considered to be necessary at an operational level for a commander to conduct operations in urban areas effectively. Nonetheless, some of these capabilities deserve specific attention because they are considered to be critical for success. These capabilities are hereafter referred to as key operational level capabilities.

[8] Destruction of targets that are in effect a general area rather than specified, smaller or pinpoint targets.

5.4 Key Operational Level Capabilities

In order to allow NATO to focus its efforts on a reasonable number of potential solutions to allow for enhanced capabilities in urban areas the Study Group concentrated upon the key capabilities. The selection for these key capabilities consisted of noting the existing capability gaps, and the military importance, as judged by the Study Group. Based on this, 15 out of the 42 operational capabilities were determined to be key operational level capabilities. When these key capabilities were classified according to the USECT framework, they were found to focus only on the Understand, Shape and Engage parts of USECT, with no key capabilities specifically supporting Consolidation or Transition. The reason for this is that during Consolidation and Transition, military action is not as paramount as the other aspects of operations in urban areas and is usually in support of other organisations. In addition, while the key capabilities for understanding, shaping and engaging could be applicable to the full spectrum of conflict, how these capabilities are realised is likely to differ in urban operations. The Study Group decided to focus exclusively upon these 15 key operational level capabilities.

5.4.1 Understand (Key Capabilities)

During Understand, the size, complexity and the ever-changing and dynamic nature of urban infrastructure, generates the need for both a broad spectrum and context - specific information about the urban area in order to identify suitable nodes. The interplay of factors that affect the differing interests of the parties concerned in an urban environment increases the need to analyse the inter-relationships between these different groups and in particular the direct and indirect consequences of actions on or by these groups. Given that an adversary might well act in an asymmetric and covert manner, operations in urban areas will present particular challenges for understanding an adversary's intentions and objectives. The key capabilities identified are:

NUMBER	CAPABILITY REQUIREMENT
U 1	Process, format and distribute large scale data and information aimed at improving the acquiring and decision making process
U 3	**HAVE AN OVERALL UNDERSTANDING OF THE NATIONAL, INTERNATIONAL AND LOCAL SITUATION AND CONTEXT (POPULATION, ETHNIC, CULTURAL, POLITICAL, FACTIONS, SYMPATHIES, AGENCIES, NGOS, ETC)**
U 6	Determine intent, aim, location, movement, status, capabilities, support structure of potential enemy forces, neutrals, key players and population
U 7	Acquire an accurate understanding of the infrastructure, the systems and the dynamics of the designated urban area and their impact on operations (identify the key nodes and vulnerabilities)

- **Table 5-6 Understand Key Capabilities**

5.4.2 Shape (Key Capabilities)

During "Shape" it is necessary to control, use and/or influence all aspects of the battlespace. There is a clear need for interoperability amongst military multi-national partners, interagency, international and regional organisations, NGOs and indigenous civil authorities. Given the growing importance of information, C4 interoperability is essential to achieve this.

NBC protection of own forces has to cater for threats beyond those traditionally considered in NBC. This includes provisions against, toxic industrial materiel and commercially based radiation hazards that can be found in most urban environments Battle damage in urban areas leads to lack of mobility for ground vehicles and troops and the population in general.

The key capabilities identified for Shape are:

NUMBER	CAPABILITY REQUIREMENT
S 5	Provide the appropriate level of mobility (surface/above surface/sub-surface, including under water) to operate effectively in urban areas
S 10	Establish, secure and maintain own forces support systems (logistics, medical, etc) to best advantage
S 11	Enable a force to use the battlespace within the urban environment
S13	Detect, identify and assess rapidly chemical, biological and radiological threats (this includes toxic threats)
S 14	Deny the enemy from operating effective C4ISTAR systems
S 18	Assure C4 interoperability for own forces

- **Table 5-7 Shape Key Capabilities**

5.4.3 Engage (Key Capabilities)

During "Engage" it is necessary to destroy, disable or control selected nodes. The large numbers of non-combatants in the area and the necessity to minimise civilian casualties highlight the importance of distinguishing properly between combatants and non-combatants. In addition, the desire to reduce collateral damage requires the ability to engage targets with precision.[9]

Many of the operational concepts employ forces operating in a dispersed non-linear fashion, which will pose increased challenges for sustainment and maintenance of tempo. Given the growing reliance upon computer networks and data transmission centres, it is important to have the capability to dominate the EM spectrum and to conduct suitable cyber operations. The key capabilities identified are:

NUMBER	CAPABILITY REQUIREMENT
E 1	Destroy or neutralise in a timely manner, fixed or mobile point targets in the urban environment with minimum casualties and collateral damage
E 2	Provide and sustain combat power and maintain tempo of own forces
E 6	Establish a reliable Friend-Foe-Civilian Identification
E 8	Dominate the EM spectrum
E 10	Conduct cyber operations

- **Table 5-8 Engage Key Capabilities**

5.5 Conclusions

Based on the USECT conceptual framework and the operational concepts, the Study Group identified 42 operational level capabilities necessary for operations in urban areas. In order to allow NATO to focus its efforts on a reasonable number of potential solutions the Study Group concentrated upon the most important of these capabilities. The two selection criteria for this were the military significance and the perceived existing capability gaps, as judged by the Study Group. Using these two criteria, the 42 operational capabilities were prioritised to the 15 nominated as the key operational level capabilities.

5.6 Recommendations

The Study Group recommends that NATO develop urban capabilities by first focussing on the key capability requirements identified in this study.

It is recommended that the 42 operational capabilities that have been identified all merit further examination but the initial focus should be on the 15 key capabilities as described in this Chapter.

It is further recommended that NATO should relate all future urban specific materiel developments to these 42 capabilities.

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[9] Precision has two aspects, first is the accuracy of the munition in hitting the target, the second is the 'scale-ability' of effects on the target with the intent of reducing collateral damage.

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CHAPTER 6

IDENTIFYING POTENTIAL SOLUTIONS

6.1 Aim and Scope

This Chapter examines potential solutions available to NATO nations in order to realise the 15 key operational capabilities described in the previous Chapter. Potential solutions for the 27 other capabilities are also included in Annex D. While each nation has its own taxonomy for describing the supporting components of a capability, NATO has yet formally to adopt one. For the purpose of this study, the Group agreed to use the term Doctrine, Organisation, Training, Material, Leadership, Personnel and Facilities (DOTMLPF) as the components necessary to realise a capability. This set of terms has been widely used for a variety of tasks and the Study Group endorses its use in this context. A given capability can best be realised or increased by considering the seven inter-related components of DOTMLPF.

6.2 A Description of DOTMLPF

By using DOTMLPF as a framework, each component of DOTMLPF for a specific capability was examined, first individually and then in relation to others. This methodology not only ensured that a wide range of potential solutions for improving or developing each capability was examined, but recognised the interrelationship of each of the components of DOTMLPF. In using this particular framework the following definitions were used:

D – Doctrine represents a common way of thinking about a particular issue or problem. Doctrine encompasses tactics, and the specific procedures for conducting tasks.
O – Organisation defines the structures and groupings that are used by formations and units on operations.
T – Training includes both individual and collective training.
M – Materiel includes specific equipment, weapon systems, stores and technology. Potential materiel solutions were examined through the use of system concepts. The implications for technologies can then be deduced.
L – Leadership defines specific training and leadership requirements; this refers to the development of leaders primarily through further education.
P – Personnel represents the type of servicemen or women that are needed for a specific capability; this includes identifying specialists and/or specific skills that are needed.
F – Facilities is a generic heading for all infrastructures needed to accommodate, train and prepare any military forces for operations in urban areas. For this the important element of these facilities is training facilities; the advent of distributed or networked virtual training simulations will help to meet these requirements.

6.3 Application of DOTMLPF

The individual component parts of DOTMLPF should not be looked at in isolation as each has potential influence on the other. For example the introduction of new material may require changes to doctrine, training and organisation. However, in an attempt to identify the broadest range of potential solutions for a particular capability, each component of DOTMLPF was examined without regard to its impact on other DOTMLPF components. This resulted in a number of potential solutions being identified to realise or improve each particular capability. See Appendix C-3 to Annex C for a listing of all 42 operational capabilities and potential solutions structured in the DOTMLPF framework.

Mainly because of the overlap of several of the components and in particular the similarities between Training and Leadership (included in T); Organisation and Personnel (included in O); and given that facilities translated to those facilities supporting training (included in T), the Study Group amalgamated the DOTMLPF components to become DOTM. This term is used subsequently in this Chapter.

During the Study it became apparent that there are one or two components of DOTM that appear to provide the most effective method of realising each capability and for the purposes of the study this component of DOTM is defined as a "Driver".[10] Given that the Drivers provide significant opportunity to realise the capability, these components should provide the starting point for further action. The CAPS, analysis at the USW and Study review were combined to generate the results for the top 15 capabilities shown in Table 6-1 below.

Of the 20 drivers shown below in Table 6-1, 12 have a materiel focus and 8 have a non-materiel focus. However lack of sufficient time meant that interactions of the drivers (or consequential changes required) or any other of the non-drivers (such as changes in doctrine for materiel reasons) were not explored, but should be in any future study.

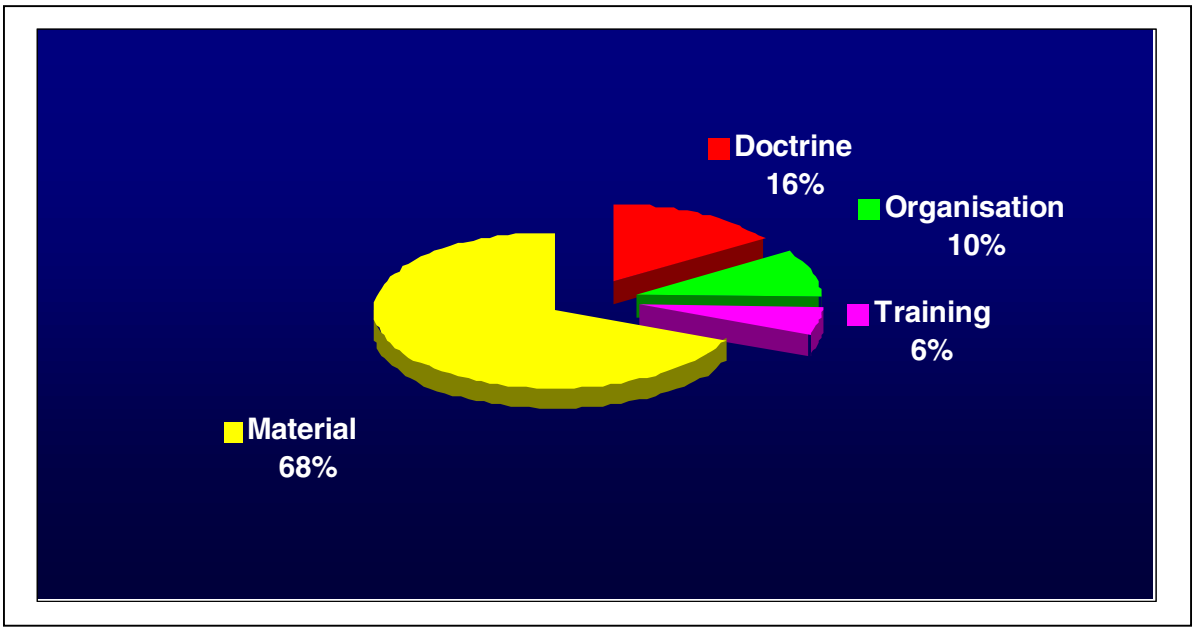
NUMBER	CAPABILITY REQUIREMENT	DRIVERS
U 1	Process, format and distribute large scale data and information at improving the decision making process	M
U 3	Have an overall understanding of the international, regional and local situation and in context with other factors such as population, ethnic, cultural, political factions, other agencies, NGOs and other groupings	O, T
U 6	Determine intent, aim, location, movement, status, capabilities, support structure of potential enemy forces, neutrals, key players and population	M
U 7	Acquire an accurate understanding of the infrastructure, the systems and the dynamics of the designated urban area and their impact on operations (identify the key nodes and vulnerabilities)	M
S 5	Provide the appropriate level of mobility (surface/above surface/sub-surface, including under water) to operate effectively in urban areas	M
S 10	Establish, secure and maintain own forces support systems (logistics, medical, etc.)	O
S 11	Enable a force to use the battlespace within the urban environment to best advantage	D, T, M
S 13	Detect, identify and assess rapidly chemical, biological and radiological threats (this includes toxic threats)	M
S 14	Deny the enemy from operating effective C4ISTAR systems	D, M
S 18	Assure C4 interoperability for own forces	M
E 1	Destroy or neutralise in a timely manner, fixed or mobile point targets in the urban environment with minimum casualties and collateral damage	M
E 2	Provide and sustain combat power and maintain tempo of own forces	D
E 6	Establish a reliable Friend-Foe-Civilian Identification	M
E 8	Dominate the EM spectrum	M
E 10	**CONDUCT CYBER OPERATIONS**	D, M

- **Table 6-1 Top 15 Key Capabilities and DOTM Drivers**

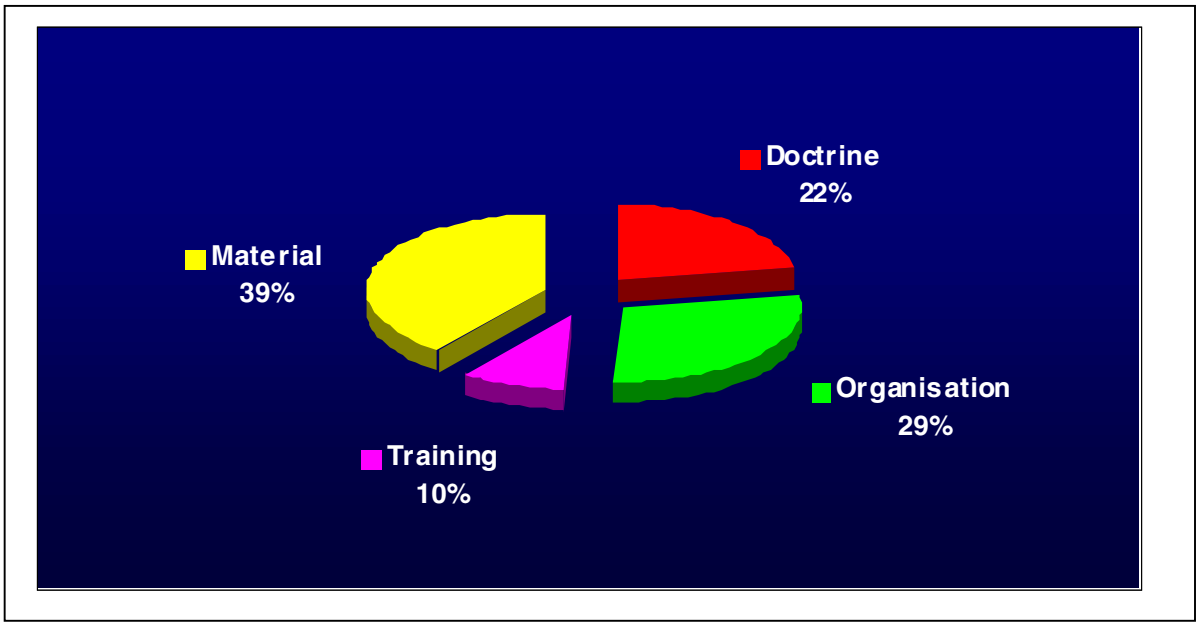
[10] A Driver is the component of DOTM, the development of which is likely to produce significant enhancement to a capability.

6.4 General Indications

This Study reinforces the view that in order for operations to succeed in the urban battlespace potential solutions will draw upon all the areas of Doctrine, Organisation, Training and Material. The Figures below illustrate the relative proportion of drivers across the capabilities.



- **Figure 6-1 Relative Proportion of Drivers for 15 Key Capabilities**



- **Figure 6-2 Relative Proportion of Drivers for 42 Capabilities**

Note: The two Pie-Charts shown in Annex D are different from the Charts above. In Annex D the Charts are weighted on the distribution of votes at the USW only. The Charts above are based upon the results of the USW and the military expert opinion formed during the CAPS. The military experts considered materiel slightly less important (respective 4% and 2%) and doctrine and organisation slightly more important.

6.4.1 Doctrine (D)

Development of doctrine is a relatively simple solution for NATO nations to improve military effectiveness in the urban battlespace. However, the implementation of such new doctrinal thinking may require considerable effort. Given that a clearly articulated and up-to-date doctrine would provide the conceptual framework from which the other requirements of the remaining components of DOTM can be fully identified this becomes the first-step to improve all capabilities. While there is much common doctrinal thinking and practices within NATO there remains a lack of doctrine for operations in urban areas and to include the IPB procedures for urban environments. At the operational level doctrine is shown to be a driver in 4 of the 15 capabilities studied in more detail, as shown in Table 6-2 below.

Number	Key Capability	Potential Solutions - Doctrine
S 11	Enable a force to use the battlespace within the urban environment to best advantage	3D BATTLESPACE CO-ORDINATION DOCTRINE FOR URBAN OPERATIONS (E.G. AIRSPACE MANAGEMENT INCLUDING "CONFLICT" BETWEEN UAVS AND CLOSE AIR SUPPORT) AND IPB
S 14	Deny the enemy from operating effective C4ISTAR systems	Doctrine for counter C4ISTAR, Need to take into account non-military assets
E 2	Provide and sustain combat power and maintain tempo of own forces	CSS doctrine to match manoeuvrist approach to operations in urban areas
E 10	Conduct cyber operations	Doctrine for Cyber Operations

- **Table 6-2 Doctrine Driven Solutions for Key Capabilities**

6.4.2 Organisation (O)

Force structures are primarily controlled by individual nations within NATO; however, there are a number of CJTF organisational changes and additions at the NATO level that would increase the overall capability of the force. In particular these are in the areas of establishing or expanding the current capabilities of HQs and formations. These include a CIMIC capability, increasing intelligence/media analysts within the various levels of HQ, ensuring an effective HUMINT capability, and the increasing requirement for the integration of Special Forces (SF) capabilities. These changes and improvements in organisation would reinforce the ability of NATO forces to deal with urban conflict and highlights the importance of being able to gain information from all factions, including non-combatants. This in turn would require the deployment and use of linguists. The ever-increasing availability of information requires information managers to process this information and skilled personnel to handle and store the data received. This suggests that NATO re-consider the balance to be struck between soldiers and technical specialists within the CJTF for the conduct of urban operations. In making organisational changes a suitable balance between robotic and manned systems needs to be determined in order to balance the benefits of a virtual presence in the urban battlespace with the flexibility of manned systems. Solutions for the provision of adequate protected logistics and rapid casualty evacuation during operations in an urban area require radical organisational change. At the operational level, organisation is shown to be a driver in 2 of the 15 capabilities studied in more detail, as shown in Table 6-3 below.

Number	Key Capability	Potential Solutions - Organisation
U 3	**HAVE AN OVERALL UNDERSTANDING OF THE GLOBAL AND LOCAL SITUATION AND CONTEXT (POPULATION, ETHNIC, CULTURAL, POLITICAL, FACTIONS, SYMPATHIES, AGENCIES, NGOS, ETC)**	• All source (civil. military, NGOs) coordination cell • Formation of 'sense to act' cells in HQs • Intelligence analysts; • SF • PSYOPS • Political and legal advisors. • Military Geographic Services • Greater emphasis on HUMINT • Country people, local customs, factional relationships and tradition cell (including specialists on these specific matters) • Media evaluation cell • Information managers / controllers; • Linguists • CIMIC
S 10	Establish, secure and maintain own forces support systems (logistics, medical, etc)	• Protected, readily available and air transportable supply services • Protected, readily available and air transportable CASEVAC

- **Table 6-3 Organisation Driven Solutions for Key Capabilities**

6.4.3 Training (T)

Specific training in urban areas is considered the best short-term enhancement available to NATO. While training is the responsibility of individual NATO nations, the lessons learned from training can be shared. Wherever possible, training should be focused upon joint and coalition operations in urban areas, featuring all aspects of the '3 Block War'[11]. Specific training/exercises would allow commanders to employ forces with more confidence while taking acceptable risks. However, there is the need for more urban-specific training facilities. There is also a need to combine these training facilities with simulation system(s) to portray more accurately the complexity of the urban battlespace. The training should be able to present the complexity of the urban battlespace at the operational level. The requirement to train and educate commanders in the cultural, political and ethnic background pertaining to the urban area will enhance their capability to deal successfully with such operations if and when they occur. At the operational level training is shown to be a driver in 2 of the 15 capabilities studied in more detail, as shown in Table 6-4 below.

Number	Key Capability	Potential Solutions
U 3	Have an overall understanding of the international, regional and local situation and in context with other factors such as population, ethnic, cultural, political factions, other agencies, NGOs and groupings.	• Focus on the region of the operation • Education programmes for commanders • POL-MIL education for designated personnel
S 11	Enable a force to use the battlespace within the urban environment to best advantage	• Joint training for urban operations • Education for commanders to think multi-dimensionally

- **Table 6-4 Training Driven Solutions for Key Capabilities**

[11] General C.C. Krulak, Commandant US Marine Corps "The Three Block War: Fighting In Urban Areas," presented at National Press Club, Washington, D.C., 10 Oct 1997.

6.4.4 Materiel (M)

The CAPS and USW[12] were used as instruments to identify and evaluate potential materiel solutions for the key operational capabilities. The USW explored capabilities at the operational level by means of 12 system concepts using a portfolio analysis.

The 12 USW materiel system concepts were assessed for their military attractiveness during the main USW sessions. A technically biased sub-group during the USW also assessed the system concepts for their technical attractiveness, risk and cost. The overall finding of the USW and CAPS are given below and the detailed results recorded at Annex E.

Understand: The most important perceived capability is to collect, communicate, process, fuse, assimilate and distribute information from many sources, especially HUMINT, in a responsive manner. This is in order to achieve effective command and control at operational level. However, the urban environment poses unique materiel challenges to achieve this. The CAPS assessment indicated that there is a very high priority to possess a near real-time 3D picture of the urban area. Indoor and outdoor situational awareness at all levels of command, particularly for soldier situational awareness, was judged to be an important capability. The difficulty of maintaining effective communications inside and outside buildings suggests that ultra-wide band should be adopted for urban operations.

The USW confirmed the importance of establishing information dominance via a network of fixed and mobile sensors and their fusion in a command and control centre. These include expendable MEMS based sensors and, in particular, the deployment of robotic devices such as the outdoor UAV specially designed to cope with flying down streets and between buildings, to overcome the problems of line of sight for sensors operating above the urban area. Locating combatants and non-combatants in buildings also remains a real challenge. The challenge should be addressed using a multi-spectral approach. Difficulties in overcoming countermeasures were also envisaged with unmanned vehicles. The CAPS assessment indicated that the capability to provide underground imagery was important.

Shape: The CAPS and USW findings show that the materiel solutions identified in the U portion of the USECT process still apply to support the Shaping activities. The USW found that the intelligent barriers/area denial system provided a means of channelling non-combatants and combatants into areas of our choice and could therefore significantly reduce the number of soldiers required for this purpose.

The USW judged that a counter-personnel NLW concept incorporating a novel device that generated pseudo random waveforms that disrupted the enemy but not our own troops could make a notable contribution to military capability in urban areas.

Although the autonomous logistic supply and medical support systems was considered in CAPS as a very promising materiel solution for S10 (establish, secure and maintain own forces support systems), organisational drivers were considered of greater importance in order to deliver the capability.

Engage: In the USW, sensing and data fusion capabilities were judged to be essential to the Engage process. However, in the CAPS assessment, target acquisition capabilities were seen in isolation from the engagement process. The CAPS and USW indicate that the counter-personnel NLW and the stand-off common precision weapons (scaleable effects) were judged to be the most essential capabilities.

The Study Group considered that if NLWs are used appropriately they offer many advantages in dealing with the enemy within an urban area. They could provide a means of attacking an opponent's senses without much risk of long term damage, while protecting own forces. However, the ROE and protocols currently make this more complicated and could leave own forces operating in the urban area with the choice of not being able to use NLW if adequate ROE have not been agreed.

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[12] The Study drew on *Workshop on Advanced Technologies for Urban Operations,* Institute for Defense Analyses, 14-15 Nov 2000, Summary of Proceedings: IDA Document D-2574, June 2001, March 2001 and *Workshop on Robotics and Urban Operations*, Institute for Defense Analyses, Jun 2001.

Table 6-5 lists those materiel solutions judged to be the most important by either the CAPS or USW.

Number	Key-Capability	Potential Solutions - Materiel
U 1	Process, format and distribute large scale data and information aimed at improving the acquiring and decision making process	**C4I URBAN COMMAND CENTRE** **C4I URBAN SPECIFIC INFRA-STRUCTURE**
U 6	Determine intent, aim, location, movement, status, capabilities, support structure of potential enemy forces, neutrals, key players and population	• C4I Urban Command Centre Urban Warrior, Sensors/ comms/situational awareness • UAV, urban outdoor, recce • Expendable MEMS
U 7	Acquire an accurate understanding of the infrastructure, the systems and the dynamics of the designated urban area and their impact on operations (identify the key nodes and vulnerabilities)	**URBAN WARRIOR, SENSORS/ COMMS/ SITUATIONAL AWARENESS** **UAV, URBAN OUTDOOR, RECCE** **3D IMAGERY OF CITY, C4I LINKED** **C4I URBAN SPECIFIC INFRA-STRUCTURE** **UAV, INDOOR, RECCE** **UGV, URBAN OUTDOOR, RECCE** **SENSORS, REMOTE, FIXED** **SENSORS, REMOTE, MAN PORTABLE**
S 5	Provide the appropriate level of mobility (surface/above surface/sub-surface, including under water) to operate effectively in urban areas	**NONE OF THE SYSTEM CONCEPTS GENERATED FOR CAPS AND THE USW ADEQUATELY ADDRESSED THIS CAPABILITY.**

Number	Key-Capability	Potential Solutions - Materiel
S 11	Enable a force to use the battlespace within the urban environment to best advantage	**C4I URBAN COMMAND CENTRE** **WEAPON, NON LETHAL** **UAV, URBAN OUTDOOR, RECCE** **3D IMAGERY OF CITY, C4I LINKED** **C4I URBAN SPECIFIC INFRA-STRUCTURE** **UGV, URBAN OUTDOOR, WEAPON** **SENSORS, REMOTE, MAN PORTABLE** **ENGINEER, BARRIERS** **EXPENDABLE MEMS** **SOLDIER SITUATIONAL AWARENESS**
S 13	Detect, identify and assess rapidly chemical, biological and radiological threats (this includes toxic threats)	**URBAN WARRIOR, SENSORS/ COMMS/ SITUATIONAL AWARENESS** **UAV, URBAN OUTDOOR, RECCE** **EXPENDABLE MEMS** **C4I URBAN COMMAND CENTRE**
S 14	Deny the enemy the operating effective C4ISTAR systems	None of the system concepts generated for CAPS and the USW adequately addressed this capability.
S 18	Assure C4 interoperability for own forces	**C4I URBAN COMMAND CENTRE** **C4I URBAN SPECIFIC INFRA-STRUCTURE**
E 1	Destroy or neutralise in a timely manner, fixed or mobile point targets in the urban environment with minimum casualties and collateral damage	**WEAPON, SCALEABLE MUNITIONS** **WEAPON, NON LETHAL** **UGV, URBAN OUTDOOR, WEAPON** **ENGINEER, BARRIERS** **UAV, URBAN OUTDOOR, RECCE** **EXPENDABLE MEMS** **URBAN WARRIOR, SENSORS/ COMMS/SITUATIONAL AWARENESS** **C4I FUSED DATA URBAN COMMAND CENTRE**

Number	Key-Capability	Potential Solutions - Materiel
E 6	Establish a reliable Friend-Foe-Civilian Identification	**URBAN WARRIOR, FFN IDENTIFICATION, TRANSLATOR** **C4I URBAN COMMAND CENTRE**
E 8	Dominate the EM spectrum	**WEAPON, SCALEABLE MUNITION** **WEAPON, NON LETHAL**
E 10	Conduct cyber operations	None of the system concepts generated for CAPS and the USW adequately addressed this capability.

- **Table 6-5 Materiel Driven Solutions for Key Capabilities**

6.5 Conclusions

6.5.1 General

This Chapter examines potential solutions available in order to deliver the 15 key operational capabilities. By using DOTM amalgamated from DOTMLPF as a framework, each component of DOTM was studied for a specific capability, first individually then in relation to other components. This methodology not only ensured that a wide range of potential solutions for improving or developing capabilities was examined, but highlighted the interrelationship between each of the components. The participants at the USW identified the drivers for each capability. The Study Group identified 12 drivers with a materiel focus and also revealed 8 "DOT drivers" (non-material).

The Study Group considered that all arms close combat will continue to be an essential feature of urban operations in the year 2020. Individual soldiers will be involved and in immediate danger. Therefore the human factor has to be incorporated into the development of all required capabilities.

6.5.2 Potential Solutions

Doctrine (D) Doctrine development is a relatively simple way for nations to improve their effectiveness in the urban battlespace. However, the implementation of doctrine may require considerable readjustment. Given that up-to-date doctrinal thinking provides the conceptual framework from which specific requirements for the remaining components of DOTM can be properly identified, doctrine becomes an important step in improving all capabilities. Beyond the national level, development of NATO joint doctrine for urban operations is key and concept development and experimentation is required to develop those doctrinal imperatives.

Organisation (O) The potential organisational solutions reinforce the evolving nature of conflict in urban areas and the importance of obtaining information from all factions, including non-combatants, which is seen as critical for Understanding. This in turn requires the deployment of linguistic specialists and enhanced HUMINT and CIMIC capability. The growth of information technology requires the implementation of information management processes and computer network operations. Technological advances in sensors and communications require new ways of planning and executing operations. These all represent a need to evolve new and changed organisations and development of additional and new skill sets for personnel.

Training (T) Specific training for urban areas is considered the best short-term improvement available to NATO nations. Wherever possible, training should be focused upon joint and coalition urban operations. In order to make real improvement there is the need for more urban-specific training facilities at the operational level; there is a need to combine these training facilities with simulation system(s) to more accurately portray the complexity of the urban battlespace.

Materiel (M) Understand and information dominance at the operational level are two of the most challenging aspects of urban operations because existing ISTAR systems cannot acquire information effectively due to obstructed lines of sight, the inability to see into buildings and to locate and identify combatants and non-combatants. CAPS highlighted the importance of gaining a 3D picture of the urban area.

The need to deploy small UAVs capable of flying down streets and hovering over areas of interest, together with other mobile and fixed sensors within the urban terrain (such as MEMS) integrated into a sensor web, was confirmed in the USW. During CAPS the need for underground surveillance was identified as important.

HUMINT will remain of crucial importance. Paradoxically, an increased use of robotics for sensor systems is anticipated but their vulnerability to countermeasures remains a serious concern.

Urban data fusion was identified as the most important aspect at the operational level, followed by soldier situational awareness. Maintaining communication within and outside buildings suggests the use of ultra wide band communications.

Shape at the operational level showed the importance of intelligent barriers to channel combatants and non-combatants into areas of choice and its importance for freeing more soldiers for other duties. The control and exploitation of urban infrastructure is important but no particular materiel solutions were identified.

Engage at the operational level highlighted the importance of precision and scalable effects. In addition NLWs could provide a means of restricting an opponent's ability to act with reduced risk of long-term damage and minimise collateral damage (both personnel and structural) while protecting own forces. However, national policies and ROE make this more complicated and could leave own forces operating in the urban area with no choice other than lethal.

6.6 Recommendations

It is recommended that potential solutions for enhanced urban capabilities be focussed at the operational level of war.

The Study Group further recommends that priority be given to Concept Development and Experimentation in order to determine potential solutions across all aspects of DOTMLPF.

- Doctrine
  Development NATO joint doctrinal guidance for urban operations.
- Organisation
  Determine what organisational change and new skill sets for personnel may be required.
- Training
  Determine what enhancements to current training facilities and staff procedures are necessary to achieve an improved level of proficiency at operational level.
- Materiel
  Exploit the USW results by initiating further research into technologies such as sensors, data fusion and non-lethal capabilities, which could lead to utilisation for urban operations. Also to initiate operational analysis and modelling & simulation to assess the benefits of emerging concepts.
  Monitor and leverage other scientific and technological research and development.
- Leadership
  Include aspects of urban operations in professional military education programs.
- Personnel
  In conjunction with organisational change determine what expertise not presently available within NATO may be needed, such as linguists, judiciary and public utility specialists.
- Facilities
  Determine requirements for Modelling & Simulation for training and operational analysis.

CHAPTER 7

URBAN OPERATIONS ROADMAP

7.1 Introduction

The study has examined the future operating environment, proposed a conceptual framework for urban operations, determined essential capabilities for their successful execution and identified potential DOTM solutions. The Roadmap offered in this Chapter identifies activities that can be taken both in the near and mid terms to realise the capabilities for 2020.

7.1.1 Purpose

The purpose of the Roadmap is to propose the direction, opportunities and targets for the development of capabilities for operations in an urban environment.

7.1.2 Scope

During the course of this Study, it was considered that it is premature now to undertake significant acquisition programs (although some opportunities may exist now for national acquisition), make specific doctrinal changes, or change organisational structures either in NATO or the military organisations of member nations. Concept development and experimentation, however, should be undertaken as this will lead, in turn, to doctrinal development and to setting priorities for other DOTM changes. There are now also opportunities to include relevant national initiatives, all of which will enhance the application of the manoeuvrist approach to operations in urban areas. Technical systems require development and testing and the operational concepts to employ them should be validated through experimentation. A timetable is proposed as a framework for co-ordination of this activity.

7.2 Direction and Implementation Requirements

Most of the work that nations are engaged in for operations in an urban environment is at an early stage and, while there is much commonality within the emerging themes, implementation has yet to be formalised. The NATO Authorities have an opportunity to establish a focal point, with the authority, resources and determination, to make effective Alliance-wide progress by co-ordinating this conceptual and technical development.

7.2.1 USECT

The adoption of USECT as the conceptual framework for operations in urban areas will underpin operational and technical programmes. This is the starting point for further concept development and experimentation

7.2.2 Lead Proponent

The key to development of an urban operations capability is considered to be the early appointment of a lead proponent within NATO. The essential function for this proponent is to have an oversight of current NATO activity in order to focus experimentation and concept development. The office would additionally be suited to the provision of active oversight of subsequent working group activities. In addition to identification of a lead proponent it is considered that SHAPE could nominate an appropriate staff branch to monitor the activities concerning operations in urban areas.

7.2.3 Concept Development & Experimentation

An additional Study of operations in urban areas is required to develop these concepts and to serve as the focus for capability development. This Study proposes experimentation activities under the stewardship of a

lead proponent. The current Study Group found that operations in urban areas are likely in the future, that NATO currently lacks important capabilities to conduct such operations and that foreseeable DOTM changes offer potential solutions to gain these essential capabilities. The additional Study and experimentation is also required to define the issues that may be accepted as Alliance doctrine. It is proposed that a volunteer 'Lead Nation' be identified and that Terms of Reference be agreed quickly in order to maintain the momentum in this important capability area. A broad membership of any Working Group formed would enable NATO to maintain awareness of emerging national concepts and other work in this area.

7.2.4 Co-ordination within NATO

A number of studies and groups within NATO address indirectly aspects of operations in urban areas. However, there is no consensus or overall view. The road map therefore identifies the requirement for a specifically urban focus group, the working party, to draw these emerging themes together and to inform other NATO fora. DOTM solutions have to be evaluated against member Nation's current and planned programmes. It is a fine judgement as to whether the proponent or a subsequent Working Group would be best placed to determine which capability gaps are already being addressed and which are not. There may also be opportunities to make use of the work of multiple groups, identify training and validation opportunities, to reduce duplication, and to address capability gaps.

7.3 Linked National Activity

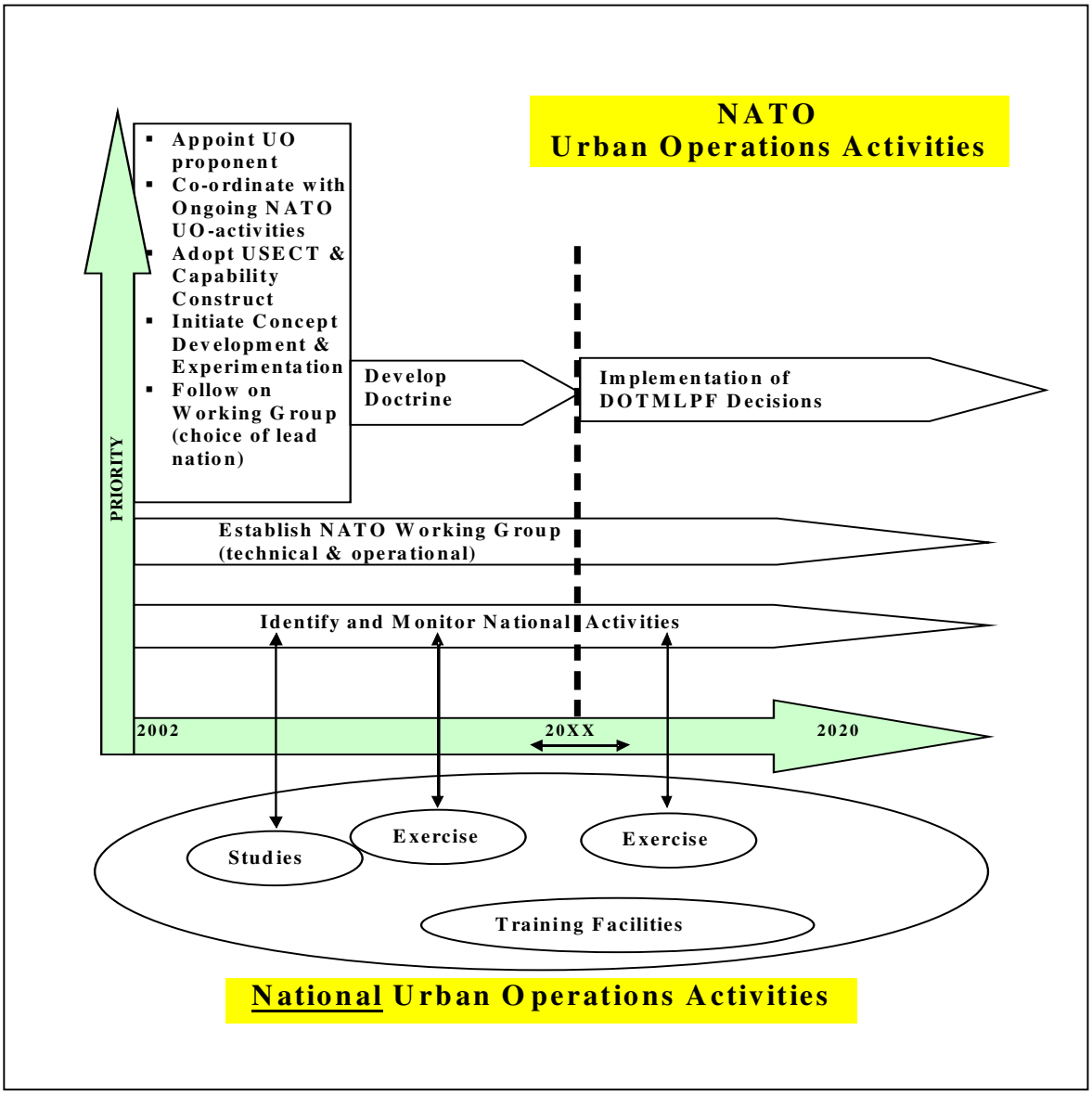
NATION	ACTIVITY	LEAD AGENCY
CA	• Canadian UO Working Group • Updating UO Training Facilities • Instrumentation of UO Site within Canadian Manoeuvre Training Centre • ABCA QWG Manoeuvre MAPEX	Directorate of Army Doctrine Director of Land Force Readiness Directorate of Land Requirements DAD 4
FR	• Master plan for urban terrain studies • Command system in Urban Terrain • Mobility in UT • Fire support in UT • Mounted engagement vs dismounted engagement in UT • Information in UT • Simulation of urban action (AZUR wargame) • Urban terrain facility	DGA /DSP/SASF DGA /SPOTI DGA /SPART DGA /SPART DGA /SPART DGA /DSP/SPOTI DGA /DSP/CAD DGA /SPART
GE	• Joint UO Study • MOUT • Modelling Urban Terrain in PABST / HORUS / FIT	GE Heeresamt GE Panzertruppenschule IABG
NL	• Urban Training Facility established • Paper on Operations in Built-Up Areas • Joint Study on Urban Operations	Army staff Army Staff MoD
IT	• Proposal for a joint UO Working Group (to be confirmed)	
UK	• UO WG • Defence Policy paper • Land Component Concept paper • URBEX • URBEX	UK MOD/DGD&D UK MOD/DFD UK MOD/DGD&D HQ LAND/G7 CD HQ LAND/G7 CD

NATION	ACTIVITY	LEAD AGENCY
USA	• Joint UO Master Plan • UO Executive Agent established • Ex PINNACLE O4	Joint Staff JFCOM JFCOM

▪ **Table 7-1 Linked National Activities**

7.4 Conclusions

NATO SAS 30 Urban Operations 2020 Roadmap identifies the direction for significantly improving the capability to conduct operations in urban areas. The approach is based on new thinking and new technologies. The new thinking looks beyond a single-Service, tactical level and seeks major improvements through the application of joint capabilities at the operational level. The new technologies have the potential to provide capabilities for use in urban areas and should be supported by co-ordinated activity across all elements of DOTMLPF. The most urgent critical organisational requirement is to create an executive focus for these operations within NATO (SHAPE) to bring the urban environment into the mainstream of research and operational development including requirements, budgeting, system development, concept development and experimentation. The conclusions are summarised in Figure 7.1



▪ **Figure 7-1 Roadmap**

7.5 Recommendations

In addition to the detailed recommendations listed in the earlier Chapters the Study Group recommends:

- That the operational concepts, capability requirements and potential solutions offered in this Study should be expended and further investigated using the USECT framework. This should include concept development and experimentation. This should also consider modelling and simulation tools to support the process.
- That the capabilities described in this study, and solutions developed are reflected in NATO's Defence Planning Process as Long Term Requirements.
- That NATO establish a Branch level lead within SHAPE to provide oversight and be the focal point for future urban activities.
- That Points of Contact be nominated in other appropriate HQs and offices to co-ordinate urban related efforts.
- That NATO establish an Urban Operations Working Group with a lead nation[13] to serve as a focal point in support of SHAPE, to co-ordinate NATO and member nations' urban related efforts and to build a plan based upon directions identified in this study.

Finally the Study Group recommends that RTB should endorse this study and it's recommendations and forward them to the Military Committee, the Conference of National Armaments Directors (CNAD) and the Strategic Commands.

[13] In May 2002 Germany and the Netherlands indicated a willingness to provide this lead.

LIST OF ACRONYMS

Abbreviation	Explanation
C4	Command, Control, Communications and Computers
C4I	Command, Control, Communications, Computers and Intellingence
C4ISTAR	Command, Control, Communications and Computers, ISTAR
CAPS	Capability Assessment
CASEVAC	Casualty Evacuation
CIMIC	Civil Military Co-operation
CJTF	Combined Joint Task Force
CNAD	Conference of National Armaments Directors
COIN	Counter Insurgency
COM	Commander
CSS	Combat Service Support
CT	Counter Terrorism
DOTM	Doctrine, Organisation, Training and Materiel
DOTMLPF	Doctrine, Organisation, Training, Materiel, Leadership, Personnel and Facilities
DP	Decisive Point
EM	Electro-Magnetic
FIST	Future Infantry System Technologies
HQ	Headquarter
HUMINT	Human Intelligence
IFFN	Identification Friend-Foe-Neutral
IPB	Intelligence Preparation of the Battlefield
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
MEMS	Micro Electro-Mechanical Systems
NBC	Nuclear, Biological and Chemical
NGO	Non-Governmental Organisation
NLW	Non-Lethal Weapon
OOTW	Operations Other Than War
POL-MIL	Political-Military
PSYOPS	Psychological Operations
RF	Radio Frequency
ROE	Rules of Engagement
RTB	Research and Technology Board
RTO	Research and Technology Organisation
SAS	Studies, Analyses and Simulation
SF	Special Forces
SHAPE	Supreme Headquarter Allied Powers Europe
UAV	Unmanned Aerial Vehicle
UGV	Unmanned Ground Vehicle
USECT	Understand, Shape, Engage, Consolidate, Transition
USW	Urban Seminar War game
WMD	Weapons of Mass Destruction

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ANNEX A - LIST OF MEMBERS / LISTE DES MEMBRES

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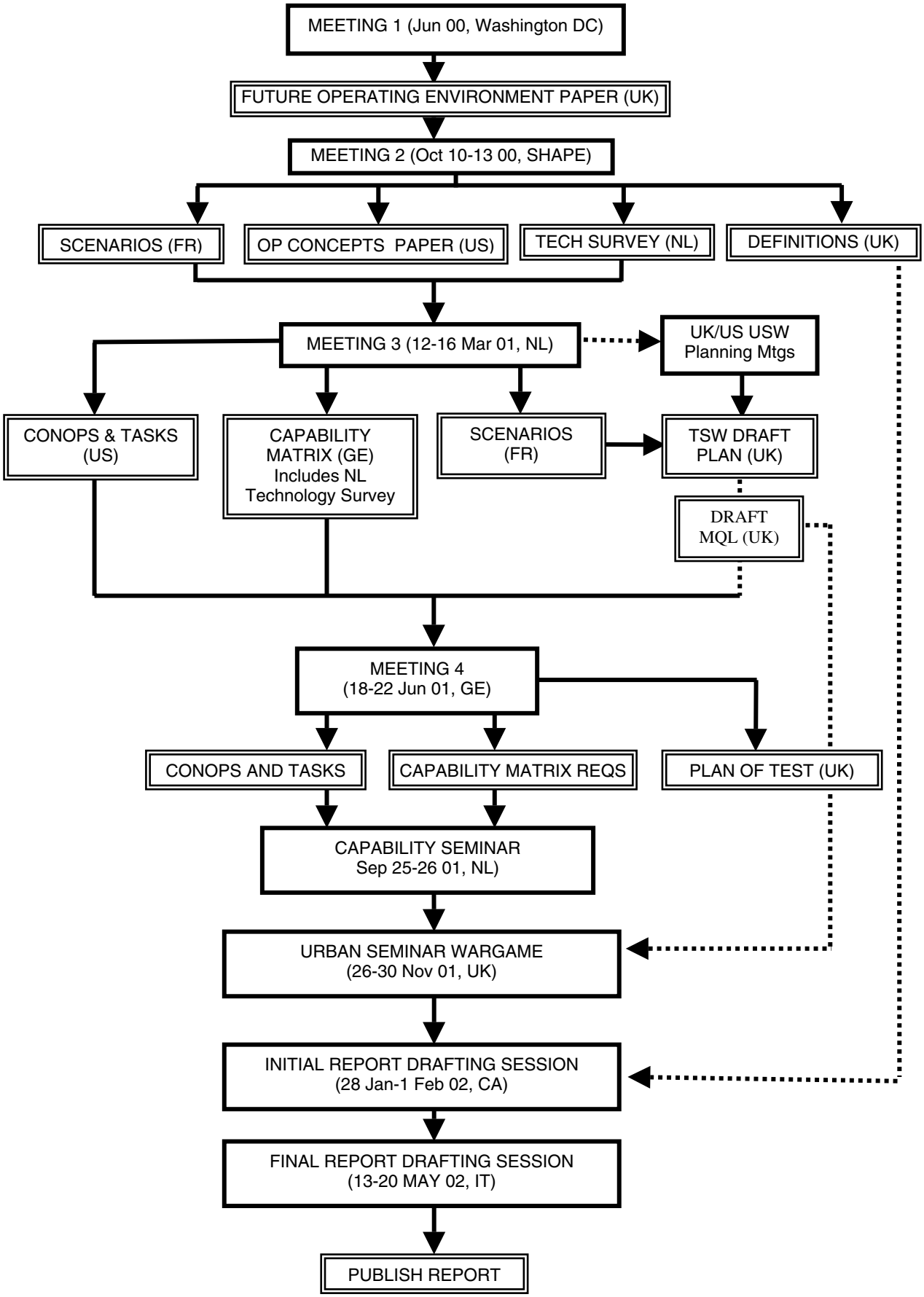
ANNEX B - METHODOLOGY



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ANNEX C - CAPABILITY ASSESSMENT SEMINAR

THE HAGUE, SEPTEMBER 2001

1. General introduction

The Study Group agreed to facilitate the process of filtering and ranking both operational capabilities and concepts (materiel) through the use of a decision support tool. The meeting where these activities were conducted was called the Capability Assessment Seminar (CAPS).

The facilities used during CAPS consisted mostly of the Dutch *Group Facility Room* in which the participants used the GroupSystems software as a decision support tool. After initial voting by the Study Group on the capabilities that were found to be essential at the operational level, the SAS-30 participants were split up. A military subgroup dealing with the non-materiel related issues of DOTMLPF, looked for drivers and possible solutions for future urban capabilities and a technology subgroup focused on possible materiel driven solutions.

2. Use of GroupSystems for decision support

The software used during the CAPS-meeting enabled the participants to give their input, ratings and comments on the different issues in an anonymous and very fast way. Several activities were undertaken during the 3 days of the CAPS meeting. Some of the activities focused on commenting on earlier products from the SAS-30 study, but most focused on the selection of the most favorable items from the original lists of all capabilities or concepts that had been developed.

On the one hand this was done in order to create a reasonable sized overview of capabilities and possible solutions to be used during the Urban Seminar Wargame (USW). On the other hand this was done to draw NATO's attention to the most relevant issues regarding urban operations at the operational level.

During the meeting there was a lot of discussion on the ranking methods used. It was explained by the TNO experts, that these methods had been chosen only to make sure that within the limited time available we could process as much information as needed for this meeting. The resulting "shortlists" therefore do not reflect an absolute ranking as a result of in depth scientific research, but have provided the consensus view of the importance of the capabilities and concepts.

For example: from the originally developed capabilities we have selected the 12 most relevant ones by simply looking at those capabilities that were deemed favorite by at least 3 out of 7 participating nations. The top 5 of those 12 capabilities did have the same score of 5 votes, the following 5 capabilities scored 4 votes and the last 2 capabilities scored 3 votes. The focus of the question before the national voting was: *select those 10 capabilities per nation that to your opinion contribute most to the operational commander's success when dealing with operations in urban terrain.*

This doesn't mean that the remaining capabilities (either 2,1 or zero votes) are not important at all with respect to their necessity / applicability in urban operations. These capabilities simply did not attract as many votes, due to the restrictions of the voting process. Another way of voting the original capabilities showed a slightly different "Top 12"; the combination of the results from those two voting sessions resulted in the Top 15 capabilities overview that has been used in Chapter 5 of this study.

3. Voting on capabilities by the Study Group

The Study Group has reassessed the 53 capabilities (see Appendix C-1) that had derived from the earlier meeting in Bonn. Through a process of commenting on all capabilities and merging those that were closely related the Study Group developed an overview of 42 capabilities. All participating nations agreed that these

capabilities would be necessary for the CJTF at the operational level, when dealing with military operations in urban terrain (see Appendix C-2 for these 42 capabilities with an explanation).

The Study Group decided in an earlier stage of the study to limit the focus of detailed wargaming to approximately 10-12 materiel concepts. Several voting sessions were used to rank and limit both the number of initially defined capabilities as well as the number of materiel concepts.

From the two voting sessions on capabilities and detailed discussion afterwards, a list of 15 Key Capabilities was derived, as shown in table C-1.

Destroy or neutralize fixed and mobile targets	Detect, identify and assess rapidly NBC threats
Establish a reliable Friend-Foe-Civilian Identification	Process, format and distribute large scale data
Conduct cyber operations	Dominate the EM spectrum
Enable a force to use the urban battlespace	Assure C4 interoperability
Acquire an accurate understanding of urban battlespace	Provide and sustain combat power and maintain tempo
Provide the appropriate level of mobility	Determine intent, aim, location, movement, status of opposing forces
Deny enemy having effective C4ISTAR	Have an overall understanding of the global and local situation
Establish, secure and maintain own forces support system	

Table C-1 Overview of the selected 15 Key Capabilities (see also Chapter 5).

4. Items discussed by the technology subgroup

As mentioned before, after the initial reassessment of the capabilities by all participants, the study group was split up into a military subgroup and a technology subgroup. The technology subgroup had participants from all nations, who worked mostly with the GroupSystems facility. A small team worked on a separate issue: grouping the concepts (materiel) in such a way that those concepts with great similarity could be combined (under new, more generic concept titles). This detailed work resulted in a new overview of materiel concepts, consisting of 36 more generic ones against the original 79 concepts that were received during the study from the participating nations. The original 79 concept systems are listed in Table C-2.

number	**concept (materiel) description**
1	MAE (Medium Altitude and Endurance)
2	Modular UAV
3	Modular RSTA platform
4	Unmanned Reconnaissance Aerial Vehicle
5	Unmanned Support Aerial Vehicle - Hi Alt VTOL
6	Unit Level Unmanned Air Vehicle
7	Unmanned Combat Aerial Vehicle – VTOL
8	VTOL UAV (Vertical Take-off and Landing) – 350kg
9	Mini Unmanned Air Vehicle
10	Micro Air Vehicle (MAV)
11	Micro Aerial Vehicle
12	Micro UAV
13	Bird-like UAV
14	Indoor hover UAV + small payload delivery
15	Unmanned airship
16	Underground Unmanned Vehicle

number	concept (materiel) description
17	Small UGV/UUV for building search/survey
18	Outdoor UO UGV Team
19	Indoor UO UGV Team
20	Data Mining
21	Cricket autonomous comms link
22	Tagging
23	Robotic Urban Sentry (Advanced MDARS)
24	EM spectrum mapping
25	Holographic SAR
26	Urban Terrain Geographic Information System (GIS) Modeller
27	Miniature man-portable target acquisition system
28	Retro-reflection optical sight locator
29	Sniper detection
30	Troop detection radar
31	Window observation (1) – dart
32	Window observation (2) - fire and recover
33	Remotely emplaced Surveillance system
34	"Chuckyball" Surveillance system
35	Laser listener
36	Expendable MEMS sensors
37	UWB sensing and communication
38	Auto re-broadcast
39	Reliable, Secure, Wideband Communications – Reachback
40	Reliable, Secure, Wideband Communications – Tactical
41	Reliable, Secure, Wideband Communications - Air/Ground
42	Reliable, Secure, Wideband Communications – Underground
43	Reliable, Secure, Wideband Communications – Coalition
44	Exploiting Local Communications Infrastructure
45	High mobility fighting subway rail vehicle
46	Urban Operations Vehicle
47	High mobility NLW APC
48	High mobility modular fighting APC
49	High mobility engineering vehicle
50	Multipurpose C4/Intelligence/Ambulance platform
51	Mobile Urban Command Centre
52	Unmanned Mobile Recce Land System - 25kg
53	Unmanned Mobile Combat Land System - 2000kg
54	Unmanned Mobile Support Land System - 2000kg
55	Decoy vehicle
56	Universal translator
57	Robotic work-horse
58	Personnel Identification Systems
59	Information Integrated Uniform
60	Medical robot – autonomous
61	MEMS inertial navigation unit for use at squad level
62	Reliable, Secure, 3-D Location System
63	Building to Building Bridge (Foam)
64	Building to Building Bridge (Trad. cantilever)
65	Building Ascent
66	Building Ascent Robot
67	Handheld Mobile Land System - 1.5kg
68	Combined body armour and continuous munition system

number	concept (materiel) description
69	Rooftop Countermobility weapon
70	Ultra Lightweight Mortar System
71	Electric Direct Fire System
72	Direct energy weapon system for urban ops
73	High mobility modular howitzer
74	Disorientation system
75	Autonomous parachute resupply system
76	Unmanned Transport Helicopter – 15t
77	High Mobility Urban Recce Platform
78	Stand-off Scaleable effects munition
79	Intelligent barriers

Table C-2. Overview of the original 79 concepts (materiel), before amalgamation and ranking

An overview of the mapping of the 79 concepts (materiel) to the 36 new concepts (CAP 01 through CAP 36) can be found in Table C-3.

No.	MATERIEL CONCEPTS AFTER EVALUATION	CONSISTS OF ORIGINAL CONCEPTS
CAP 01	C4I Urban Command Center	51
CAP 02	C4I urban specific infra-structure	5, 20, 24, 26, 38, 39, 40, 41, 42, 43, 44
CAP 03	3D Imagery of city, C4I linked	25
CAP 04	Imagery of underground terrain, C4I linked	16, 17, 52
CAP 05	Sensors, airship	15
CAP 06	Sensors, remote, fixed	32, 33, 36
CAP 07	Sensors, remote, mobile	66
CAP 08	Sensors, vehicle mounted	30
CAP 09	Sensors, remote, man portable	31, 34, 35
CAP 10	Sensor, target acquisition	27, 28, 29
CAP 11	UAV, indoor, weapon	11, 14
CAP 12	UAV, indoor, recce	11, 12
CAP 13	UAV, urban outdoor, recce	8, 9, 10, 11, 13
CAP 14	UAV, urban outdoor, weapon	11
CAP 15	UAV, warfighting, weapon	2, 7
CAP 16	UAV, warfighting, recce	1, 2, 4, 5, 6
CAP 17	UGV, warfighting, weapon	53
CAP 18	UGV, warfighting, decoy	55
CAP 19	Robotic Work-Horse	57
CAP 20	UGV, indoor, recce	19, 52, 67
CAP 21	UGV, indoor, weapon	67
CAP 22	UGV, urban outdoor, recce	3, 18, 23, 54
CAP 23	UGV, urban outdoor, weapon	53
CAP 24	HMMV variant (incl. rubble clearance)	45, 46, 47, 48, 49, 50, 54, 65, 73, 77
CAP 25	Logistics/supply, medevac (incl. autonomous)	54, 60, 75, 76
CAP 26	Urban Warrior, protection	59, 68
CAP 27	Urban Warrior, sensors/comms/situational awareness	21, 37, 59, 61, 62
CAP 28	Urban Warrior, FFN identification, translator	22, 56, 58
CAP 29	Urban Warrior, weapons	68, 70
CAP 30	Weapon, anti-armor	69

CAP 31	Weapon, direct-fire / indirect-fire	71, 73
CAP 32	Weapon, DEW	72
CAP 33	Weapon, non lethal	74
CAP 34	Engineer, bridging	63, 64
CAP 35	Weapon, scaleable munition	O1 (added during CAPS)
CAP 36	Engineer, barriers	O2 (added during CAPS)

Table C-3. Overview of the grouped concepts (materiel) into 36 new concepts

During the work on grouping the 79 concepts into a more logical order of concepts (materiel), the remaining members of the technology subgroup have ranked the original 79 concepts, resulting in 11 concept systems with 3 or more votes (out of 7 possible votes, 1 per nation). These were considered to be concepts (materiel) that were specifically well suited as materiel solutions for the CJTF commander during urban operations. After that, the 36 new concepts were reviewed for their possible contribution at the operational level. This resulted in a ranked list of the concepts that came from another national voting session. The earlier selection of 11 original concepts was well represented in the new shortlist of 12 CAPS concepts (broader categories) that had 3 national votes or more. This overview of the Top 12-20 is shown in Table C-4.

ID	**RANKED ORDER OF SELECTED CONCEPTS**
CAP 35	Weapon, scaleable munition
CAP 28	Urban Warrior, FFN identification, translator
CAP 01	C4I Urban Command Center
CAP 27	Urban Warrior, sensors/comms/situational awareness
CAP 33	Weapon, non lethal
CAP 25	Logistics/supply, medevac (incl. Autonomous)
CAP 13	UAV, urban outdoor, recce
CAP 03	3D Imagery of city, C4I linked
CAP 02	C4I urban specific infra-structure
CAP 07	Sensors, remote, mobile
CAP 12	UAV, indoor, recce
CAP 22	UGV, urban outdoor, recce
CAP 06	Sensors, remote, fixed
CAP 10	Sensor, target acquisition
CAP 11	UAV, indoor, weapon
CAP 20	UGV, indoor, recce
CAP 23	UGV, urban outdoor, weapon
CAP 09	Sensors, remote, man portable
CAP 04	Imagery of underground terrain, C4I linked
CAP 36	Engineer, barriers

Table C-4. Top 12 / 20 concepts (materiel) as voted during CAPS

As the technology subgroup also had to deliver a reasonable view on the most appropriate concepts (materiel) for the chosen Top-12 capabilities, a final ranking was done for the selected 12[14] concepts against the selected 12 capabilities.

[14] To enable the UK team to prepare the USW in a proper way, the Study Group finally ranked 20 concept systems that had 2 national votes or more, instead of the "Top 12"

Nations voted, using the numbers 0-10 with the following meaning:

0 the concept does not contribute at all to the specified capability [leave blank]
1 the concept has only very small potential for this capability
2 the concept has only small potential ….
:
:
9 the concept is very applicable to ….
10 the concept is ideal to fulfil the specified capability

National voting during CAPS gave an initial overview of cross-capability applicability of concepts (materiel) as well as a relative ranking of concepts for a given capability. Table C-5 shows the results from this voting (applicability of the selected 20 CAPS concepts for each selected capability). The numbers in this table are the averages based upon the marks given by the participating nations (minimum score 0, maximum score 10).
The general conclusions with respect to the applicability of materiel solutions to the required capabilities can be found in Chapter 6 and Annex D.

Capability (Top 12/20, as considered in CAPS)	Concept (materiel)	U 6 Determine intent, aim,	E 1 Destroy or neutralize	E 6 Establish reliable FFN ID	S 5 Provide mobility	S 14 Deny enemy C4ISTAR	E 10 Conduct cyber ops	U 3 Have overall understanding	U 7 Acquire accurate understanding	S 18 Assure C4 Interoperability	S 11 Enable use of battlespace	E 2 Provide and sustain combat power	S 13 Detect, ID and assess NBC threats/hazards
CAP 35	Weapon, scaleable munition	0.3	9.4	0.1	3.7	5.1	0.1	0.1	0.1	0.1	4.3	7.4	0.3
CAP 28	Urban Warrior, FFN identification, translator	3.9	5.1	8.1	2.9	3.4	3.4	6.6	4.6	4.6	4.7	4.7	3.6
CAP 01	C4I Urban Command Centre	8.3	5.0	5.0	3.3	4.0	5.3	6.3	3.6	7.9	6.4	6.7	4.9
CAP 27	Urban Warrior, sensors/comms/situational awareness	6.0	5.3	6.3	4.9	2.6	2.0	6.9	5.6	4.1	6.0	6.1	5.6
CAP 33	Weapon, non lethal	0.9	7.3	0.3	2.6	5.6	4.1	0.1	0.1	0.3	5.9	5.1	0.1
CAP 25	Logistics/supply, medevac (incl. autonomous)	1.3	4.4	0.7	6.0	0.6	0.4	1.6	1.1	2.1	6.0	9.3	2.9
CAP 13	UAV, urban outdoor, recce	8.4	5.6	6.4	5.4	2.9	1.7	6.9	8.6	1.4	6.3	6.0	6.4
CAP 03	3D Imagery of city, C4I linked	6.3	6.4	3.0	7.0	2.7	3.7	7.3	7.9	3.9	7.6	5.9	3.1
CAP 02	C4I urban specific infra-structure	5.1	6.1	3.6	6.4	4.6	4.7	7.1	8.6	5.1	7.1	5.7	3.1
CAP 07	Sensors, remote, mobile	6.0	5.9	4.6	5.9	3.4	2.1	5.4	7.0	1.0	5.4	5.1	5.9
CAP 12	UAV, indoor, recce	6.4	5.3	5.6	3.7	2.6	1.6	4.1	7.3	1.0	4.9	4.3	5.1
CAP 22	UGV, urban outdoor, recce	6.9	5.9	5.0	6.7	4.0	2.3	6.4	7.1	1.0	6.0	5.9	6.6
CAP 06	Sensors, remote, fixed	6.1	5.3	5.4	5.0	2.7	1.9	5.3	6.9	1.1	6.7	6.3	5.6
CAP 10	Sensor, target acquisition	4.7	7.7	4.0	2.3	5.4	1.1	3.4	2.9	1.6	6.9	7.7	1.6
CAP 11	UAV, indoor, weapon	1.7	7.7	0.1	2.1	2.9	0.1	0.1	0.1	1.3	5.7	5.0	0.3
CAP 20	UGV, indoor, recce	6.1	6.3	5.3	4.3	3.1	1.6	4.4	6.6	1.0	6.7	4.4	5.3
CAP 23	UGV, urban outdoor, weapon	1.9	8.3	0.7	3.1	3.9	0.3	0.3	0.1	1.1	7.4	7.0	0.4
CAP 09	Sensors, remote, man portable	6.9	5.9	6.1	5.3	4.9	1.9	6.1	7.3	1.1	7.1	5.7	5.7
CAP 04	Imagery of underground terrain, C4I linked	6.3	6.0	3.0	5.7	3.7	4.1	6.7	7.9	4.0	7.7	5.7	3.3
CAP 36	Engineer, barriers	0.9	6.4	0.4	6.0	1.4	0.1	0.4	0.4	1.3	8.1	7.3	0.1
	High score per capability High score per concept (materiel) Combined high score (capability and concept)												

Table C-5.
Overview of average scores; concepts' applicability for a given operational capability

5. Results from the military subgroup

During CAPS the military subgroup assessed potential solutions (non-materiel) for the 42 operational level capabilities that resulted from the initial CAPS voting session. This identified the major drivers (DOTMLPF) as potential solutions for the key capabilities.
Although initial effort was focused on the Top-12 capabilities, all 42 have been considered. The resulting matrix, populated with potential (non-materiel) solutions can be found in Appendix C-3.

Further work of the Study Group resulted in an overview of the most likely drivers for the most relevant capabilities. These are indicated in Chapter 6 of this study (Potential solutions).

6. Summary

Final results of the CAPS meeting therefor may be summarized as follows:

- Selection of 15 Key Capabilities;
- Overview of possible materiel solutions (79 concepts);
- Mapping of the 79 original concepts to the 36 new CAPS concepts;
- Ranking of most relevant concepts (materiel) (12-20);
- Ranked overview of concepts meeting capability requirements;
- Overview of the original 53 capabilities;
- Potential solutions (DOTMLPF) for the 42 selected capabilities.

APPENDIX C-1

53 original capabilities (results of the Bonn meeting)

U1, Process, format and distribute large scale data and information aimed at improving the decision making process
U2, Know location and status of own forces
U3, Have an overall understanding of the global and local situation and context (population, ethnic, cultural, political, factions, sympathies, agencies, NGO's, etc)
U4, Establish a shared understanding of own forces capabilities and limitations
U5, Establish a psycho-sociological profile of the enemy, neutrals, key players and population
U6, Determine intent, aim, location, movement, status, capabilities, support structure of enemy forces, neutrals, key players and population
U7, Conduct urban battle damage assessment (BDA)
U8, Acquire an accurate understanding of the infrastructure, the systems and the dynamics of an urban area and their impact of operations (identify the key nodes and vulnerabilities)
S1, Track and control crowds with non-lethal means
S2, Selectively control infrastructure, utilities and non-military communications
S3, Restrict the effect of chemical, biological and radiological hazards
S4, Restrict enemy's movement/logistics/ intentions
S5, Provide the appropriate level of mobility (surface/above surface/sub-surface, including under water)
S6, Provide own forces with protection, mobility and information
S7, Prevent enemy's sensors functioning
S8, Manage the media's impact on the operation
S9, Know location and status of own forces
S10, Isolate an urban battlespace
S11, Influence the local population by means other than force
S12, Influence the local population (Conduct PSYOPS, win hearts and minds)
S13, Find and track enemy forces
S14, Establish, secure and maintain own forces support systems (logistics, medical, etc.)
S15, Enable a force to use the airspace within the urban environment including airspace coordination and SEAD
S16, Do small unit combined arms
S17, Detect, identify and assess rapidly chemical, biological and radiological threats
S18, Deny enemy having effective C4ISTAR
S19, Deceive enemy as to BLUE intentions and actions
S20, Co-ordinate joint/interagency/coalition activities
S21, Control (stimulate/prevent) non-combatant mass movement
S22, Assure C2IS interoperability
E1, Destroy or neutralize, in a timely manner, fixed or mobile point targets in the urban environment with minimum casualties and collateral damage
E2, Sustain firepower of own forces
E3, Sustain combat power and tempo of own forces
E4, Simultaneously conduct throughout the spectrum (anti-urban guerilla operations, etc.)
E5, Seal off areas to enemy denying them maneuver
E6, Reinforce dispersed/isolated forces
E7, Provide for displaced population
E8, Operate simultaneously inside and outside the urban area
E9, Fix the enemy indefinitely in an urban area from the outside
E10, Establish a reliable Friend-Foe-Civilian Identification
E11, Ensure basic provision for the non-combatants within the sieged area
E12, Dominate the EM spectrum
E13, Destroy wide-area targets in all dimensions
E14, Conduct cyber operations
C1, Secure an urban area
C2, Address the effects of WMD and other environmental hazzards

C3, Set the conditions for the restoration of infrastructure and services
C4, Ensure swift and effective MEDEVAC, food, water, etc. for the population
C5, Ensure swift and effective MEDEVAC for own forces
C6, Re-establish the civil administration (justice, law enforcement, etc)
C7, Control returning displaced persons
T1, Conduct “exit” operations for the force
T2, Return final control to civil authorities

APPENDIX C-2

The 42 selected capabilities with short explanation. Note that the numbers have been changed to reflect the 42 capabilities that were selected.

No	Capability	Explanation
U 1	Process, format and distribute large scale data and information aimed at improving the decision making process	Data fusion, processing, distribution throughout all levels of command Digitalisation
U 2	Know location and status of own forces	Selected information at the operational level Real Time Information
U 3	Have an overall understanding of the global and local situation and context (population, ethnic, cultural, political, factions, sympathies, agencies, NGO's, etc)	Awareness on the general and specific background of the situation, conflict, region etc
U 4	Establish a shared understanding of own forces capabilities and limitations	Understanding of JOINT and Combined forces effects, strength and weaknesses
U 5	Establish a psycho-sociological profile of the enemy, neutrals, key players and population	How to get into the minds and understand the relationships of the parties/individuals involved
U 6	Determine intent, aim, location, movement, status, capabilities, support structure of enemy forces, neutrals, key players and population	Evolving situation/dynamics
U 7	Acquire an accurate understanding of the infrastructure, the systems and the dynamics of an urban area and their impact of operations including BDA (identify the key nodes and vulnerabilities)	Awareness on the interrelation of subsystems in an urban environment, e.g. infrastructure, public services
S 1	Monitor and control crowds within urban areas	Controlled observation and stimulation of group movements
S 2	Selectively control infrastructure, utilities and non-military communications	E. g. roads and bridges, public services, broadcasting systems, telephone systems etc.
S 3	Restrict the effect of chemical, biological and radiological hazards	Including Toxic Industrial Materiel
S 4	Restrict enemy's movement/logistics/ intentions	Best possible control and prediction of the adversary
S 5	Provide the appropriate level of mobility (surface/above surface/sub-surface, including under water)	Mobility of own forces including all branches
S 6	Provide own forces with protection.	Including physical, electromagnetic spectrum, psychological protection Personnel and equipment
S 7	Manage the media's impact on the operation	Co-operation with the media Controlled and co-ordinated media-operations at all levels of command
S 8	Isolate an urban battlespace	3 D Control of the Area of Operation (AOR) Prevent influences by other groups (refugees, population, enemy...)
S 9	Influence the local population.	The use of InfOps, PSYOPS, CIMIC, Media
S 10	Establish, secure and maintain own forces support systems (logistics, medical, etc.)	Robust CSS
S 11	Enable a force to use the battle space within the urban environment.	Own forces possibility to use all components in an urban battle space by 3 D battle space coordination
S 12	Use combined arms effects at the lowest level.	Ability to use the effects of combined arms at all levels
S 13	Detect, identify and assess rapidly chemical, biological and radiological threats	Including Toxic Industrial Materiel
S 14	Deny enemy having effective C^4ISTAR	All kind of Counter ISTAR means The use of active and passive measures

		From e.g. active jamming to emission control plans
S 15	Deceive enemy as to BLUE intentions and actions	Deception and Counter ISTAR actions
S 16	Co-ordinate joint/interagency/coalition activities	Co-ordination of military, governmental and non-governmental activities
S 17	Control (stimulate/prevent) non-combattant mass movement	Non-combattant movements as part of the operational planning process
S 18	Assure C^4 interoperability	Materiel and non-materiel interoperability of own forces C^4 capabilities
E 1	Destroy or neutralize, in a timely manner, fixed or mobile point targets in the urban environment with minimum casualties and collateral damage.	Precision strikes
E 2	Provide and sustain combat power and maintain tempo of own forces.	The way to operate (manoeuvre warfare) and the way to support it (CSS)
E 3	Simultaneously conduct operations throughout the spectrum	From humanitarian to war fighting operations (3 Block War)
E 4	Operate with dispersed/isolated forces	Ability to command and control, and sustain forces in a non-linear, non-contiguous battle space
E 5	Provide support for displaced population	Humanitarian aid to increase own freedom of action
E 6	Establish a reliable Friend-Foe-Civilian Identification	Within a JOINT and combined force including personnel and equipment
E 7	Ensure basic provision for the non-combatants within the sieged area	In the area blue forces are sieging
E 8	Dominate the EM spectrum	Within the AOR
E 9	Destroy wide-area targets in all dimensions	As a course of action in the operation
E 10	Conduct cyber operations	Including Info Ops, EW, computer network warfare, etc
C 1	Establish a secure environment in an urban area	Re-establish the rule of law and return to normality
C 2	Address the effects of WMD and other environmental hazards	Manage the consequences
C 3	Ensure swift and effective medical support, food, water, etc. for the population	Ensure humanitarian aid if required and tasked in order to consolidate the situation
C 4	Re-establish the civil administration (justice, law enforcement, etc)	CIMIC
C 5	Control returning displaced persons	CIMIC
T 1	Conduct “exit” operations for the force	To leave the AOR with or without pressure
T 2	Return final control to civil authorities	CIMIC

APPENDIX C-3

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ANNEX D - URBAN SEMINAR WARGAME

D.1 Introduction

D.1.1 Aim & Objectives

- The aim of the USW was to determine which system concepts, identified within the Capability Seminar (CAPS), were likely to provide the most military benefit during the conduct of urban operations in 2020, primarily at the operational level of command. The system concepts were selected to reflect the likely breadth of capabilities required to conduct such operations.

- The 12 system concepts examined were based on those outlined at CAPS. The concepts were finalised and agreed by National Heads of Delegation in the course of the USW rehearsal for the USW.

- The specific objectives of the USW therefore reflect the objectives of the NATO UO2020 study itself and were:

  - To construct agreed and appropriate scenarios and vignettes that included OPFOR, terrain and mission.
  - To identify the key mission tasks to be undertaken within each scenario.
  - To identify the requirements derived from these tasks.
  - To identify current capabilities and capability gaps.
  - To identify the system concepts that were most usefully employed.
  - To identify structural and procedural changes that were most appropriate in light of the deployment of these system concepts.
  - To map outputs against the agreed Understand, Shape, Engage, Consolidate & Transition (USECT) framework.
  - Where appropriate, to provide input for NATO and national defence planning processes.

D.1.2 Scope

- The USW was focused at the operational level of command. Doctrinal organisational and training approaches were examined wherever possible to supplement material system concept solutions and address relevant issues.

- The force structure considered in the study was a NATO/Coalition joint operation, comprising a Combined Joint Task Force (CJTF) Headquarters commanding a corps size Land Component and an Air Component. Maritime considerations were confined to littoral operations/power projection.

- The USECT conceptual framework provides the over-arching direction for the USW. Scenarios and vignettes were constructed to include all elements of the USECT framework. System concepts were ranked against their utility to meet the requirements of the USE elements during the USW. Consolidate and Transition elements were not evaluated as they were considered to be of lesser importance.

- The USW was only able to examine twelve system concepts, given the limited duration of the seminar. Therefore, twelve USW system concepts were constructed from a synthesis of the initial 36 new concepts from CAPS in an attempt to cover the breadth of the key capabilities defined during CAPS.

- The USW therefore considered these 12 Material system concepts, but during the syndicate and plenary sessions, some potential non-Materiel (i.e. DOT) solutions were also discussed. Separately, the primary DOTM 'driver(s)' for each of the 42 capabilities was determined by electronic voting.

D.2 Method

D.2.1 Background

- A seminar wargame (SW) is, in essence, a structured judgmental exercise to examine the possible application and value of new technologies used in postulated weapon systems. Experience has shown that this can best be done in the context of specific scenarios, as the interaction between equipment and specific military objectives prompts discussion and generation of insights.

- After participants have considered how new military systems might be applied, the relative merits of these systems are then assessed. The scenarios are therefore established to facilitate discussion of the systems under consideration. The essential element of the SW is discussion and judgmental opinion of the teams who take part. This dialogue provides the framework that allows judgement to be expressed and expert opinion articulated. The recording and analysis of this dialogue is a vital output of the SW.

- Electronic voting was also used to capture opinions. This technique is often used to assist decision making amongst large numbers of systems, but even with few types of systems it is a useful catalyst for decision making.

- The key to such a study is the use of the SW to judge, in a structured format, the relative military advantages of the candidate systems under assessment. In the course of the SW the syndicates have presented to them descriptions of scenarios and information about RED and BLUE 'forces' depicted in these scenarios (e.g. aim, disposition, objectives, organisational structure, assets available and their capabilities). Syndicates are presented with different vignettes - and are then asked to discuss their approach to the military situation, identify the relative strengths and weaknesses of the various system concepts and the best way to use them. Syndicates are also asked to consider the best way to counter such systems if used by the enemy.

- The SW proceeds initially in 'closed' mode, i.e. each syndicate is kept completely or partially ignorant of the other syndicates' discussions, but at various points the syndicates are brought together to share their conclusions and discuss and explore the reasons for differences.

- The output from the gaming leads to a better understanding of:
  - How a military force might best achieve its aim and objectives;
  - The strengths and weaknesses of proposed system concepts;
  - The strengths and weaknesses of countermeasures;
  - Tactical or doctrinal strengths and weaknesses.

D.2.2 Application of Seminar Wargaming

- **Scenarios:** Two scenarios were developed. The first scenario considered force on force war-fighting in an urban environment; the second scenario concentrated upon operations other than war (OOTW) in an urban environment. These scenarios are further detailed in Annex E.

- These scenarios provided definition of:
  - the general situation,
  - political directives,

- general threat assessment,
- NATO force(s) involved,
- chain of command,
- the mission(s) to be conducted,
- concept(s) of operations.

- **Vignettes:** A series of smaller more practical vignettes were constructed for the USW to encompass a range of issues and provide a framework for considering the relative merits of different system concepts across the spectrum of urban operations, as depicted within the scenarios above. All vignettes were designed to provide concurrent symmetric and asymmetric threats, in addition to the reaction of the civilian populace, non- and local government organisations. This was anticipated to pose significant challenges for the CJTF commander.

- Initially, five vignettes were constructed but this was later reduced to three by amalgamation of some vignettes. These vignettes allowed for variation in the characteristics of urban operations, to provide for robust analysis across the spectrum of operations and included:
  - different urban environments (e.g. density, type, population etc.),
  - concurrent and different mission tasks (i.e. the concept of the '3 Block War'),
  - mix of threats (e.g. terrorist, conventional threat forces, civil disturbance),
  - reaction of civilian populace (e.g. friendly, indifferent, hostile),
  - reaction of non-government organisations (e.g. media, humanitarian agencies).

- The number, type and content of vignettes was agreed at the USW rehearsal by all Heads of Delegation.

- **Key Questions:** A number of key questions were formulated at the operational level to facilitate discussion within the vignettes. Supplementary questions were also provided for guidance of syndicate chairman at the tactical level. The framework for these questions was defined at the USW rehearsal. Specific questions were initially defined for the Defensive vignette but these were subsequently extended to the other two vignettes.

- **NATO Forces:** Confirmation and definition of the NATO force was defined in the over-arching scenarios. This includes the relevant capabilities to be provided by "battle space digitisation technology" within the scenarios considered.

- Political directives were provided to the NATO CJTF in terms of political goals, strategic goals and desired end state(s). This was supported with key operational assumptions, e.g. neutrality of adjoining states. Mission statements were also provided and broken down into main operational and support tasks. Outline concept(s) of operations to complete these tasks were also provided.

- **Opposing and non-combatant forces:** Outlines of the nature and capabilities of both opposing and non-combatant forces were provided. These assessments were further refined to provide a detailed generic threat assessment within the over-arching scenarios. This was supported by explicit threat assessments, including likely concept(s) of operations for opposing forces, for each of the three vignettes.

- **Syndicate Structure:** It was considered necessary to consider urban operations from several viewpoints within the USW in order to ensure that the multi-dimensional nature of the problem "space" was considered. Consequently, two BLUE, one RED and one WHITE syndicate were represented. Dedicated note-takers were attached to each syndicate in order to capture points of discussion.

- Two BLUE syndicates were established in order to see if similar approaches were adopted and to facilitate a robust discussion. These syndicates were largely composed of senior military officers from several

NATO nations with support from a few technologists and analysts in order to provide a balanced view. Representatives from the NATO SAS-30 Study Group were included in each syndicate.

- The RED syndicate consisted of a number of intelligence advisers from NATO nations. Their number was supplemented by the inclusion of technologists to facilitate more informed debate with respect to the system concepts. No interaction was allowed between BLUE and RED during the syndicate session, although BLUE and RED concept(s) of operation were briefed to all delegates prior to each syndicate session.

- The WHITE syndicate represented a novel departure from the method originally adopted within LO2020. This was considered essential given the difficulties posed by the nature of urban operations. This syndicate was comprised of specialists from legal, media, psychological and people domains. This group was again supplemented wherever possible with relevant technologists.

- The role of this syndicate evolved during the USW. It was concluded that this syndicate was most effective by operating in the following manner:

  - Initial period for WHITE syndicate to discuss key issues within itself,
  - Dispersal of WHITE delegates to the other three syndicates to act as advisers during the bulk of the syndicate session,
  - Re-formation of the WHITE syndicate to formulate key issues from all other syndicates just prior to the close of the syndicate session.

- **USW Structure:** The first day of the USW consisted of a number of briefings concerning each individual element of the USW in an attempt to provide a clear understanding of the design and execution of the process. This was time consuming but essential in order to ensure each delegate was aware of and understood all of the relevant material. Additional details of this briefing material can be located within the USW Briefing Pack and the Delegate Packs.

- Over the course of the next three days, each of the three vignettes was considered in turn. A similar approach was taken on each occasion with the following steps:

  - Initial briefing on vignette, including BLUE ORBAT, mission and key tasks,
  - Intelligence briefing on likely opposition forces and potential concept(s) of operation,
  - Break into syndicate groups for consideration of key questions,
  - Reconvene into plenary session for discussion of the use and other relevant issues relating to the system concepts in plenary session in order to consider all viewpoints; BLUE (NATO), RED (OPFOR) & WHITE (NGOs, civilian infrastructure and non-combatants),
  - Discussion and identification of the significant doctrinal, organisational and training issues that arise from the deployment of the system concepts in each vignette.
  - Comparison of and electronic voting on the military attractiveness of each system concept against a set of predefined USECT criteria to establish a relative order of merit.
  - Comparison of contribution of each system concept and legacy system to the key mission tasks in each vignette, by use of structured questionnaire.

- The final day of the USW considered the military benefit of each of the system concepts across all three vignettes. It is these results which have been used to summarise the military attractiveness of the system concepts in this annex. In addition, the DOTM drivers for each of the 42 capabilities were determined.

- **Electronic voting techniques:** The electronic voting techniques to be used were defined at the USW rehearsal and wherever possible, Delphi decision analysis techniques were adopted.

D.2.3 Materiel System Concepts

- Twelve system concepts were formulated as a mechanism to examine the likely capabilities required by the NATO CJTF to achieve its political directives within the scenarios considered. These system concepts, shown in Table 1 below, were designed to reflect the breadth and range of likely key capabilities, as advised by the CAPS assessment. Nearly all the key capabilities were represented within the system concepts.

- An outline of each system concept was provided during the USW. Further details, including an illustrative representation of each system concept, were also provided. In addition, a summary of all the system concepts and detailed system concept description sheets were provided in the USW delegate packs.

Designation	Materiel System Concept
USW 1	Outdoor UAV, multi-role
USW 2	Indoor UAV, multi-role
USW 3	Outdoor UGV, multi-role
USW 4	Stand-off common precision weapon
USW 5	Counter-personnel NLW
USW 6	High mobility multi-role urban vehicle
USW 7	Expendable MEMS
USW 8	Intelligent barriers/area denial system
USW 9	Soldier situational awareness
USW 10	IFFN/tagging
USW 11	Urban data fusion command centre
USW 12	Rapid-UAV-based underground mapper

Table 1: Materiel System Concept Definition

- A brief outline of each system concept is provided below.

- **Outdoor UAV – Multi-role (USW1):** This concept represents a hovering UAV capable of autonomous flight to the target area over rooftops and along streets, with a visual/IR camera to identify personnel. It has a laser target designator (LTD) and can mount a variety of different sensor(s) and weapon(s), both lethal and non-lethal, payloads.

- **Indoor UAV – Multi-role (USW2):** This concept represents an expendable, highly manoeuvrable, Micro Air Vehicle (MAV) to enhance situational awareness and/or provide surveillance within buildings. It has a Fibre-Optic (FO) link (primary) and radio communications (secondary) to a ground station a short distance away. It is capable of carrying weapons payload in an anti-personnel role.

- **Outdoor UGV – Multi-role (USW3):** This small UGV platform is designed for deployment in streets and building entrances. It can deploy payloads including smaller “spider” robots inside buildings and confined spaces when required. Its principal mission is surveillance, but it is also capable of delivering lethal/non-lethal payloads including demolition charges.

- **Stand-Off Common Precision Weapon (USW4):** This concept represents a precision-guided, surface or air launched, indirect fire (IF) common missile, with a scaleable effects warhead to minimise collateral damage. The warhead separates into two modules in its final descent phase, providing automatic Battlefield Damage Assessment (BDA) with a trailing EO/IR sensor module.

- **Counter-Personnel Non-Lethal Weapon (USW5):** This concept uses acoustic transducers in and around buildings, to output very loud, pseudo random programmable waveforms to disorientate enemy personnel or non-combatants and so prevent effective communication. Own forces have noise cancellation headphones and can operate and continue to communicate effectively.

- **High Mobility Multi-role Urban Vehicle (USW6):** This concept is a lightweight (air-transportable), all-wheel drive (6x6), high mobility vehicle, optimised for operations in confined urban areas. It features a powered ascent system for allowing dismounted infantry quick access up to the 4th floor of a building. Potential roles include assault, reconnaissance and casualty evacuation.

- **Expendable MEMS (USW7):** This concept consists of a field of very low cost, unattended Micro Electro-Mechanical System (MEMS) based sensors (centimetre-size), which act co-operatively, communicate covertly, and detect enemy vehicles and soldiers using seismic, acoustic, thermal and visual sensors.

- **Intelligent Barriers/Area Denial System (USW8):** This concept comprises a number of primarily non-lethal devices that can be either manually or remotely laid over a dispersed area. They are able to react to approaching enemy personnel or vehicles and can be activated/ deactivated remotely for a graduated level of response. They communicate with each other and can act together to maximise area coverage, by re-orientation ('self-healing').

- **Soldier Situational Awareness (USW9):** This concept features a MEMS-based device, integrated in the soldier carriage system to improve urban soldier situational awareness including: (a) accurate, reliable and secure 3D location and communication in urban terrain, and (b) soldier medical condition monitoring. Its primary role is to provide 3D situational awareness, particularly inside buildings, at tactical and operational levels of command.

- **IFFN/Tagging (USW10):** This concept allows for discrimination between friendly forces, foes and neutrals. It comprises covertly placed tags on personnel and vehicles, with a sensor network to interrogate these tags. It also incorporates distributed imaging systems linked to a central database to identify individuals.

- **Urban Data Fusion Command Centre (USW11):** This concept represents a fusion hub for data management. Information overlays are displayed on a 3D image of the urban area. Mission planning and decision aids would also be provided by means of advanced Man Machine Interfaces (MMI). The system provides situational awareness primarily at the operational level to enable informed and timely command decisions to be made.

- **Rapid UAV-based Underground Mapper (USW12):** This concept is based on a hovering Micro Aerial Vehicle (MAV) with both visual/IR camera and ultrasonic mapping/obstacle avoidance sensor systems for rapid mapping/imaging of underground tunnels. It has a Fibre-Optic (FO) link (primary) and radio communications (secondary) to a ground station a short distance away.

- **Legacy Systems:** In order to consider the military attractiveness of the system concepts against known benchmarks, the contribution of a number of legacy systems towards achievement of mission tasks was also undertaken. This was based upon a paper questionnaire, completed by all delegates, at the conclusion of each of the individual vignettes. These legacy systems were selected to be immediately recognizable by the delegates and to provide a broad spectrum of current capabilities that could be deployed to support NATO operations. The list of legacy systems was agreed at the USW rehearsal and is detailed in the table immediately below.

Designation	Legacy System
Legacy 1	Medium UAV
Legacy 2	Main Battle Tank (MBT)
Legacy 3	Attack Helicopter (AH)
Legacy 4	Support Helicopter (SH)
Legacy 5	Armoured Infantry Fighting Vehicle (AIFV)
Legacy 6	Self Propelled Gun (SPG)
Legacy 7	Multiple Launch Rocket System (MLRS)
Legacy 8	Reconnaissance (Recce) vehicle
Legacy 9	Fighter/Ground attack aircraft
Legacy 10	Bridging vehicle
Legacy 11	Light Armoured Vehicle (LAV)
Legacy 12	JSTARS

Table 2: Legacy System Definition

- It may be noted that the list of legacy systems did not include the dismounted soldier. In hindsight, perhaps the soldier should also have been considered, as he/she is likely to remain as the core system of the urban battle. This was repeatedly stated during both syndicate and plenary discussions during the USW.

D.2.4 Evaluation Criteria

- **Military Attractiveness:** On the final day of the USW, the military attractiveness of the system concepts was assessed in plenary session, across all three of the vignettes considered. The participants included military officers, civilian scientific staff and operational analysts. However, the majority of the group was drawn from the former group. In total, 45 of the delegates present voted.

- Delegates were instructed to consider all of the discussion during the USW in formulating their judgements on individual system concepts. Delegates were also reminded of the information available on the system concepts in the delegate and briefing packs. In addition, a summary presentation of each system concept was again provided just prior to the voting.

- The over-arching question posed to the group was: “What contribution does the system concept make to the achievement of the key mission tasks at the operational level, across all three vignettes considered?”

- The participants were asked to provide a value between 1 and 9 according to the following scale (see table below). For example, a value of ‘1’ represents that the system concept makes no contribution to the achievement of the key mission tasks. The notes provided attempt to clarify the definition of contribution for each value.

Value	Contribution	Notes
1	No	Does not contribute
2	Marginal	No useful contribution
3	Slight	Minor useful contribution
4	Small	Useful contribution
5	Some	Significant contribution
6	Notable	Considerable contribution
7	Important	Major direct contribution
8	Very important	Key direct contribution
9	Vital	Essential contribution

Table 3: Military Attractiveness Criteria

- **Technical Attractiveness:** In parallel with the USW, a technical sub-group representing the NATO nations carried out an assessment of technical attractiveness. The participants included some military but predominantly civilian scientific staff and research programme managers. The majority of the group was not serving military officers. Group size was also much reduced compared to the USW itself (16 compared to 45).

- The contribution of each of the system concepts to pushing back the frontiers of technology, to the advancement in the area of systems integration (including Human Machine Interface (HMI)), the applicability across a range of different military applications and its robustness within the military environment was considered. The voting reflects all of the aspects indicated above in a single overall vote.

- The over-arching question posed to the sub-group was: “As a technical director of a military research programme, how important is it to include this system concept in your future research programme, taking account of the technical attractiveness sub-criteria?”

- The participants were asked to provide a value between 1 and 9 according to the following scale (see table below). For example, a value of ‘1’ represents that that system concept is of no importance for inclusion in the future research programme.

Value	Scale of Importance
1	No
2	Marginal
3	Slight
4	Small
5	Some
6	Notable
7	Important
8	Very important
9	Vital

Table 4: Technical Attractiveness Criteria

- **Technical Risk:** In parallel with the USW, the technical sub-group of 15 carried out an assessment of technical risk.

- The over-arching question posed to the sub-group was: "What is the likelihood of completing a successful research programme for this system concept by 2015, given 'reasonable' funding?"

- 'Reasonable' funding assumes that sufficient resources are made available to allow the research required to be conducted in order to realise the system concept.

- The participants were asked to provide a value between 1 and 9 according to the following scale (see table below). For example, a value of '5' indicates that the research programme is just as likely to fail as to succeed by 2015. Only intermediate values were assigned explicit likelihood of completion, although a linear scale was implied.

Value	Likelihood of completion	Notes
1	0%	Will fail
2		
3	25%	More likely to fail than to succeed
4		
5	50%	Just as likely to fail as to succeed
6		
7	75%	More likely to succeed than to fail
8		
9	100%	Will succeed

Table 5: Technical Risk Criteria

- **Research Cost:** In parallel with the USW, the technical sub-group (reduced to 10 only) carried out an assessment of research cost.

- These results have been generated by means of a questionnaire, which the delegates were asked to complete. A brief discussion regarding costs did take place with the key differences in costs between systems being highlighted. For example, the point was made that a vehicle system might require several prototypes to be built during its development to reduce risk in several of its key sub-system technology areas with a consequent high cost. On the other hand, a miniature electronic device might have thousands of prototype variants designed, built and tested for relatively low cost.

- The questionnaires were collected the following morning. It was noted that out of the 16 questionnaires issued, 10 responses were received, with some responses indicating that they did not have sufficient visibility or experience regarding research programme costs for some equipment types.

- The over-arching question posed to the sub-group was: "What is the level of research cost – relative to your individual national programmes?"

- Participants were reminded that cost should include a demonstration of concept viability, and asked to provide a value between 1 and 9, in accordance with the following scale:

Value	Relative cost	Notes
1	Minimal cost	
2	Very low cost	
3	Low cost	
4	Medium/low cost	
5	Medium cost	
6	Medium/high cost	
7	High cost	
8	Very high cost	
9	Extreme cost	(unaffordable)

Table 6: Research Cost Criteria

D.3 Study Results

D.3.1 Military Attractiveness

- Examination of the mean, mode(s) and standard deviation within the sample indicates that there is very close agreement between the mean and mode for the majority of system concepts. Greatest variation is noted for the high mobility multi-role urban vehicle (USW6), where more than one mode value is present. The mean value for this system concept is in excellent agreement with the lower mode value. Consequently, the mean value was used in the subsequent analysis.

- A measure of the confidence attributed to the results was determined by conducting a Mann-Whitney significance testing. It is clear that there are very few instances where confidence levels fall below 95% and that the vast majority of pair-wise comparisons confirm that the differences observed are significant. The levels of confidence obtained are much higher than those that will be observed later for technical attractiveness, technical risk and research cost. This could be due to the relatively large sample or to the greater understanding of the system concepts, urban environment and voting criteria over the period of the four preceding days (as compared to one brief session). It is likely to be a combination of both factors.

- The relative military attractiveness of the system concepts[15] is shown in Figure 1 below.

[15] USW1: Outdoor UAV, USW2: Indoor UAV, USW3: Outdoor UGV, USW4: Stand-off weapon, USW5: Counter-personnel NLW, USW6: High mobility vehicle, USW7: Expendable MEMS, USW8: Intelligent barriers, USW9: Situational awareness, USW10: IFFN/tagging, USW11: Data fusion centre, USW12: Underground mapper

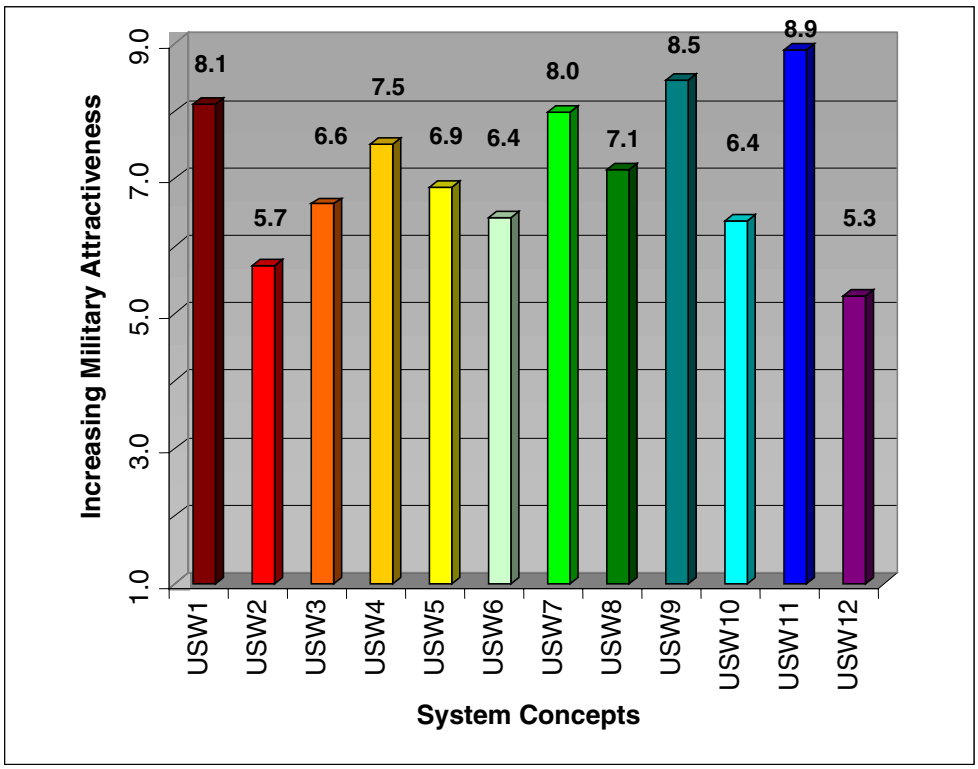


Figure 1: Military Attractiveness of System Concepts

- Figure 1 shows there was considerable variation in the perceived military attractiveness of the system concepts for conducting urban operations in 2020. However, even the least attractive concept possesses some utility.

- Table 7 presents the relative ranking of the system concepts within each individual vignette and, finally, across all of the vignettes considered. These rankings are based on all of the statistical parameters considered not just the mean of the distribution. These rankings show good consistency, whether the mean, median or mode(s) are considered, except in a few specific cases.

Designation	Materiel System Concept	Ranking of Materiel System Concepts			
		CRO Vignette	Defensive Vignette	Offensive Vignette	Across Vignettes
USW1	Outdoor UAV, multi-role	2=	2	2=	3=
USW2	Indoor UAV, multi-role	9=	11	11	11
USW3	Outdoor UGV, multi-role	9=	7=	8	8
USW4	Stand-off common precision weapon	11=	6	4	5
USW5	Counter-personnel NLW	5=	9	7	6=
USW6	High mobility multi-role urban vehicle	7=	10	10	10
USW7	Expendable MEMS	2=	3	5	3=
USW8	Intelligent barriers /area denial system	5=	5	6	6=
USW9	Soldier situational awareness	2=	4	2=	2=
USW10	IFFN/tagging	7=	7=	9	9
USW11	Urban data fusion command centre	1	1	1	1
USW12	Rapid-UAV-based underground mapper	11=	12	12	12

Table 7: Military Attractiveness of System Concepts in each vignette

- Where system concepts are equally ranked in Table 7 above, then this is represented by the "=" symbol, e.g. in the CRO vignette, counter-personnel NLW and intelligent barriers are ranked equal 5th, in terms of perceived military benefit.

- It can be seen from the above table that the trends are relatively consistent between vignettes and that the ranking of system concepts across all three vignettes reflects the findings in the individual vignettes, with few exceptions.

- There appear to be four broad clusters of system concepts. Firstly, the urban data fusion command centres (USW11), which is universally perceived to provide the greatest military benefit for NATO operations in urban terrain in 2020.

- Secondly, the outdoor UAV (USW1), MEMS (USW7) and soldier system awareness (USW9) are highly attractive system concepts to conduct urban operations.

- The third cluster of system concepts comprises the outdoor UGV (USW3), scalable stand-off weapon (USW4), counter personnel NLW (USW5), high mobility multi-role urban vehicle (USW6), intelligent barriers (USW8) and IFFN/Tagging (USW10). The importance of individual system concepts in this group may also vary with vignette. For example, the scalable stand-off weapon, was considered to have relatively low utility in the CRO vignette, increasing in utility in the defensive operation, becoming highly attractive for offensive operations.

- The fourth cluster, comprising the indoor UAV (USW2) and the rapid UAV underground mapper (USW12) were seen to provide comparatively little military utility for conducting urban operations.

- This analysis reflects the plenary and syndicate discussion where data fusion (USW11), in particular, and those other system concepts supporting 'Understand' were considered highly attractive. System concepts supporting 'Shape' were considered to be of some utility but of less importance than those underpinning 'Understand'. Few system concepts were solely concerned with 'Engage' but the most likely (USW4) was considered to have variable utility in different vignettes.

- It was concluded during discussion that integrating individual system concepts into the urban data fusion command centre would further enhance military capability. This view became more widely accepted as the USW progressed.

- Furthermore, it also became clear that at the operational level of command, it is the related capabilities to collect, communicate, assimilate and distribute information in a responsive manner that are of critical importance to urban operations. This supports the premise within the conceptual framework that 'Understand' is pre-eminent. This suggests that it is important to apply the same approach to existing systems. It may therefore be of greater benefit to integrate existing 'Understand' capabilities now and to research novel system concepts to further enhance 'Understand'.

D.3.2 Comparison with Legacy Systems

- Separately, an assessment of the relative contributions of the system concepts and 12 legacy systems were undertaken in order to examine any perceived capability gaps of existing systems. Each delegate was allowed a single vote for each system concept and legacy system on a scale of zero (no contribution to key mission tasks) to 100% (vital contribution to key mission tasks) within each vignette. This facilitates the assessment of current capability against that projected to be available to NATO forces in 2020.

- The results are depicted in the Figure 2 overleaf with the legacy systems on the left hand side of the figure and the system concepts to the right. These comparisons reflect consideration across all vignettes. Apart from the stand-off common precision weapon (USW4), which is less likely to be deployed during Crisis Response Operations, there was close agreement on the ranking of systems for each vignette and across both scenarios.

- However, there was less agreement observed for the legacy systems. In general, legacy systems were considered to offer lower utility in the CRO than in the war-fighting scenario. In addition, many of the legacy systems were expected to provide an increased contribution to offensive rather than defensive operations.

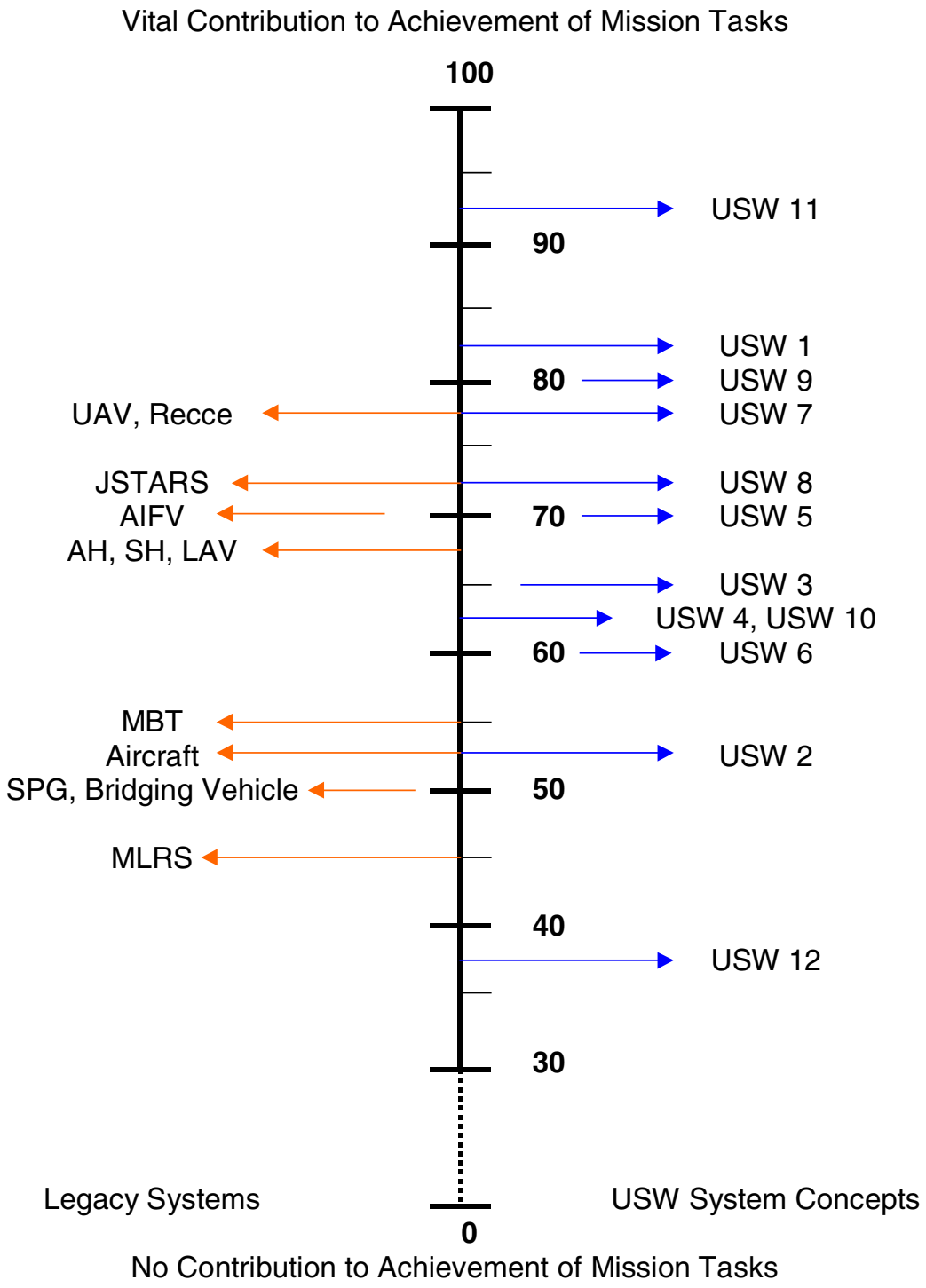


Figure 2: Comparison of USW System Concepts[16] and Legacy Systems

[16] USW1: Outdoor UAV; USW2: Indoor UAV; USW3: Outdoor UGV; USW4: Stand-off weapon; USW5: Counter-personnel NLW; USW6: High mobility vehicle; USW7: Expendable MEMS; USW8: Intelligent barriers; USW9: Situational awareness; USW10: IFFN/tagging; USW11: Data fusion centre; USW12: Underground mapper

- In general, the legacy systems were perceived to have lower utility than the system concepts, thus confirming the current capability gap faced by NATO in conducting urban operations in 2020. Those legacy systems that were perceived to be of highest utility were also those expected to contribute to 'Understanding', namely the modular UAV and the reconnaissance vehicle.

- Several legacy systems were considered to be of relatively lower importance for the conduct of urban operations. These included main battle tanks, ground attack aircraft and artillery systems.

D.3.3 Technical Attractiveness

- Examination of the mean, mode(s) and standard deviation within the sample indicates that there is very close agreement between the mean and mode for the majority of system concepts. Greatest variation is noted for expendable MEMS (USW7) but the mode remains within one standard deviation of the mean value. Consequently, the mean value was used for subsequent analysis.

- A measure of the confidence attributed to the results was determined by conducting a Mann-Whitney significance testing. It is clear that the degree of confidence varies between system concepts and is an indicator of the consensus reached within the sub-group. There is particularly good agreement for counter-personnel NLW (USW5), soldier situational awareness (USW9) and urban data fusion command centre (USW11). In the case of USW5, it was considered a challenge to produce a pseudo random acoustic noise effect in synchrony with noise cancellation headphones, whilst for USW9 and USW11 the utility of communication and data management technologies in the urban environment were considered as very important. However, where there was less consensus, the small sample size of 16 delegates probably contributes to the lower confidence levels, observed when comparing some system concepts, for technical attractiveness compared with military attractiveness.

- The relative technical attractiveness of the system concepts is shown in Figure 3 below.

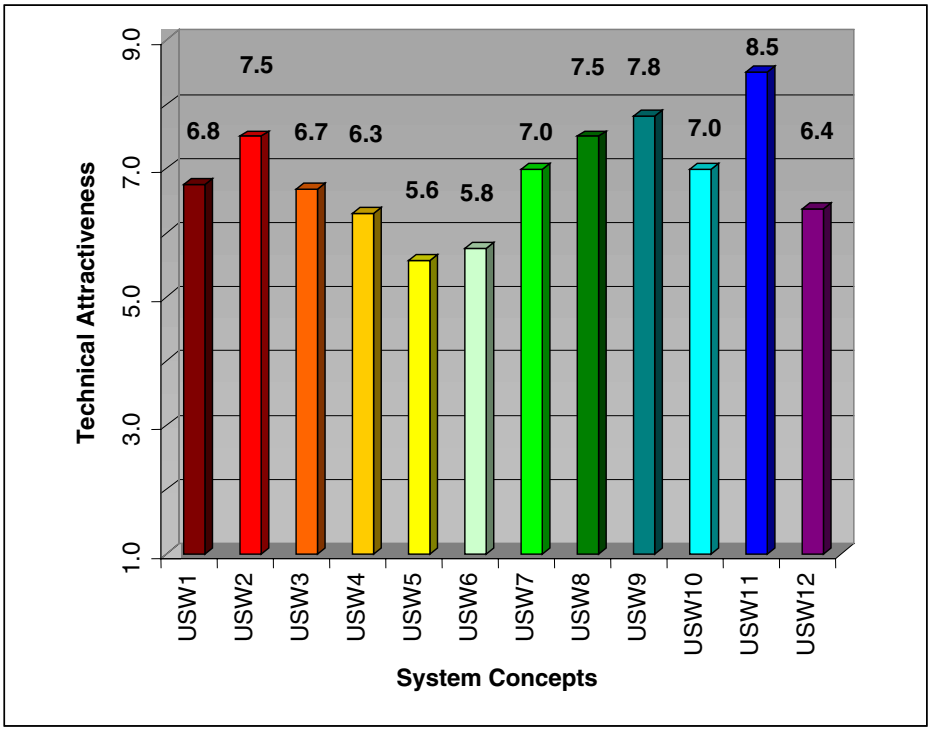


Figure 3: Technical Attractiveness of System Concepts[17]

- The distribution of results is slightly narrower than was observed for the military attractiveness of the concepts, but the urban data fusion command centre (USW11) was again considered the most attractive system concept. The high mobility multi-role urban vehicle (USW6) and counter-personnel NLW (USW5) were considered the least technically attractive, but nevertheless regarded as notable for inclusion in a research programme. The technical attractiveness for the high mobility multi-role urban vehicle (USW6) perhaps depends on the level of trade-off accepted for weight against high manoeuvrability and protection.

D.3.4 Technical Risk

- Examination of the mean, mode(s) and standard deviation within the sample indicates that there is very close agreement between the mean and mode for the majority of system concepts. Greatest variation is again noted for expendable MEMS (USW7) but the mode remains within one standard deviation of the mean value. Consequently, the mean value was used for subsequent analysis. However, it should be noted that the spread of results for the technical risk of individual system concepts is greater than that for technical attractiveness; there was much less consensus in evaluation of the technical risk of the system concepts.

[17] USW1: Outdoor UAV; USW2: Indoor UAV; USW3: Outdoor UGV; USW4: Stand-off weapon; USW5: Counter-personnel NLW; USW6: High mobility vehicle; USW7: Expendable MEMS; USW8: Intelligent barriers; USW9: Situational awareness; USW10: IFFN/tagging; USW11: Data fusion centre; USW12: Underground mapper

- Good agreement was observed for the high mobility multi-role urban vehicle (USW6), IFFN/Tagging (USW10) and the rapid UAV-based underground mapper (USW12). It was generally felt that the high mobility multi-role urban vehicle (USW6) was not complex in terms of integration and would utilise individual elements of advanced technology, i.e. advanced armour protection. There was close agreement that the tagging technology was risky in terms of its advanced nature and perhaps due to a lack of clarity over what had to be delivered technically. There was a clear understanding of the technologies that had to be integrated in the rapid UAV-based underground mapper (USW12). However, some consideration was given as to whether the platform for this system concept should be capable of flying, swimming or traversing along the ground, or any combination of the three.

- Poor agreement was observed for the stand-off common precision weapon (USW4), expendable MEMS (USW7) and the urban data fusion command centre (USW11). In the case of the stand-off common precision weapon (USW4), the risk of achieving a scaleable warhead and precision guidance control was considered as quite high by some and not by others. The expendable MEMS (USW7) presented risks that were difficult to quantify until a clearer specification of the system was developed. For example the number of multi-function MEMS and communication capability presented a system whose risks were difficult to quantify. The urban data fusion command centre (USW11) was similarly a very complex system with many interfaces with other systems at the operational level.

- A measure of the confidence attributed to the results was determined by conducting a Mann-Whitney significance testing. Despite the greater spread of results observed within the voting for individual system concepts, significance testing indicates that there is greater confidence in the relative values between different system concepts, than was observed for technical attractiveness of the system concepts.

- The relative technical risk of the system concepts is shown in Figure 4 below. A higher value indicates greater likelihood of success or relatively lower technical risk and vice versa.

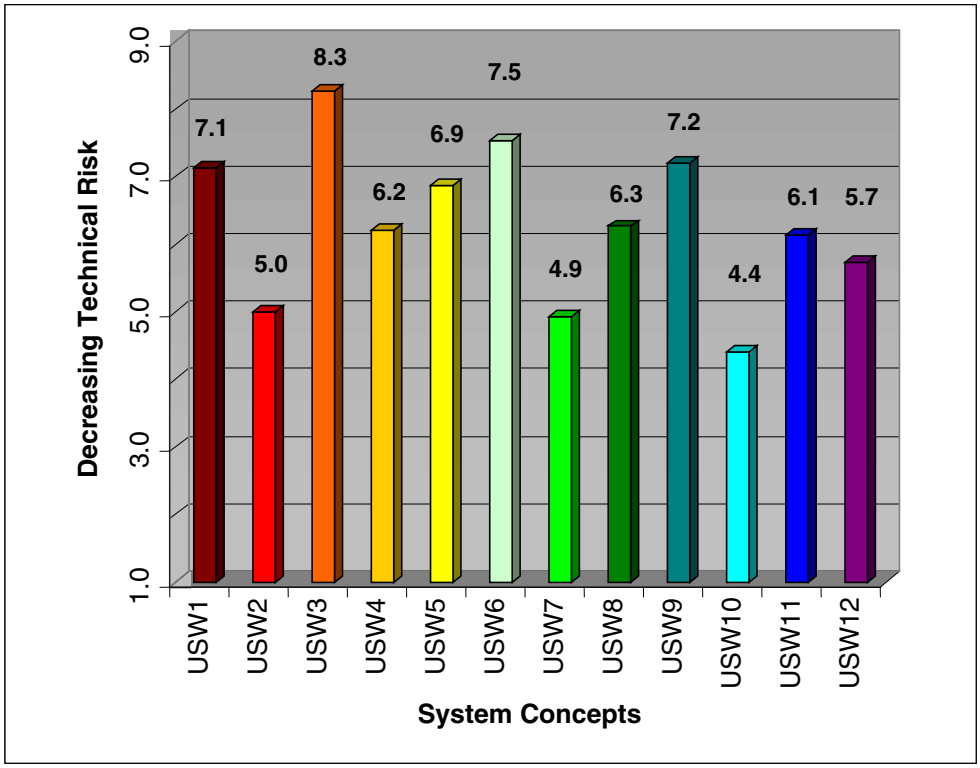


Figure 4: Technical Risk of System Concepts[18]

- The results of the delegates show a considerable variation in the perceived technical risk associated with the research required to underpin specific system concepts. Recalling that a value of '5' indicates that the research programme is just as likely to fail as to succeed by 2015, it can be seen that several system concepts are all considered to pose considerable risk in terms of realising the underpinning research required to support them. These concepts include:
  - indoor UAV – multi-role (USW2),
  - expendable MEMS (USW7),
  - IFFN/Tagging (USW10).
- The indoor UAV – multi-role (USW2) was considered to have all the inherent risks of the outdoor UAV but in addition had the issues of miniaturisation, integration and collision avoidance in tight spaces. Expendable MEMS (USW7) involved the complexity of miniaturised multi-spectral sensors and communication systems integration. The IFFN/Tagging (USW10) concept, whilst embodying a clear capability, required further technical definition especially with respect to achieving covert tagging, which made the concept relatively high risk. Furthermore, the legal and moral constraints involved with non-cooperative tagging may also have influenced the relatively high risk accorded to this system concept.
- Where system concepts are considered to pose significant technical risks and it is perceived that they would be militarily attractive for urban operations in 2020, mechanisms to reduce the research risk

[18] USW1: Outdoor UAV; USW2: Indoor UAV; USW3: Outdoor UGV; USW4: Stand-off weapon; USW5: Counter-personnel NLW; USW6: High mobility vehicle; USW7: Expendable MEMS; USW8: Intelligent barriers; USW9: Situational awareness; USW10: IFFN/tagging; USW11: Data fusion centre; USW12: Underground mapper

should be actively considered within NATO. This is of particular importance for the realisation of a system concept, based upon expendable MEMS (USW7).

- By contrast, the research required to support several system concepts is more likely to succeed than to fail (value of 7 or greater) in the judgement of the technical sub-group. These system concepts can therefore be considered relatively lower risk. These concepts include:
  - outdoor UAV – multi-role (USW1),
  - outdoor UGV – multi role (USW3),
  - high mobility multi-role urban vehicle (USW6)
  - soldier situational awareness (USW9).
- It may also be feasible to include counter-personnel NLW (USW5) within this group. The outdoor UAV – multi-role (USW1) was seen as being similar to concepts already being pursued in current research programmes with just one or two key technologies to be "de-risked". The relatively low risk of the outdoor UGV – multi role (USW3) reflects the feeling that a significant amount of research has already been carried out and that the key technical challenges have already been achieved. In the case of the high mobility multi-role urban vehicle (USW6), it was felt that the only risks are in terms of packaging the sub-systems, including armour within the weight constraint. The risks in the soldier situational awareness (USW9) concept were seen by some as being addressed by programmes already underway. Lastly, counter-personnel NLW (USW5) is also seen as a concept which has some commonality with acoustic systems already fielded or in research, but the capability envisaged for the system does make it more risky than the concepts above for the 2015 timeframe.
- Where these system concepts are considered to be militarily attractive, some may be considered to provide 'quick wins' for enhancing the effectiveness of NATO forces during future urban operations. This is of particular relevance to the outdoor UAV-multi-role (USW1) and the soldier situational awareness (USW9) system concepts.
- The most militarily attractive system concept is the urban data fusion command centre (USW11), but this can be seen to be of relatively medium risk. Consideration might also therefore be given to reducing the research risk associated with certain elements of the development of this system concept.

D.3.5 Research Cost

- It should be noted that the spread of results for the research cost of individual system concepts is greater than that for technical attractiveness and technical risk. There was even less consensus in evaluation of the research cost of the system concepts, primarily due to the reduced numbers of participants (10) and the more limited experience of the delegates in this area.
- In particular, there was poor consensus for expendable MEMS (USW7) and the rapid UAV-based underground mapper (USW12). The former result may have been due to the fact that the cost of developing a complex system based on nanoscale technology was difficult for individuals to evaluate. The latter result reflects differences in opinion with respect to the relative cost of this system concept; some considered it relatively low research cost whereas others perceived it was high cost. Its reliance upon more mature UAV technology, contrasted with the potential difficulty in applying such technology to the underground/underwater domain may also help to explain the differences in opinion noted.

- The technical risk of the system concepts is demonstrated in the Figure below. A higher value indicates lower technical risk and vice versa.

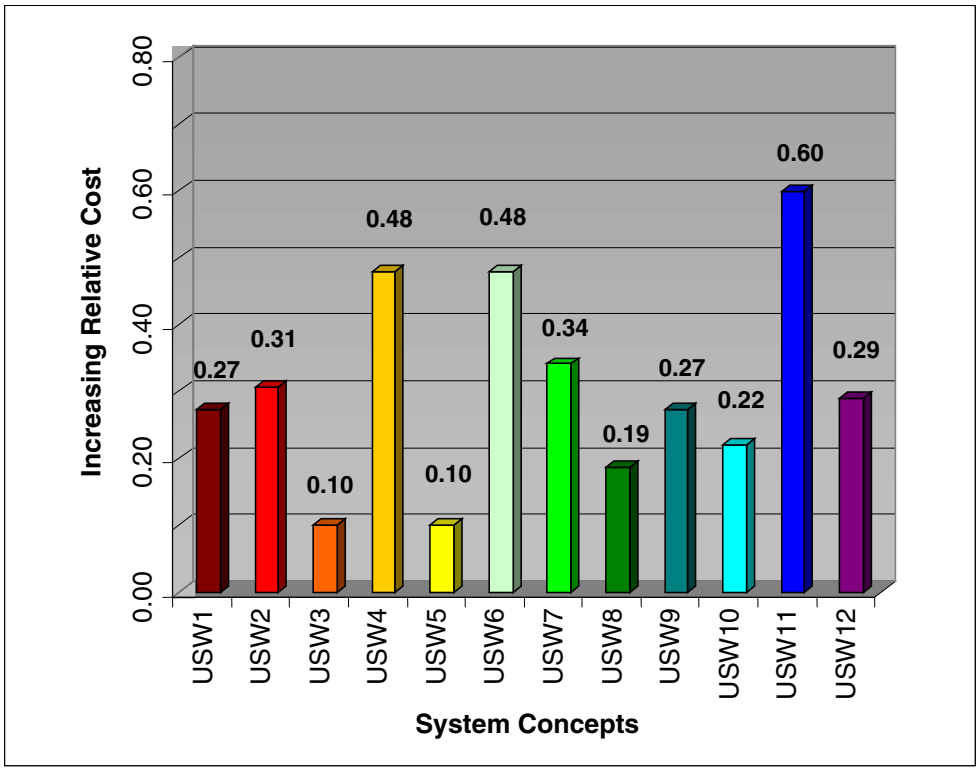


Figure 5: Relative Research Cost of System Concepts[19]

- There was excellent agreement that the urban data-fusion command centre (USW11) was high or very high cost, and that this system concept was perceived to be the highest cost of all of the system concepts examined. This is likely to be due to the high volume, prioritisation and fusion of information from many disparate platforms within the urban domain and consequently the large number of system interface issues that need to be resolved.

[19] USW1: Outdoor UAV; USW2: Indoor UAV; USW3: Outdoor UGV; USW4: Stand-off weapon; USW5: Counter-personnel NLW; USW6: High mobility vehicle; USW7: Expendable MEMS; USW8: Intelligent barriers; USW9: Situational awareness; USW10: IFFN/tagging; USW11: Data fusion centre; USW12: Underground mapper

- The research costs of individual system concepts are relative to each other and should therefore only be considered as indicative costs. It is recommended that the research cost associated with individual system concepts should be reconsidered in the light of the underpinning technologies, to provide a more robust evaluation of this criterion.

D.3.6 Susceptibility to Counter-measures

- The susceptibility of each system concept to potential enemy counter-measures was evaluated following completion of the USW but has been included within this annex for information. These reflect the complete spectrum of counter-measures likely to be available to high technology conventional or improvised asymmetric opposing forces

- **Outdoor UAV (USW1):** Counter-measures may include disruption of communications between the UAV and its command centre, decoy or dazzle of its sensor sub-systems, direct engagement with radio frequency (RF) or other weapon systems.

- **Indoor UAV (USW2):** Counter-measures may include disruption of communications between the UAV and its command centre, decoy of its sensor and/or weapon sub-systems, installation of protective screens or barriers to prevent access to interior of structures and direct engagement with RF or other weapon systems.

- **Outdoor UGV (USW3):** Counter-measures may include disruption of communications between the UGV and its command centre, decoy of its sensor sub-systems, deployment of obstacles, direct engagement with RF or other weapon systems and the use of improvised measures by unfriendly forces, e.g. spray paint, blankets or direct action (tipping, theft, vandalism).

- **Stand-off common precision weapon (USW4):** Counter-measures may include laser reflectors, dazzlers or multi-spectral screening smoke to prevent laser and/or electro-optical target designation, use of decoys or direct engagement with RF or other weapon systems. The scaleable nature of this system concept will help to reduce, but may not necessarily negate, the impact of expected asymmetric counter-measures such as the use of human shields and/or structures, e.g. hospitals or schools, by opposing forces.

- **Counter-personnel NLW (USW5):** Counter-measures may include disruption of communications between the platform(s) and their command centre, acoustic protective measures, direct engagement of platform(s) with RF or other weapon systems, or the use of improvised measures by unfriendly forces, e.g. theft and/or vandalism.

- **High mobility multi-role urban vehicle (USW6):** Counter-measures may include decoy of its sensor sub-systems, targeting its exterior features (e.g. building ascent, sensors, communications antennae), or direct engagement with RF (attacking potential electric drive sub-system) or other weapon systems. The nature of this system concept will help to reduce, but may not necessarily negate, the impact of expected counter-measures such as obstacles and/or rubble in the urban domain.

- **Expendable MEMS (USW7):** Counter-measures may include disruption of reporting mechanism(s) between the individual sensors and their command centre, deception of its sensor systems or use of RF weapons. The ability to provide false information and to overwhelm sensor and/or processing systems by use of multiple decoy targets and/or non-combatants may also need to be considered.

- **Intelligent barriers/area denial system (USW8):** Counter-measures may include disruption of communications between the individual sensors (to prevent self-healing) and/or reporting mechanism(s) to their command centre, the use of RF weapons and specific (e.g. dozer blades) or improvised (e.g. columns of refugees) obstacle clearing devices.

- **Soldier situational awareness (USW9):** Counter-measures may include disruption of communications between the individual soldiers and their command centre, use of RF weapons or deception, through

the use of captured sub-systems to provide false information. The ability of the enemy to use direction-finding systems to locate this system concept may also increase soldier vulnerability.

- **IFFN/tagging (USW10):** Counter-measures may include disruption of communications between tags and their command centre, use of RF weapons or deception. Captured tags may be used to provide misleading information and direction.

- **Urban data fusion command centre (USW11):** Counter-measures may include the use of RF weapons and/or electronic warfare techniques (including intercept, direction finding and jamming), anti-radiation missiles and overload of communications, data fusion and/or processing sub-systems by use of multiple decoy targets and/or non-combatants. It is likely that this system concept will be considered to be a key node by opposing forces.

- **Rapid UAV-based underground mapper (USW12):** Counter-measures may include disruption of communications between the UAV and its command centre, use of radio frequency (RF) or other weapon systems, and installation of protective screens (improvised or otherwise) to restrict access to underground structures.

D.3.7 Portfolio Analysis

- This technique is used to provide a clear summary of multi-dimensional criteria in order to aid decision-making. It is not intended to provide a single solution but to allow the decision-maker to select a number of options (portfolio of options) with which to proceed. In this case, the criteria under consideration are:

  - Military attractiveness (x-axis)
  - Technical attractiveness (y-axis)
  - Technical risk (colour of bubble)
  - Research cost (size of bubble)

- Each of the criteria to be considered was examined to ascertain suitable numerical values to be attributed within the portfolio analysis.

- **Military Attractiveness:** Broad agreement was reached on the military attractiveness of the majority of the system concepts considered, when the voting distributions were examined. Some system concepts demonstrated very close agreement within the voting population as to their utility for urban operations at the operational level. These included the outdoor UAV (USW1), expendable MEMS (USW7), soldier situational awareness (USW9) and the urban data fusion command centre (USW11). This consensus of opinion was associated primarily with those system concepts thought to possess high military attractiveness.

- There was a very diverse spread of opinion over the utility of some system concepts. These were typified by broad unimodal distributions. Examples in this category include the indoor UAV (USW2), counter-personnel NLW (USW5), IFFN/Tagging (USW10) and the rapid UAV-based underground mapper (USW12).

- However, there were also some clear differences in opinion of the utility of some system concepts within urban operations. Bimodal distributions and conflicting comments from discussion helped to identify these differences. The high mobility multi-role urban vehicle (USW6) was a classic example. Some comments suggested that current vehicle capability can provide the level of mobility required and therefore there is no requirement for such a concept. In contrast, many delegates thought the ability to transport infantry rapidly throughout the spectrum of the urban battlespace was very important to mission success and required the development of such a concept.

- In light of these differences of opinion, the votes provide a quantitative measure of the military attractiveness of each system concept. Statistical parameters considered included the mean, median

and mode(s) of the distribution. The greatest differences are typically observed between the mean and the mode(s) for certain system concepts. However, when the entire distribution of votes was considered, only the high mobility multi-role urban vehicle (USW6) was observed to show significant variation, due to bimodality. Therefore the mean of the votes for each system concept is an appropriate measure to use in the initial portfolio analysis.

- **Technical Attractiveness:** Analysis of these results has broadly indicated similar features to that of the military attractiveness data. Good agreement was observed between the mean and modes of the distribution for most system concepts. It has therefore been concluded that it is appropriate to consider the mean results within the overall portfolio analysis.

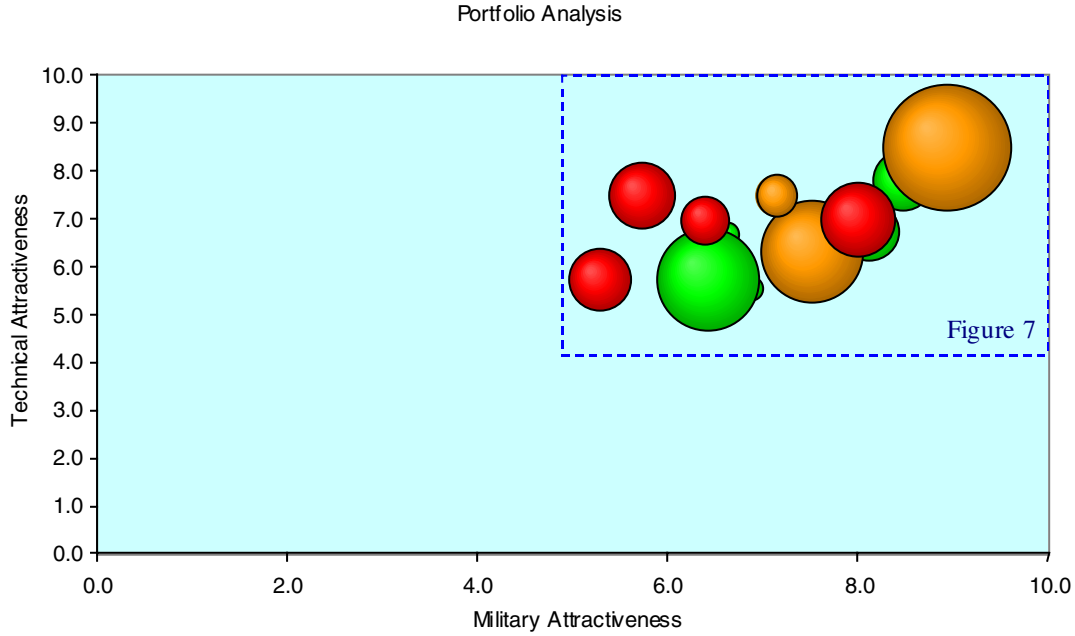
- **Technical Risk:** The distribution of votes across all system concepts was used to define three criteria for classifying technical risk into three groups. The upper quartile, median and lower quartile were used to provide a relative measure of technical risk on a numeric scale. This was used to classify each of the system concepts individually and assign them to one of three groups. Those classified lowest risk were likely to possess a greater than 75% chance of completing a successful research programme by 2015, i.e. research programme is more likely to succeed than fail. These are coloured green in the portfolio analysis. Next, those considered to lie broadly between 50%-75% probability of completing were colour coded orange. Lastly those that were considered to have approximately 50% chance or less of completing the research programme were colour coded red, i.e. research programme is just as likely to fail as to succeed.

- **Research Cost:** These data presented several problems. Given the difficulties in ascertaining costs, there is a very broad spread of opinion recorded. This is particularly noticeable for USW7 and USW12 where there is significant disagreement. Other system concepts also illustrate disagreement but to a lesser extent. It is recommended that the research cost associated with individual system concepts should be reconsidered in the light of the underpinning technologies, to provide a more robust evaluation of this criterion.

- However, in order to provide an indication of the relative cost of each system concept, the votes were assigned to a linear numeric scale. The maxima and minima for the sample set were determined and each system concept assigned, on the basis of the mean value against this linear scale. This provides a measure of relative cost and is represented by the size of the coloured bubble attributed to each system concept on the following graphs. Those possessing relatively higher cost were assigned a large bubble and those possessing relatively lower cost were depicted as bubbles of smaller size.

- Figure 6 immediately below therefore represents the whole spectrum of available solutions.

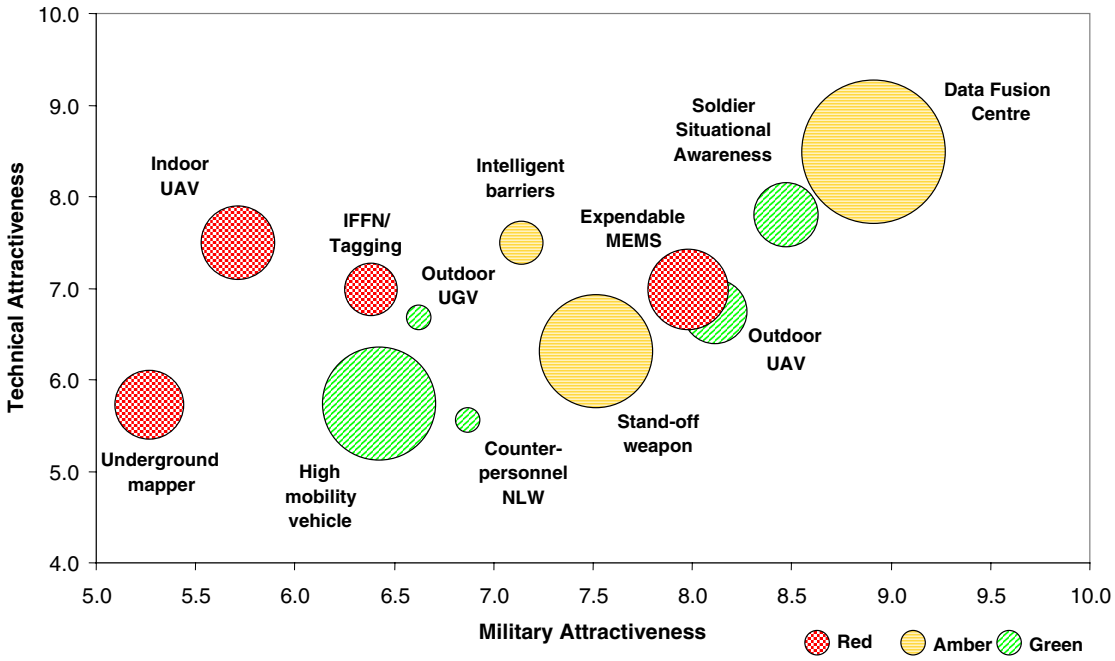
Figure 6: Portfolio Analysis: Extended Axes



- It can be seen that of the system concepts considered, none were found to have no or little benefit for urban operations. It was hoped that this would have been the case given the process of system concept definition within the NATO SAS-30 group. Consequently the system concepts are grouped in the top right hand corner.

- However, if this area of the figure is increased in size, then the differences between the various system concepts becomes clear. This is depicted in the figure below, with the axes re-drawn to concentrate upon this region.

Figure 7: Portfolio Analysis: Restricted Axes



- It might have been expected that there would be a relatively high risk associated with system concepts that were perceived to be technically attractive and, consequently, that those with relatively low technical risk would be technically unattractive. It is clear from the figure above that this is not the case.

- In addition, there is some evidence for a correlation between the military and technical attractiveness of individual system concepts. This might suggest that these votes are not independent. Given that the delegates responsible for the assessment of technical attractiveness were a sub-set of those participating in the USW, that forum may have influenced them. In hindsight, it would have been preferable, if the technical attractiveness assessment was conducted wholly separately from the USW with different participants.

- Ideally the portfolio analysis would provide a system concept with high military attractiveness, high technical attractiveness, relatively low technical risk (i.e. green) and relatively low cost (small bubble). The closest system concept to this ideal solution is the soldier system awareness (USW9) system concept that is considered to be relatively low risk and cost, but both militarily and technically attractive.

- Interestingly, it was repeatedly stated during discussion that there would always be a need to put soldiers on the ground in urban operations, given the psychological, legal and civic issues of fielding robotic systems. It could be postulated that this concept could be considered to be a ‘data fusion centre’ for each individual soldier. Certainly the increasing support as the USW progressed for this system concept was particularly noticeable.

- The urban data fusion command centre (USW11) is both highly militarily and technically attractive and could be considered to provide the greatest benefit. However, it is considered to be of relatively medium risk and relatively high cost. Therefore, although it has particular advantages, there are also significant challenges.

- Whichever of the most desirable system concepts are finally developed, it is abundantly clear that those concepts that support 'Understand' dominate those that are both militarily and technically attractive. This analysis therefore supports the move from 'Engage' to 'Understand' proposed in the conceptual USECT framework. This may also be due to the concentration upon the operational, rather than tactical level.

D.3.8 DOTM Drivers

- It became apparent that there are one or two components of DOTM that appear to provide the most effective method of realising each capability and for the purposes of the study this component of DOTM is defined as a 'Driver'. Given that the Drivers provide the greatest opportunity to realise the capability, these components are likely to provide the starting point for further action. The participants at the USW were asked to identify the Drivers for all 42 capabilities using the Delphi decision analysis technique.

- A single vote was therefore taken using the electronic voting system to determine the main driver (being one of Doctrine, Organisation, Training and Materiel) in providing each of the following capabilities within the USECT concept framework. The key capabilities and their respective driver(s) from the USW are detailed in Table 8. Where materiel is one of the main drivers, then the potential materiel solutions and their respective system concepts are also indicated.

- The USW therefore identified 12 drivers with a materiel focus and also revealed 7 "DOT drivers" (non-material). The identified drivers and/or combination of drivers indicate how NATO nations should address the 15 key capabilities and their solutions. However the interactions of the drivers (or consequential changes required) or any other of the non-drivers (such as changes in doctrine for materiel reasons) were not explored.

No.	Key Capability	Driver	Potential Solutions (Materiel)	Related Concepts (Materiel)
U 1	Process, format and distribute large scale data and information aimed at improving the acquiring and decision making process	M	C4I Urban Command Centre C4I Urban specific infra-structure	CAP 01/USW 11 CAP 02/USW 11
U 3	Have an overall understanding of the international, regional and local situation and in context with other factors such as population, ethnic, cultural, political factions, other agencies, NGOs and other groupings	O T		
U 6	Determine intent, aim, location, movement, status, capabilities, support structure of potential enemy forces, neutrals, key players and population	M	C4I Urban Command Centre Urban Warrior sensors/ comms/situational awareness UAV, urban outdoor, recce Expendable MEMS	CAP 01/USW 11 CAP 27/ USW 9 CAP 13/USW 1 CAP 06/USW 7
U 7	Acquire an accurate understanding of the infrastructure, the systems and the dynamics of the designated urban area and their impact on operations (identify the key nodes and vulnerabilities)	M	Urban Warrior, sensors/ comms/ situational awareness UAV, urban outdoor, recce 3D Imagery of city, C4I linked C4I urban specific infra-structure UAV, indoor, recce UGV, urban outdoor, recce Sensors, remote, fixed Sensors, remote, man portable	CAP 27/USW 9 CAP 13/USW 1 CAP 03/USW 11[20] CAP 02/USW 11 CAP 12/USW 2[21] CAP 22/USW 3 CAP 06/USW 7 CAP 09/--[22]
S 5	Provide the appropriate level of mobility (surface/above surface/sub-surface, including under water) to operate effectively in urban areas	M	None of the system concepts generated for CAPS and the USW adequately addressed this capability., although the high mobility multi-role urban vehicle (USW6) may meet some of the capability requirements.	
S 10	Establish, secure and maintain own forces support systems (logistics, medical, etc.)	O		

[20] Incorporated within USW11
[21] USW 2 was not considered to be a robust solution within the USW
[22] No readily identifiable USW concept

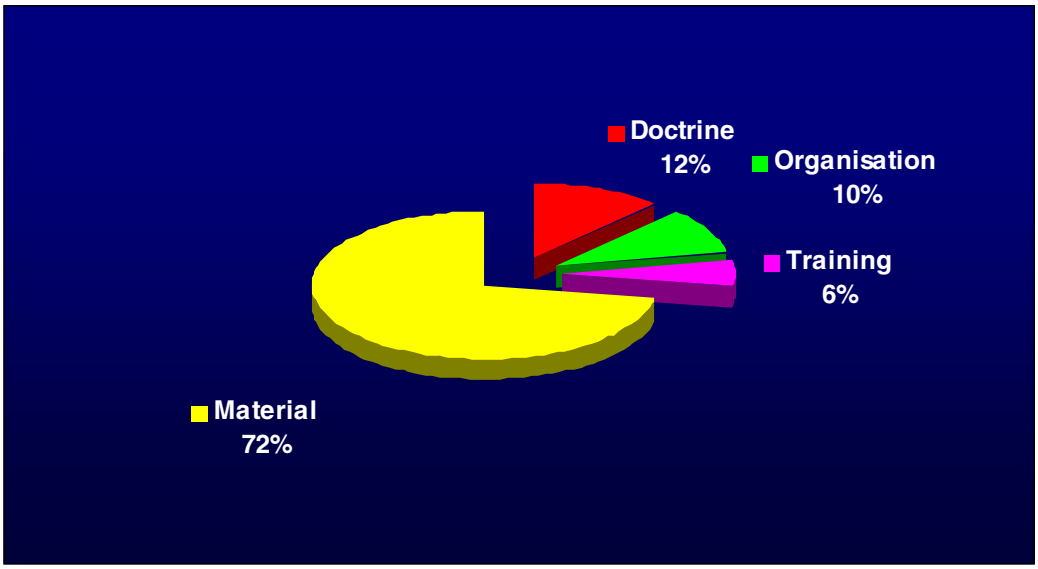
No.	Key Capability	Driver	Potential Solutions (Materiel)	Related Concepts (Materiel)
S 11	Enable a force to use the battlespace within the urban environment to best advantage	D T M	C4I Urban Command Centre Weapon, non lethal UAV, urban outdoor, recce 3D Imagery of city, C4I linked C4I urban specific infra-structure UGV, urban outdoor, weapon Sensors, remote, man portable Engineer, barriers Expendable MEMS Soldier situational awareness	CAP 01/USW 11 CAP 33/ USW 5 CAP 13/USW 1 CAP 03/USW 11[23] CAP 02/USW 11 CAP 23/USW 3 CAP 09/--[24] CAP 36/USW 8 CAP 06/USW 7 CAP 27/ USW 9
S 13	Detect, identify and assess rapidly chemical, biological and radiological threats (this includes toxic threats)	M	Urban Warrior, sensors/ comms/ situational awareness UAV, urban outdoor, recce Expendable MEMS C4I urban command centre	CAP 27/USW 9 CAP 13/USW 1 CAP 06/USW 7 CAP 01/USW 11
S 14	Deny the enemy the operating effective C4ISTAR systems	M	None of the system concepts generated for CAPS and the USW adequately addressed this capability.	
S 18	Assure C4 interoperability for own forces	M	C4I Urban Command Centre C4I urban specific infra-structure	CAP 01/USW 11 CAP 02/USW 11
E 1	Destroy or neutralise in a timely manner, fixed or mobile point targets in the urban environment with minimum casualties and collateral damage	M	Weapon, scaleable munitions Weapon, non lethal UGV, urban outdoor, weapon Engineer, barriers UAV, urban outdoor, recce Expendable MEMS Urban Warrior, sensors/ comms/situational awareness C4I fused data urban command centre	CAP 35/USW 4 CAP 33/USW 5 CAP 23/USW 3 CAP 36/USW 8 CAP 13/USW 1 CAP 06/USW 7 CAP 27/USW 9 CAP 01/USW 11
E 2	Provide and sustain combat power and maintain tempo of own force	D		
E 6	Establish a reliable Friend-Foe-Civilian Identification	M	Urban Warrior, FFN identification, translator C4I urban command centre	CAP 28/USW 9 CAP 01/USW 11
E 8	Dominate the EM spectrum	M	Weapon, scaleable munition Weapon, non lethal	CAP 35/USW 4 CAP 33/USW 5, USW 9, USW 11
E 10	Conduct cyber operations	D M	None of the system concepts generated for CAPS and the USW adequately addressed this capability.	

Table 8: DOTM Drivers, Potential Solutions and Concepts for Key Capabilities

[23] Incorporated within USW11
[24] No readily identifiable USW concept

- Examination of the main driver(s) for each of the key capabilities reinforces the view that in order for operations to succeed in the urban battlespace potential solutions will draw upon all the areas of Doctrine, Organisation, Training and Materiel. The figure below illustrates the relative weighted proportion of drivers across the 15 key capabilities.

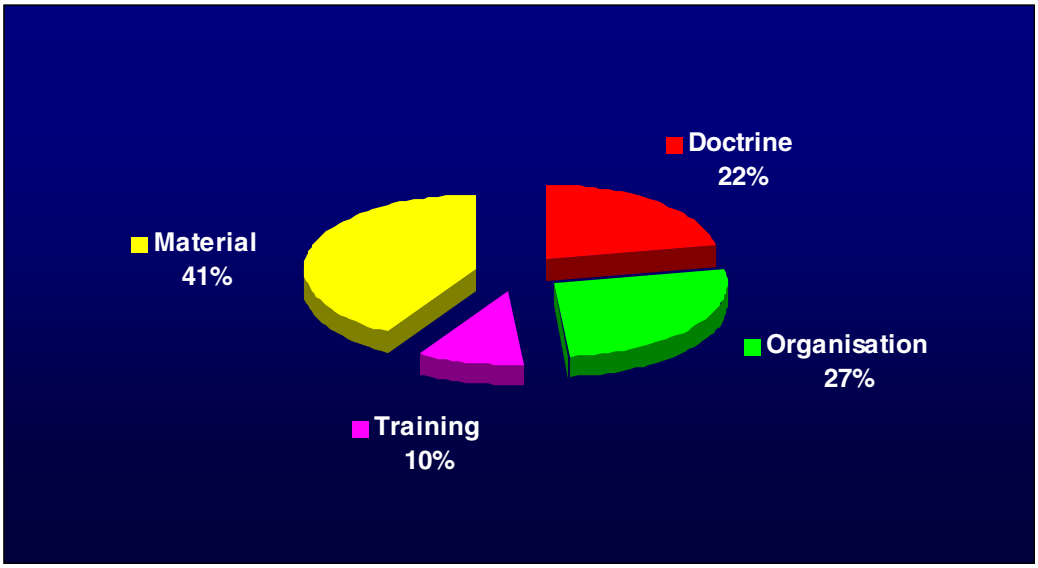
Figure 8: Breakdown of DOTM Drivers in Key Capabilities



- It should be noted that the contribution provided by materiel solutions for the 15 key capabilities is significant, providing the majority of the solutions. This reinforces the view that although conducting current urban operations degrades NATO technological superiority, the benefits of developing novel future system concepts may reinstate some of that superiority.

- It is perhaps coincidental that materiel solutions perform so well within the 15 key capabilities, as they are less dominant across all 42 capabilities, as shown in Figure 9 below. The importance of materiel driver(s) may therefore be over-emphasised if attention is focussed solely on the 15 key capabilities.

Figure 9 Breakdown of DOTM Drivers in All 42 Capabilities



- If the decomposition of DOTM driver(s) are considered in terms of the USECT conceptual framework then the contribution of each of the DOTM lines of development can be readily observed. This is depicted in Figure 10 below. It is evident that materiel drivers contribute to 'Understand' more than 'Shape' or 'Engage'. The contribution of materiel drivers to 'Consolidate' or 'Transition' is minimal.

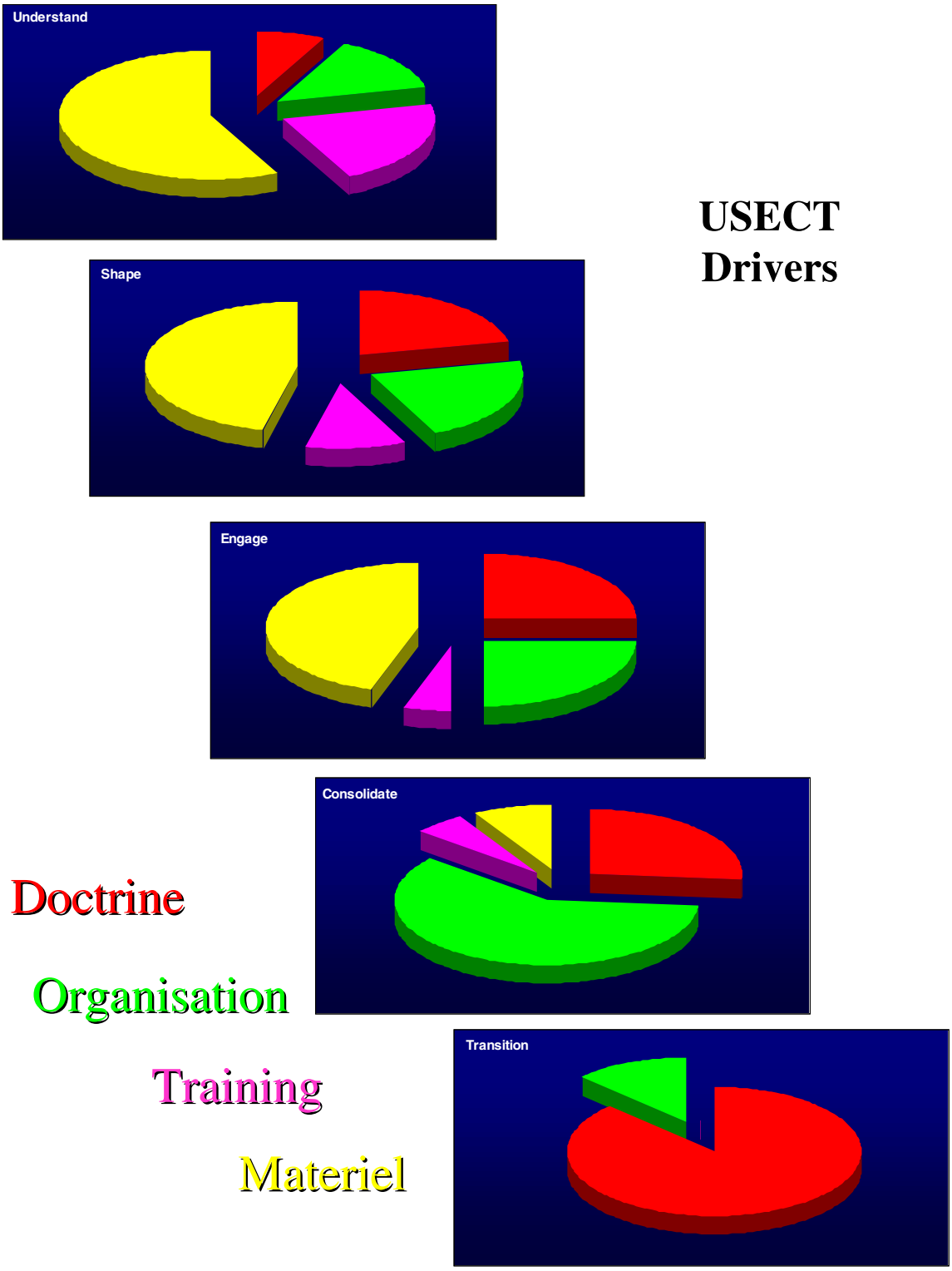


Figure 10: Breakdown of DOTM Drivers for USECT

D.3.9 Summary

- The USW provided an effective means of capturing the expert opinions of the participants on the importance of the 12 materiel system concepts for the vignettes and for recording comments on the other lines of development.

- At the operational level of command, it is the related capabilities to collect, communicate, assimilate and distribute information in a responsive manner that are of critical importance to urban operations. This supports the premise within the conceptual framework that 'Understand' is pre-eminent. This suggests that it is important to apply the same approach to existing systems. It may therefore be of benefit to integrate existing 'Understand' capabilities now and to research novel system concepts to further enhance 'Understand' in the future, with specific focus on data fusion. In particular, the urban data fusion command centre (USW11) and soldier situational awareness (USW9) strongly supports these capabilities.

- Results also show that the outdoor UAV (USW1) and expendable MEMS (USW7) strongly support 'Understand'. These sensor systems were judged to be more important than legacy ISTAR systems. These cannot currently meet the ISTAR information requirements within the urban environment. Discussions showed the importance of the sensors being integrated together to contribute to a coherent common operational picture. The balance between manned and unmanned systems, whether fixed or mobile, needs to be established. The difficulties in maintaining communications in the urban area were acknowledged.

- The need for precision strike and scaleable effects was supported and should provide the flexibility to engage targets within the urban environment.

- The need to control the movement and location of combatants and non-combatants into areas of our choosing was important. This could be achieved through the use of intelligent barriers. In addition this facilitated the release of soldiers for other duties.

- The use of NLWs should make a notable future contribution to key military tasks in the urban area. Moral and legal aspects presently constrain the use of NLWs.

- The outdoor UGV and the multi-role urban vehicle were judged to make a notable contribution to urban operations. To cover all the remarks made during the USW further development of the concepts is necessary.

- The system concept for IFFN/tagging for urban operations needs further development as well. IFFN should provide an important operational capability but its relatively low ranking probably reflects the practical difficulties of achieving a technical solution. There was also concern over the moral and legal implications of covert tagging.

- The indoor UAV was judged one of the least militarily attractive concepts mainly because it was easily countered and it was difficult to see how to devise an effective technical solution.

- The importance of mapping and surveillance (including underground) was highlighted at the CAPS. This was generally confirmed during the USW, however, the particular underground mapper system concept was judged to be of low utility during the USW

- Evaluation of the DOTM driver(s) for the key capabilities shows that materiel solutions are likely to provide important contributions to the future urban operational capabilities for 'Understand', 'Shape' and 'Engage'. It was not envisaged that materiel solutions are likely to contribute to 'Consolidate' and 'Transition'.

ANNEX E - SCENARIOS AND VIGNETTES

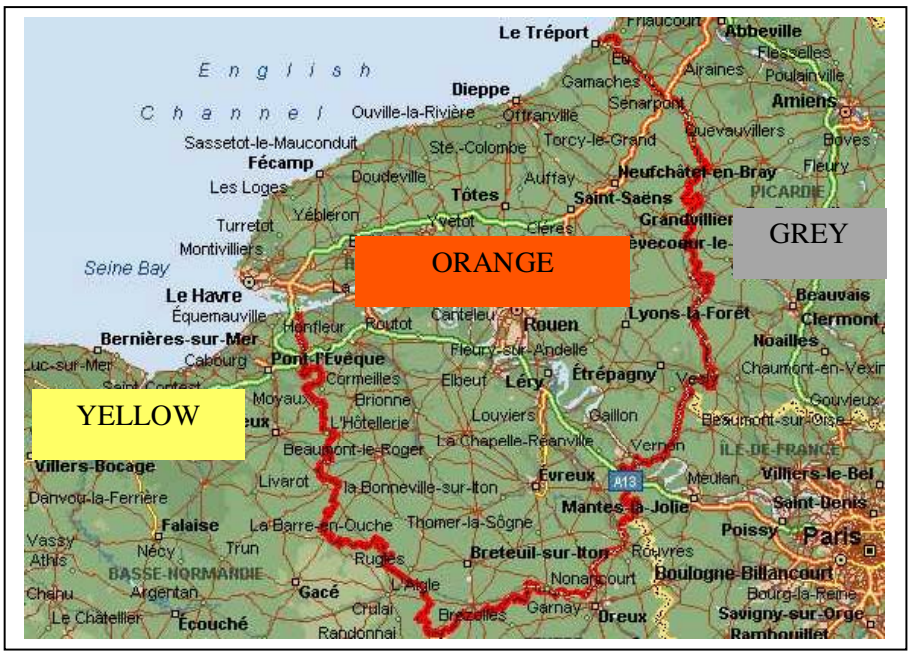
1. Introduction

This Annex presents the two scenarios and the three vignettes used in the SAS 030 NATO Study to support the reflections of the participants to the USW. It contains:

- The general background of the situation and an assumption of its evolution.
- Some maps showing a generic ethnic ground occupation and the initial situations.
- A detailed presentation of each scenario (CRO and War-Fighting).
- A presentation of each vignettes (CRO, Offensive War-Fighting and Defensive War-Fighting) as they were shown to USW's participants.

2. General situation:

In 2015, ORANGE (Normandy area) seceded from YELLOW (covering loosely the area of Brittany and Normandy) after a short war, and achieved Statehood. YELLOW, contained today in its former Southern half, has never accepted nor recognised ORANGE. The population of ORANGE is divided into two different ethnic groups, separated by religion, history and culture and who are mutually antagonistic towards each other. North of the River SEINE, the NORTHERN ethnic group is dominant and holds all the important State posts in government, administration and the armed forces. South of the River SEINE, the SOUTHERN ethnic group represents a strong minority, supported by YELLOW with increasing demands for annexation of its former Lands. The population is mixed in the two ORANGE main cities: ROUEN, the administrative capital and LE HAVRE, the economic main centre of the state.



3. Cities of Strategic Interest:

LE HAVRE: main harbour;
- airport;
- major industrial area, mainly chemical;
- main economic centre;
- 200 000 inhabitants.

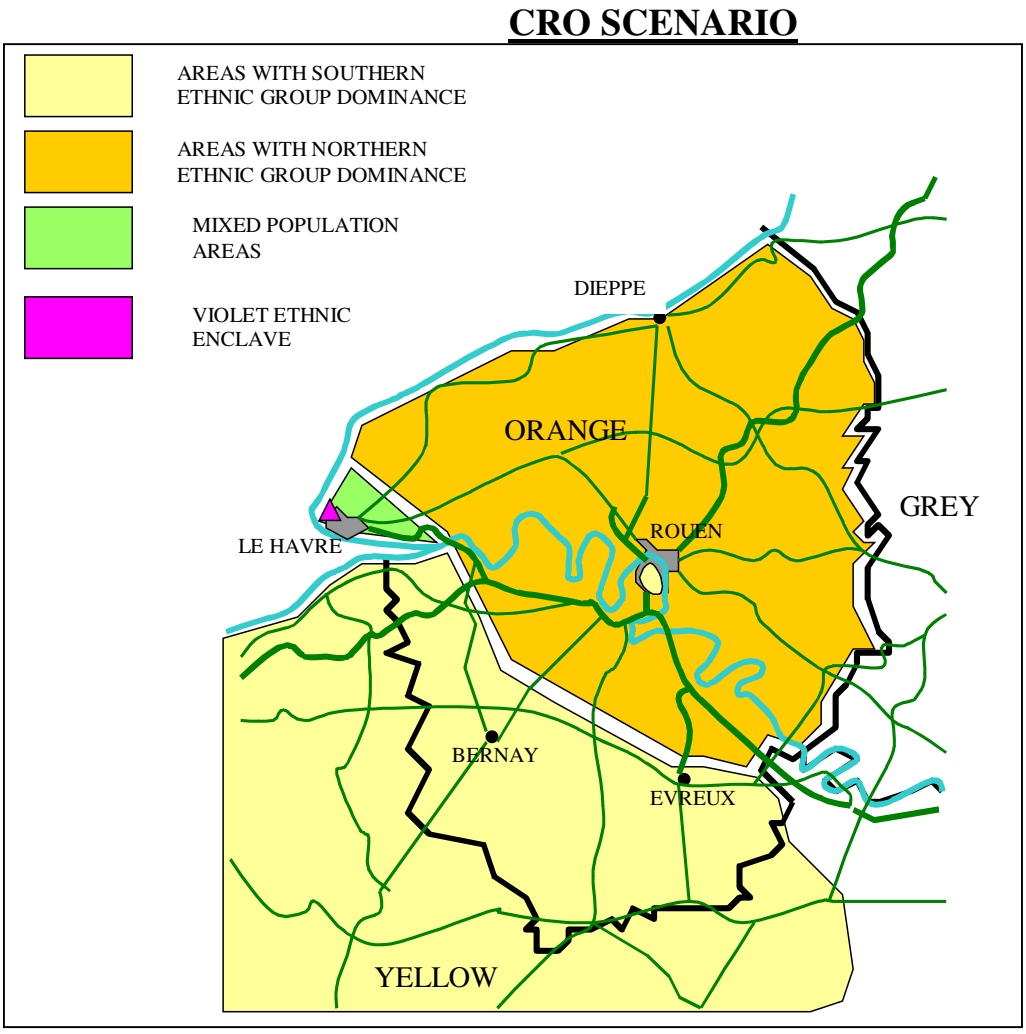
ROUEN: fluvial harbour;
- airport;
- crossing points of the SEINE River (the firsts upstream should the TANCARVILLE and DE BRETONNE Bridges be destroyed);
- industrial areas;
- administrative capital;
- 220 000 inhabitants.

EVREUX: regional capital;
- 50 000 inhabitants;
- airport.

DIEPPE: alternative harbour;
- 40 000 inhabitants.

4. Generic ethnic ground occupation

This map shows the various representations on the area of each ethnic involved in the action.



1. SITUATION

1.1. Background

1.1.1. Historical, political and military

Rebellion of the SOUTHERN ethnic group against the NORTHERN ethnic group began in 2019 leading to serious internal crises within ORANGE.

ORANGE armed forces, which are officially at the disposal of the NORTHERN ethnic group, include:

- Two infantry brigades, each including one tank battalion, one armoured infantry battalion, two light infantry battalions, one artillery group and an engineers company. These forces are systematically undermanned (about 70% of their strength).
- One helicopter battalion with 10 utility helicopters, 8 reconnaissance helicopters and 8 attack helicopters.
- Six paramilitary border guard battalions deployed permanently on the YELLOW border, from HONFLEUR to VERNON. These forces are at full strength.
- Six patrol ships based in LE HAVRE.
- One squadron of 18 multipurpose combat aircraft based at EVREUX military airport.

YELLOW has equipped the paramilitary forces raised by the SOUTHERN ethnic group. These forces include the equivalent of three light infantry battalions, acting independently in the Southern part of ORANGE with secure basis across the border if necessary. In addition, urban and extra urban guerrillas are harassing government forces in ROUEN, LE HAVRE and the main communication routes North and South the River SEINE.

1.1.2. Current situation

SOUTHERN forces have succeeded in creating a “liberated area” within the polygon VERNEUIL – SUR – AVRE / CONCHES – EN – OUCHE / SERQUIGNY / BERNAY / THIBERVILLE / YELLOW State border following a period of violence. While Government Forces have eradicated the extra urban guerrillas North of the River SEINE, they have failed to neutralise rebel forces in the “liberated area” and the urban guerrillas in ROUEN and LE HAVRE. In addition, a large immigrated VIOLET community, mainly composed of harbour workers families and settled in the SAINTE-ADRESSE part of LE HAVRE, has maintained internal cohesiveness and proper culture from their origin 3rd World country. Due to unemployment as a result of the ORANGE internal trouble, this community became violent in claiming for assistance from the ORANGE institutions. It has organised a militia, equipped with light armament, which does not hesitate into using wives and children as human shields.
The open violence inflicted intensive damage to the ORANGE economy that has led to an exodus of both ethnic groups towards fellow clan peoples.

Negotiations have taken place in GENEVA between the two parties, under United Nations auspices from September to December 2019. On the 1st January 2020, a cease-fire was agreed demanding: The cessation of hostilities and the constitution of unified ORANGE national armed forces;

- The constitution of a transitional national unity government including Southern and Northern political figures;
- The transformation of the SOUTHERN political organisation into an official ORANGE political party;
- Elections to be hold in April 2021;
- The release of prisoners and abductees;
- The return of refugees and displaced persons;

Then, on 15th January, a UNSC Resolution was passed with the implementation orders for the deployment of a peacekeeping force to ORANGE, under Chapter VII of the UN Charter, to monitor the peace process. This Force would be a CJTF led NATO Coalition Force with two subordinate Peacekeeping Forces (South and North) and an Air Component. All elements were to be equipped with the following battle space digitisation technology:

- Allowing situation awareness at every operational level ;
- All terrain space positioning systems down to the individual soldier level for dismounted infantry, to include urban environments;
- Identification systems down to the individual soldier level, especially for dismounted infantry ;
- ISTAR assets, particularly drones and robots, for intelligence gathering, particularly for urban environments;
- Interoperable large data rate protected CIS.

A robust night fighting capability was to be deployed at all levels and ACV protection by passive electronic devices (alert systems, jamming systems, flares), rather than pure armour, has become normal. Artillery fires bonus shells.

NGO also deploy in ORANGE, among which are “CARE”, “MEDECINS SANS FRONTIERES” and “SAVE THE CHILDREN”.

1.2. Political directives

1.2.1. Political goals

The situation in ORANGE has to be stabilised in order to prevent it from becoming a threat to international peace and security. In addition, the international community cannot ignore the current humanitarian crisis, nor the ethnic, political and economic causes of the conflict that, if left unresolved, could engulf the whole region. Steps must be taken to reduce the potential for regional conflict, reconcile the division within ORANGE and the surrounding area, as well as ameliorate the worst effects of the humanitarian crisis.

1.2.2. Strategic goals

- To monitor the cessation of violence in ORANGE and the successful implementation of the 1st January 2020 Cease-Fire Agreement.
- To alleviate the humanitarian suffering within ORANGE.
- To assist in the reestablishment of law and order and in the promotion of reconciliation and social harmony, in order to encourage refugees and displaced persons to return to their homelands.
- To assist in the establishment of a legitimate government representing, and recognised by, all the people of ORANGE.

1.2.3. End State

The UN’s desired End State is the construction of a stable and economically sound ORANGE, through political liberalisation, reform of the armed forces and foreign investment, thereby helping to promote peace, prosperity and security in the whole region.

1.3. Threat assessment

1.3.1. Internal threat

The military failure of the NORTHERN ethnic group demonstrates that, today it is impossible to gain additional advantages through military operations. Therefore, it is unlikely that Government Forces do represent any further threat. They are expected to be co-operative and compliant.
The attitude of the SOUTHERN ethnic group is unstable. It is likely to use the cease-fire to reconstitute its forces in case it fails to gain equable representation in the transitional government. However, it is assessed that they will maintain the goodwill of the international community by eschewing military operations, by either conventional forces or urban guerrillas at the outset.
Finally, the VIOLET militia in LE HAVRE represents a significant civil unrest potential, both to NATO peace keepers and the ORANGE population.

1.3.2. External threat

YELLOW government's attitude is the key element to peacekeeping in the region. If the cease-fire agreement hold, YELLOW will perceive that it has lost any legitimacy over the ORANGE Southern region. To prevent this, it is likely to attempt to interfere in the ORANGE internal political process, in order to impede the international community efforts to promote peace and stability in the region. Thus, YELLOW military action in ORANGE is assessed as likely after the initial period. This coincides with the potential for reconstitution of SOUTHERN forces within ORANGE. This military action would be:

- either an increased support to the SOUTHERN forces;
- or harassment in the border region through raids and limited offensive actions;
- or a large offensive action to capture and secure the SOUTHERN ethnic group populated region in the ORANGE State.

1.4. Assumptions

- That GREY remains neutral to the internal affairs of ORANGE.
- That the UN current mandate of the NATO Coalition Force in ORANGE will be renewed, if necessary, after the first 12 months to allow the completion of the mission.
- That the humanitarian agencies are prepared to step up their operations once the NATO Coalition Force is deployed in ORANGE.
- That the International Community is prepared to implement the diplomatic and military measures necessary to contain possible YELLOW military action against ORANGE territory.

1.5. Main tasks

1.5.1. Operational tasks

- To deploy on orders to assigned locations.
- To monitor the withdrawal of all military forces to barracks and the constitution of national unified armed forces.
- To monitor the YELLOW – ORANGE border in order to prevent any weapons smuggling to aid the SOUTHERN forces.
- To support the political process to hold free and fair elections in April 2021 leading to a united transitional government.
- To support the return of refugees and displaced persons.

1.5.2. Support tasks

- To secure DIEPPE and LE HAVRE harbours and airports as NATO Coalition Force SPODs.
- To secure ROUEN as main communication centre between the North and South of ORANGE.

- To organise and secure the logistic flux in theatre from DIEPPE and LE HAVRE to the forces deployed South and North of the River SEINE.
- To support a possible reinforcement of two divisions, simultaneously disembarked at DIEPPE and LE HAVRE SPODs.

2. MISSION

The NATO Coalition Force in ORANGE is to implement the 1st January 2020 cease-fire agreement and UNSCR in order to create the conditions for a more secure and stable environment in ORANGE.

3. MISSION EXECUTION

3.1. Concept of operations

3.1.1. General

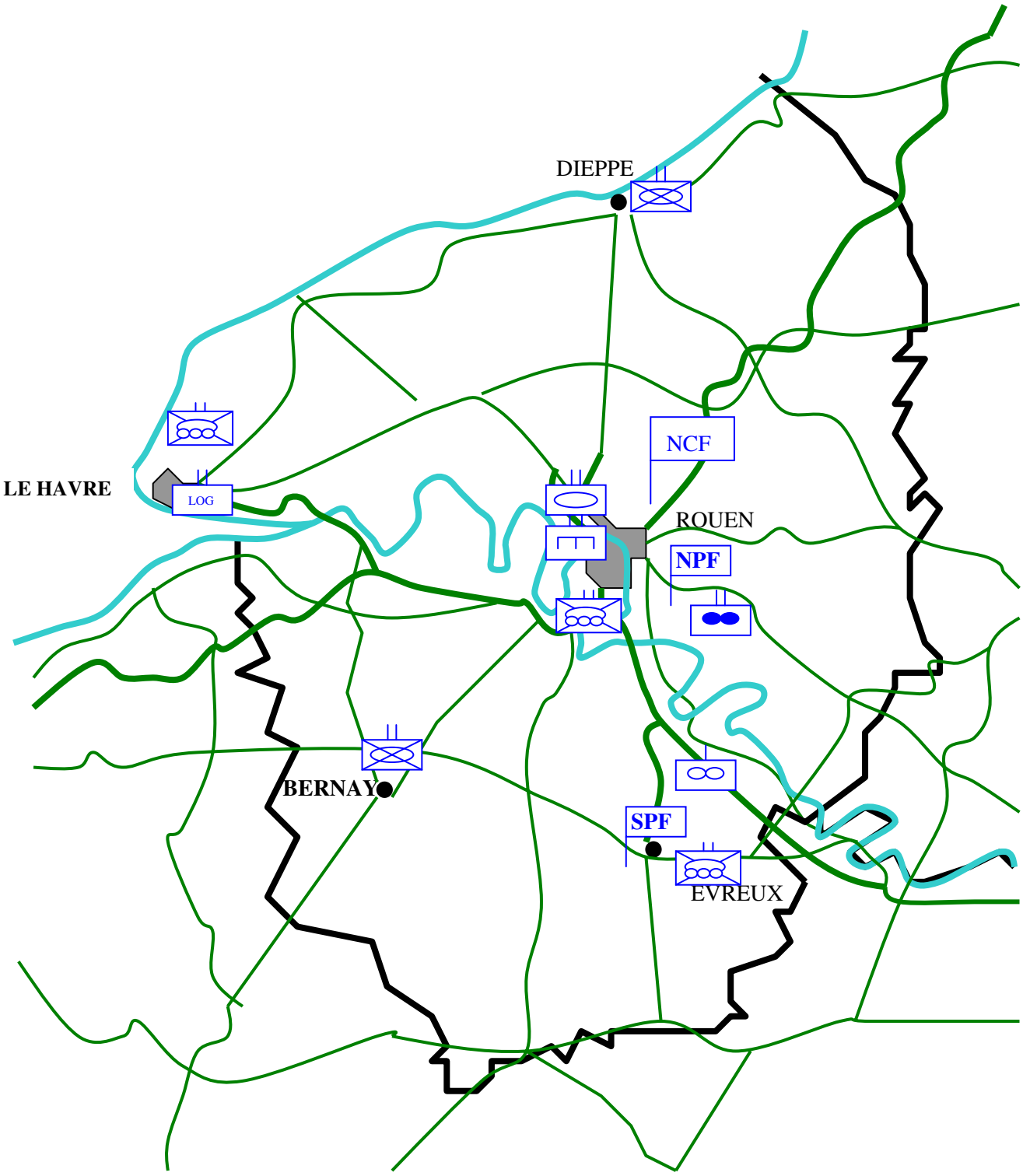
Acting under Chapter VII of the United Nations to implement The 1st January 2020 cease-fire agreement, the NATO Coalition Force is to carry out peacekeeping operations in ORANGE. It is to ensure that while doing so it remains an impartial force and is perceived as such by all belligerent parties. The priority is to use all diplomatic skills, negotiation and mediation, to gain the consent, trust and co-operation of all belligerent factions at all levels. Where this fails, the NATO Coalition Force in ORANGE may take the necessary action to ensure the security and freedom of movement of its personnel and, within its capabilities and areas of deployment, to afford protection to civilians under imminent threat of physical violence. At all times the Force must remain cognisant of the ORANGE Government responsibilities.

3.1.2. Phases

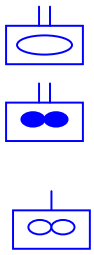
- Phase 1 - from deployment to the 31st July 2020: promote a stable and secure environment by the implementation of the military aspect of the cease fire agreement.
- Phase 2 - from the 1st of August 2020 to the elections of April 2021: assist in the implementation of the political and civilian aspects of the cease fire agreement.

3.1.3. Necessary forces

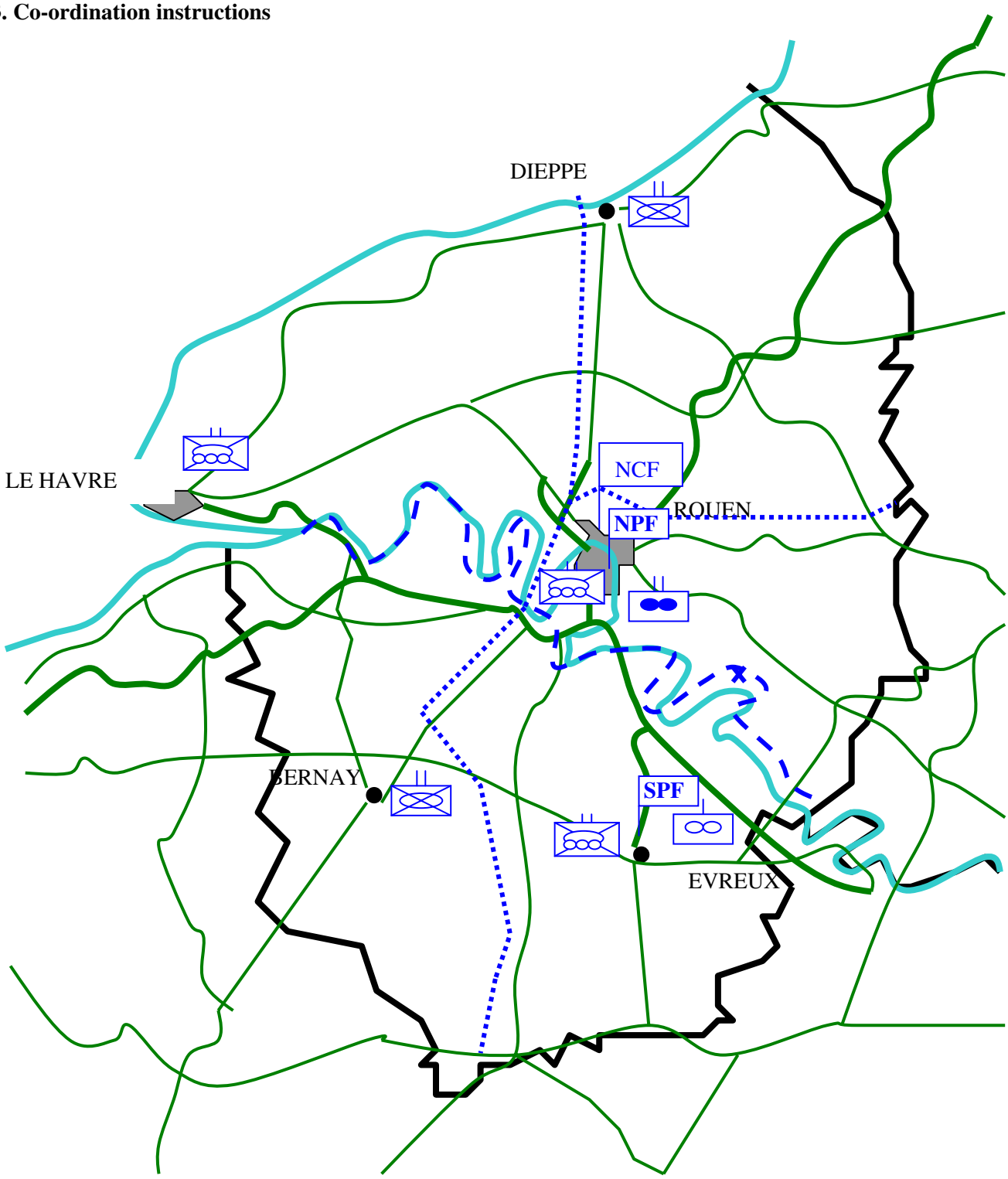
- A CJTF Headquarters;
- One NATO Coalition Force (NCF) including two subordinate Peacekeeping Forces (NPF and SPF) and a tactical reserve;
- One squadron of 9 reconnaissance aircraft.


DIEPPE
NCF
LE HAVRE
LOG
ROUEN
NPF
BERNAY
SPF
EVREUX

3.2. Subordinate *unit* tasks

Unit	Location	Main task	Other task	Nation
	LE HAVRE	Ensure the logistic support of the NATO Coalition Force in ORANGE		BROWN
	ROUEN	Tactical reserve of the NATO Coalition Force in ORANGE		GREEN BLUE BROWN
	ROUEN	Tactical reserve of the NATO Coalition Force in ORANGE	Ensure the crossing of the River SEINE and the engineer support of the NATO Coalition Force in ORANGE	BLACK
North Peacekeeping Force 	ROUEN	Implement the provisions of the cease fire agreement North of the River SEINE	Secure the crossing points of the River SEINE in ROUEN and the harbour and airport installations in LE HAVRE and DIEPPE Ensure the liaison with the ORANGE local institutions and the humanitarian organisations deployed North of the River SEINE	BROWN
	ROUEN	Implement the provisions of the cease fire agreement in its area	Secure the crossing points of the River SEINE in ROUEN	BROWN
	LE HAVRE	Implement the provisions of the cease fire agreement in its area	Secure the harbour and airport installations of LE HAVRE	BROWN
	DIEPPE	Implement the provisions of the cease fire agreement in its area	Secure the harbour installations of DIEPPE	BLACK
South Peacekeeping Force 	EVREUX	Implement the provisions of the cease fire agreement South of the River SEINE	Survey the YELLOW – ORANGE border Ensure the liaison with the ORANGE local institutions and the humanitarian organisations deployed South of the River SEINE	BLUE
	EVREUX	Implement the provisions of the cease fire agreement in its area	Survey the YELLOW – ORANGE border in its area	BLUE
	BERNAY	Implement the provisions of the cease fire agreement in its area	Survey the YELLOW – ORANGE border in its area	BLUE

3.3. Co-ordination instructions



TOTAL WARFIGHTING OPERATIONS

4. SITUATION

4.1. Background

4.1.1. Framework

According to the 15th January 2020 UNSC Resolution, a NATO Coalition Force has been progressively deployed in ORANGE in February and March 2020, in order to monitor the implementation of the 1st January Cease-Fire Agreement.

In spite of initial successes, the situation begun to worsen in June. Frequent incidents occurred at the YELLOW-ORANGE border, such as limited incursions of the regular YELLOW forces or exchange of artillery fire. Within ORANGE, guerrilla warfare developed, especially in the sensitive economic and industrial SEINE River area, in the ROUEN and LE HAVRE region, and in the SOUTHERN ethnic group populated region, south of the SEINE River.
The NATO Coalition Force has supported the legal government, but has finally been overwhelmed by the increasing number of incidents between the two ethnic groups, which degenerated in July into ethnic massacres, flows of refugees, destruction of houses and infrastructure. The governmental ORANGE institutions did not succeeded into managing the situation and gradually lost control of the southern part of the country.

Additionally, arguing the protection of the SOUTHERN minority in the ORANGE State, YELLOW armed forces have invaded the ORANGE State on the 1st August 2020, supported by armed militia of the SOUTHERN ethnic group. Accordingly, YELLOW's actions have been condemned unanimously by the international community and on 1st August the UNSC passed a Resolution asking NATO to augment its military Force in ORANGE, to restore the integrity of the state, its legitimate government and to enforce peace in the region as soon as possible.

4.1.2. Current situation

The legal ORANGE government has collapsed and has fled abroad. YELLOW armed forces have secured the southern part of ORANGE, south of the River SEINE and have captured ROUEN. The YELLOW government has declared the ORANGE country was the YELLOW 6th Province. It settled in ROUEN Province government institutions, headed by a SOUTHERN Group governor, in the former ORANGE government buildings. YELLOW armed forces are currently moving towards LE HAVRE with the intention of capturing the city. The TANCARVILLE and DE BROTONNE Bridges are unusable. ROUEN City has suffered severe damage from bombing during the conflict. National institutions have collapsed and the population is lacking medical care, food and drinkable water and approximately 200 000 people are now homeless.

The threat is both symmetric and asymmetric, regular YELLOW forces being supported by Southern militias, mainly active in ROUEN and south of the River SEINE. The co-existence in ROUEN of both SOUTHERN and NORTHERN communities, respectively settled in the left and the right bank of the SEINE River, became problematic. The NORTERN community is systematically intimidated, harassed and submitted to various violent incidents, such as arson, assassination and bombing.

Finally rejected by both SOUTHERN and NORTHERN ethnical groups, the VIOLET immigrated community fled LE HAVRE and massively returned to its origin country at the beginning of the current hostilities.

NATO Coalition Forces have withdrawn to LE HAVRE, DIEPPE and HONFLEUR, except the infantry battalion in EVREUX which is now surrounded and isolated in its barracks by the YELLOW forces with no freedom of movement.

The initially deployed NATO units have been tasked to defend LE HAVRE and DIEPPE. The infantry battalion withdrawn to HONFLEUR will be extracted. Follow-on NATO Forces will be tasked to conduct an offensive manoeuvre towards ROUEN in order to:

- recapture the city and seize its crossing points on the River SEINE (phase 1);
- then attack EVREUX in order to effect link-up with the besieged infantry battalion there (second phase);
- expel YELLOW armed forces from ORANGE (third phase).

A tactical air wing deployed in BROWN territory (equating to the British Isles), and a maritime component of a carrier task force and an amphibious task force, will support the operation.

4.1.3. Involved military forces

4.1.3.1. Enemy forces

1(YE) Bde (BMP4):

- One Mechanised Infantry battalion fixing our friendly infantry battalion in EVREUX.
- Two Mechanised Infantry battalions occupying ROUEN : these battalions, reinforced and supported by ethnic militias, could, successively or simultaneously :
  - Delay UN forces on two axes (TOTES, ROUEN and DIEPPE, ROUEN) with the minimum of one company on each axis;
  - Deny, temporarily, the line MAROMME CQ580820, MONT SAINT AIGNAN CQ610820, BOIS GUILLAUME with at least one battalion;
  - Deter the crossing of the River SEINE with at least one battalion by:
    - either defending the city centre (CQ613790, CQ622792, CQ632785),
    - or, defending the Southern river bank.
- Both battalions could be reinforced by one tank company (T80) and supported by an Artillery regiment located south of the River SEINE. The Engineer battalion will have carried out 10 days of CMob preparation.

2(YE) Bde (BTR):

- Three mechanised infantry battalions,
- One Tank battalion (wheeled, type CENTAURO),
- One Artillery regiment (mixed : mortars, self-propelled guns and multiple rocket launchers),
- In an attempt to prevent the arrival of follow-on forces, this brigade could mount an offensive operation north of the SEINE to seize the LE HAVRE harbour by either:
  - advancing on a main axis of the river (effort), while simultaneously making a diversionary attack on the northern approaches to LE HAVRE; or
  - advancing on a broad front of three reinforced battalions (D940, D925, N15) in order to swamp friendly forces defences.

Enemy forces have limited access to battle space digitalisation technology, such as:

- Situation awareness at brigade level only;
- Space positioning systems deployed only to artillery units and command posts;
- No identification systems ;
- 2000 generation CIS.

Night fighting capability is limited to the main armoured combat vehicles and weapons which are 2000 system technology.

4.1.3.2 Friendly forces

ORANGE remaining forces only include:

- the equivalent of a brigade reduced to 70% of its initial strength;
- the equivalent of an helicopter company;
- the six patrol ships based in LE HAVRE.

The combat aircraft squadron of EVREUX has been completely destroyed by sabotage on the military airport or during the defensive operations against the YELLOW regular forces.

Contingency planning during the initial NATO Coalition Force deployment phase allowed for the deployment of NATO Joint Follow-on Forces to take two weeks.

The Maritime Component consists of:
- An amphibious force, deployed in the Channel since the end of July, of 4 LPD, 2 LPH, 6 Frigates, and one land force including 1 Infantry Brigade (23BDE) and 1 helicopter battalion (2AVNBN) (2 UH companies and 1 attack company);
- A surface Group of 1 attack submarine, 4 frigates and 1 carrier with 30 multi-role aircraft embarked.

4.2. Political directives

The situation in ORANGE has to be stabilised in order to prevent it from becoming a threat to international peace and security. In addition, the international community cannot ignore the deliberate aggression of the YELLOW State, the current humanitarian crisis, nor the ethnic, political and economic causes of the conflict that, if left unresolved, could engulf the whole region. Steps must be taken to reduce the potential for regional conflict, to restore ORANGE territorial integrity, reconcile the division within ORANGE and the surrounding area, as well as ameliorate the worst effects of the humanitarian crisis.

4.2.1. Strategic goals

- To restore ORANGE territorial integrity.
- To enforce the cessation of violence in ORANGE and the reestablishment of law and order.
- To promote negotiations within the ORANGE State for a new cease-fire agreement.
- To alleviate the humanitarian suffering within ORANGE.
- To assist in the promotion of reconciliation and social harmony, in order to encourage refugees and displaced persons to return to their homelands.
- To assist in the establishment of a legitimate government representing, and recognised by, all the people of ORANGE.

4.2.3. End State

NATO desired End State is:
- the restoration and international recognition of ORANGE territorial integrity
- the reestablishment of legal authorities in ORANGE
- the reconstruction of the ORANGE armed forces
- the reconstruction of a independent, stable, self sustaining and economically sound ORANGE State, through political liberalisation and foreign investment
- the restoration of peace, prosperity and security in the whole region.

4.3 Threat assessment

The legal ORANGE government and national institutions have collapsed, the government has fled abroad. Nevertheless, the remaining ORANGE governmental forces do not represent any threat to the NATO forces. They are co-operative, compliant and eager to fight YELLOW forces side-by-side with NATO units.
The SOUTHERN ethnic group has used the cease-fire to reconstitute its forces. SOUTHERN militias do support regular YELLOW forces. In addition, they represent an asymmetric guerrilla-type threat to NATO units, able to:
- collect intelligence for the YELLOW regular forces;
- create an unsecured environment, especially in urban areas, prejudicing the logistic flux to the NATO forces and harassing NATO units.

4.3.1 External threat

YELLOW government has never accepted nor recognised the Statehood of ORANGE. Since regular YELLOW armed forces have captured and secured the southern part of ORANGE and are moving towards LE HAVRE with the intention of capturing the city, it is most likely that YELLOW government's intention is to annex the SOUTHERN ethnic group populated ORANGE region, using the sensitive economic and industrial SEINE River area between LE HAVRE and ROUEN as a territorial gage for further negotiations. Therefore, regular YELLOW forces represent a substantial symmetric threat to the NATO forces. They might:

- either try to capture LE HAVRE in order to prevent, disrupt or delay the landing of the NATO follow-on forces in this city;
- or capture and defend the industrial SEINE River area;
- or defend the currently occupied region south of the SEINE River.

Considering their limited offensive capabilities versus landed NATO forces, the third option is highly probable. Their action north of the SEINE River would rather be a delaying action, possibly combined with the sabotage or destruction of the industrial ORANGE potential in the SEINE River area.

4.4. Assumptions

- That GREY Country will continue not interfering in the conflict.
- That only a few humanitarian agencies remain on the territory and concentrated in the main cities.
- That the international community will be prepared to implement diplomatic measures, necessary to face a post-war period.

4.5. Main tasks

4.5.1. Operational tasks

- To secure LE HAVRE and DIEPPE harbour and airport facilities, in order to allow the second operational echelon to disembark.
- To recapture ROUEN and to seize the crossing points on the SEINE.
- To, simultaneously or in phase, advance on EVREUX in order to effect link-up with the besieged infantry battalion still there.
- To expel all YELLOW forces from ORANGE territory.
- To defend the YELLOW – ORANGE border in order to prevent the YELLOW second echelon forces from intervening.
- To reconstitute the ORANGE state including its legal government and institutions.

4.5.2. Support tasks

- To secure DIEPPE and LE HAVRE harbours as NATO follow-on forces SPODs.
- To secure ROUEN as main communication centre between the North and South of ORANGE.
- To organise the logistic flux in theatre from DIEPPE and LE HAVRE to the forces deployed South and North of the River SEINE.
- To support a possible reinforcement of two divisions, simultaneously disembarked at DIEPPE and LE HAVRE SPODs.

5. MISSION

The NATO follow-on forces are to restore the integrity of ORANGE territory and to assist in the reconstruction of the ORANGE State.

6. EXECUTION OF THE MISSION

6.1. Concept of operations

6.1.1. General

The NATO forces are to carry out military operations within ORANGE. There will be a first phase, during which the regrouped units of the initially deployed NATO Coalition Force will defend LE HAVRE and DIEPPE, in order to secure the bridgehead to allow the disembarkation of the Follow-on Forces. The Force will, then, recapture ROUEN and EVREUX. There are three possible options:

- 1: to advance on the axis DIEPPE – ROUEN with the formations disembarked at DIEPPE: seize the ROUEN bridges by force, then continue towards EVREUX to relieve the besieged infantry battalion.

- 2: to conduct the advance ROUEN (effort) - EVREUX simultaneously to an amphibious operation along the SEINE River or a breakout from the initial landing at HONFLEUR, or both.

- 3: to combine the advance with an assault crossing of the SEINE in the area of LES ANDELYS (preliminary op) in order to conduct an offensive operation in the direction of EVREUX and/or ROUEN.

6.1.2. Phases

- Phase 1: defend LE HAVRE and DIEPPE harbour and airport facilities with regrouped units of the initially deployed NATO Coalition Force.
- Phase 2: secure a crossing point on the SEINE (LES ANDELYS), attack and seize ROUEN [see Options 1, 2 & 3].
- Phase 3: seize EVREUX and relieve the besieged infantry battalion.

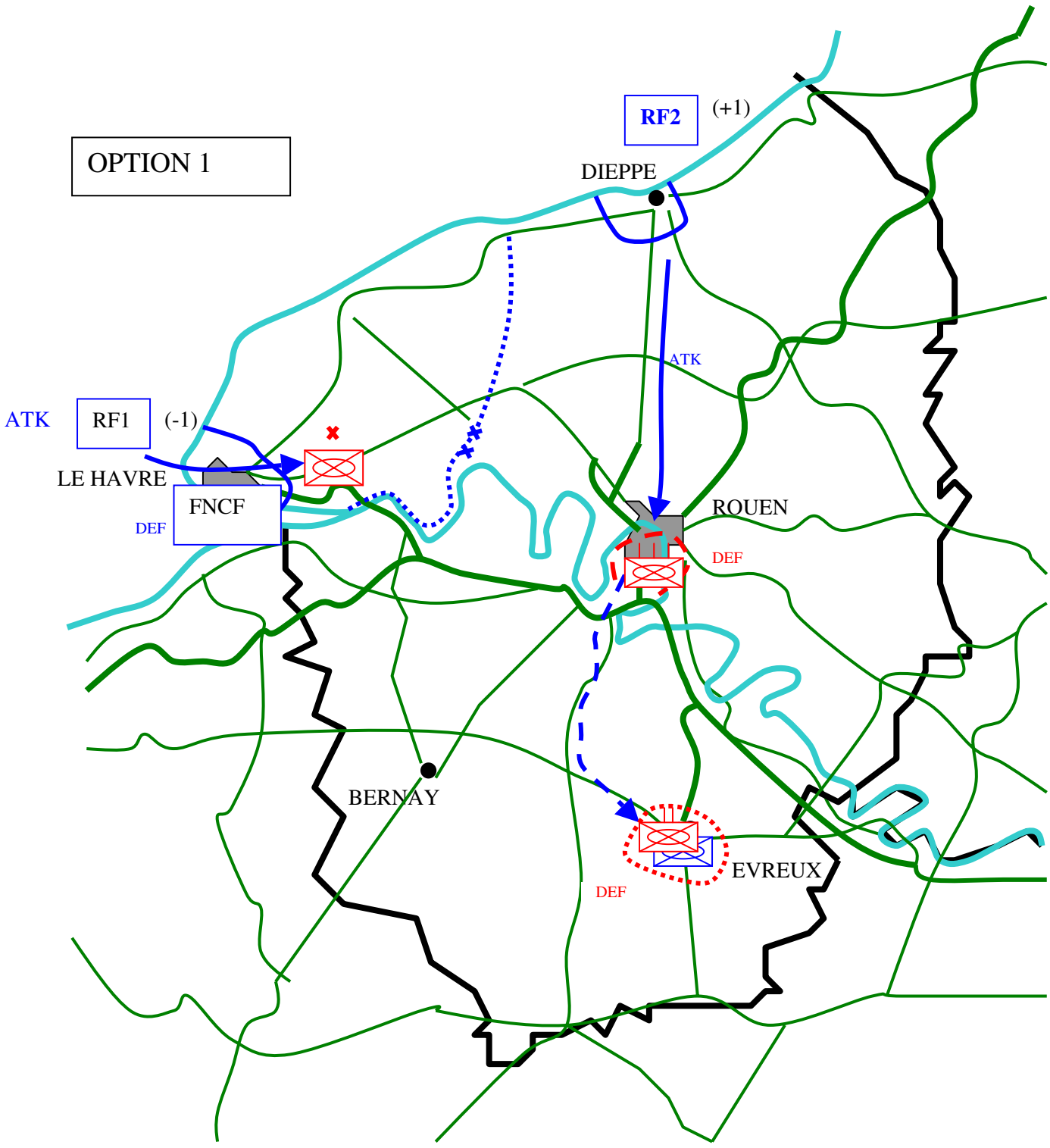
6.1.3. Necessary forces

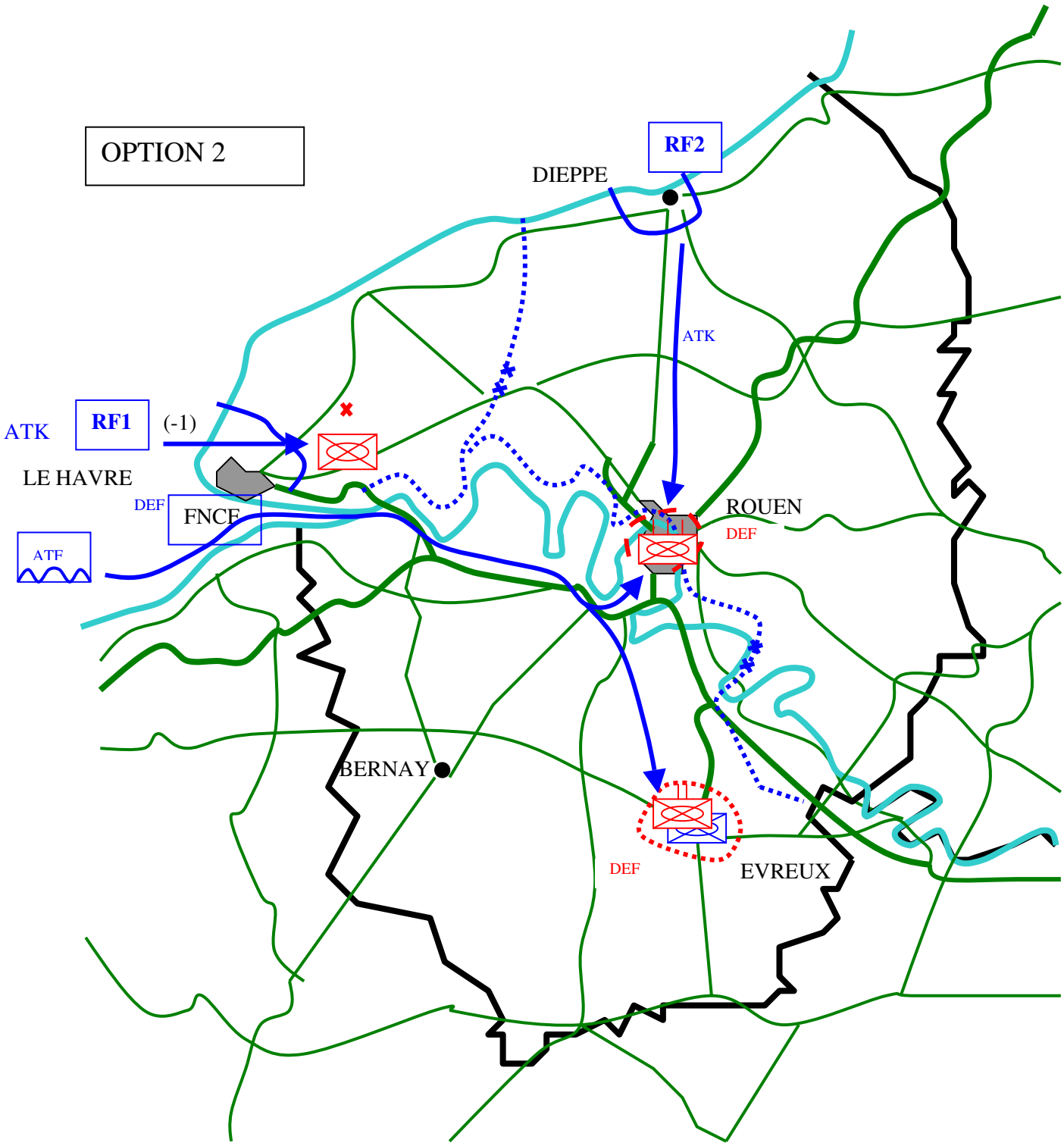
- A Maritime Component of a carrier and an amphibious task force.
- A Land Component composed of a NATO Restoration force including three subordinate forces (Former NATO Coalition Force, Restoration Forces 1 and 2).
- An Air Component of a tactical air wing.

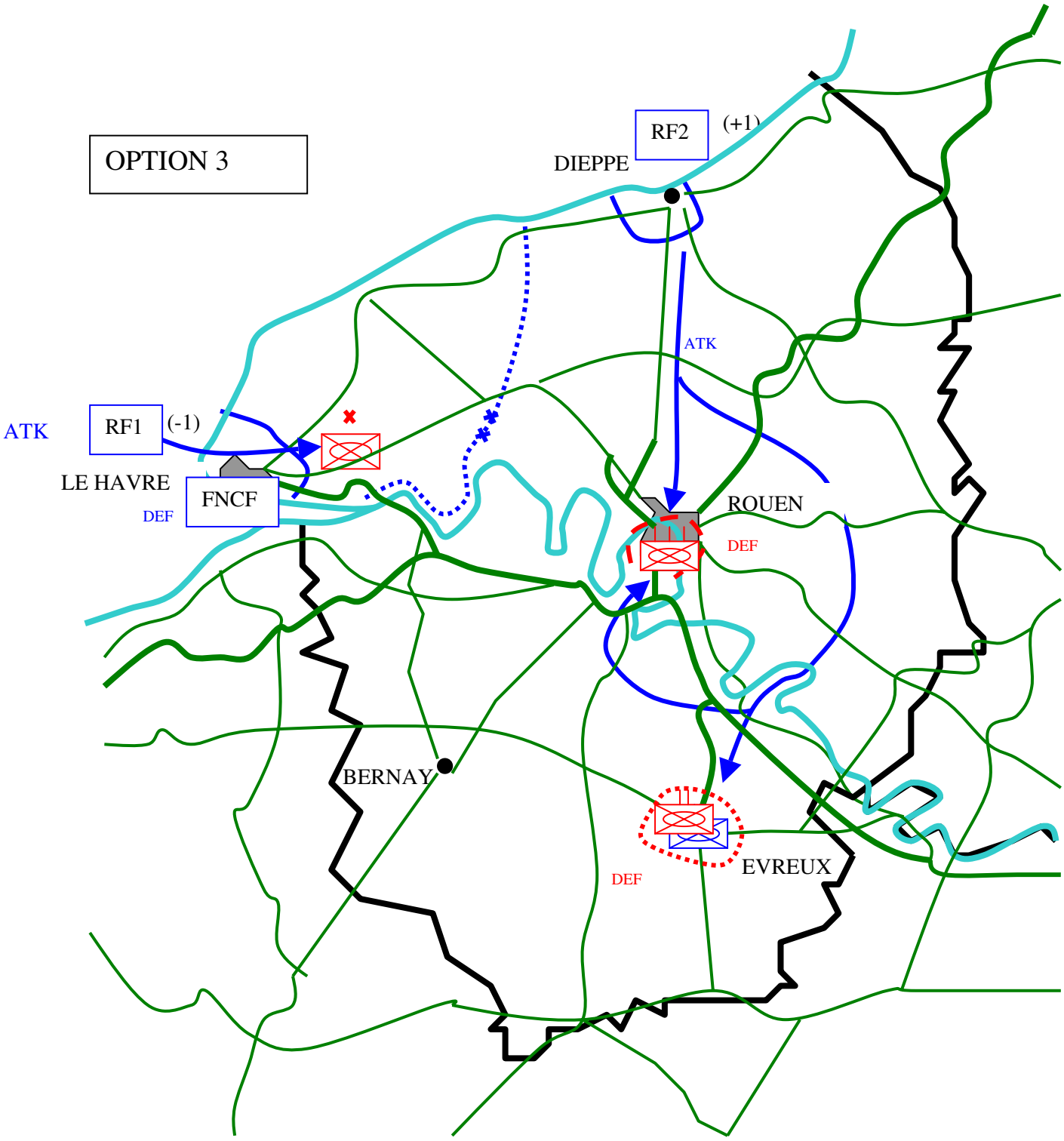
6.2. Subordinate units tasks

Unit	Location	CA1	CA2	CA3
FNCF	LE HAVRE and DIEPPE	Defence of the town and especially the airport and harbour facilities: establish a bridgehead		
Amphibious force : ATF	South of the SEINE	Integrated in the RF2	Offensive operation 1. in direction of ROUEN to capture of the southern part of the city 2. and/or in direction of EVREUX to extricate the besieged infantry battalion	Integrated in the RF2
RF1	LE HAVRE AO	1. Destroy YELLOW forces committed in LE HAVRE AO 2. Be prepared to participate in their expulsion from ORANGE territory	1. Destroy YELLOW forces committed in LE HAVRE AO 2. Be prepared to participate in their expulsion from ORANGE territory	1. Destroy YELLOW forces committed in LE HAVRE AO 2. Be prepared to participate in their expulsion from ORANGE territory
RF2	DIEPPE ROUEN EVREUX AO	1. Attack on the axis DIEPPE – ROUEN 2. Seize the crossing points on the SEINE River 3. Continue towards EVREUX in order to relieve the besieged inf. battalion. 4. Be prepared to participate in the expulsion of YELLOW forces from ORANGE territory	1. Attack on the axis DIEPPE - ROUEN 2. Capture the northern part of ROUEN and fix the enemy forces on the SEINE River 3. Be prepared to participate in the expulsion of YELLOW forces from ORANGE territory	Attack on two axis: 1. DIEPPE - ROUEN in order to capture the northern part of ROUEN 2. DIEPPE - LES ANDELYS - EVREUX in order to relieve the besieged inf. battalion and /or DIEPPE – LES ANDELYS – ROUEN in order to capture the southern part of the city. 3. Be prepared to participate in the expulsion of YELLOW forces from ORANGE

6.3. Co-ordination instructions




OPTION 2
RF2
DIEPPE
ATK
ATK
RF1
(-1)
LE HAVRE
DEF
FNCE
ATF
ROUEN
DEF
BERNAY
DEF
EVREUX


OPTION 3
RF2
(+1)
DIEPPE
ATK
ATK
RF1
(-1)
LE HAVRE
FNCF
DEF
ROUEN
DEF
BERNAY
DEF
EVREUX

Crisis Response Operation
Vignette 1

Situation

- 2019 - Rebellion of SOUTHERN ethnic forces against YELLOW
- Succeed in establishing liberated area in south
- Government fail to neutralise rebel forces in liberated area and guerrillas in Rouen and Le Havre
- Immigrated VIOLET community organise militia in Le Havre
- Violence led to exodus of ethnic groups towards fellow clan peoples

Negotiations take place in Geneva under UN auspices between September and December 2019.
On the 1st January a cease-fire was agreed demanding:

- Cessation of hostilities and constitution of unified ORANGE armed forces;
- The constitution of a transitional national unity government including Southern and Northern political figures;
- The transformation of the SOUTHERN political organisation into an official ORANGE political party;
- Elections to be hold in April 2021;
- The release of prisoners and abductees;
- The return of refugees and displaced persons;

15th January a UNSC resolution passed for deployment of peacekeeping force to ORANGE to monitor peace process.
This Peacekeeping Force would consist of:

- a CJTF led NATO Coalition Force,
- with two subordinate Peacekeeping Forces (South and North) and,
- an Air Component.

Political Directives - Political Goals

- Situation has to be stabilised for international security
- International community cannot ignore humanitarian crisis, nor ethnic, political or economic causes of conflict
- Steps must be taken to reduce the potential for regional conflict

Political Directives - Strategic Goals

- To monitor cessation of violence in ORANGE and successful implementation of cease-fire Agreement
- To alleviate the humanitarian suffering within ORANGE
- To assist in the reestablishment of law and order and in the promotion of reconciliation and social harmony, in order to encourage refugees and displaced persons to return to their homelands
- To assist in the establishment of a legitimate government representing, and recognised by, all the people of ORANGE

Mission

The NATO Coalition Force in ORANGE is to implement the 1st January 2020 cease-fire agreement and UNSCR in order to create the conditions for a more secure and stable environment in ORANGE.

War-fighting Operations

General

Blue Strategic Goals for War-fighting Operations

- 2019 - Rebellion of SOUTHERN ethnic forces against YELLOW
- Secure LE HAVRE and DIEPPE harbour and airport facilities, in order to allow follow-on forces to disembark
- Restore ORANGE territory
- Stop the violence
- Re-negotiation of new cease-fire
- Reconstruction of ORANGE armed forces
- Return of refugees and displaced persons
- Reconstruction of an independent ORANGE state

Vignette 2: Defensive War-fighting Operations

Crisis Development (1st August 2020)

- Situation deteriorated from June with YELLOW cross border engagements
- July, ethnic massacres, population displacement and infrastructure destruction – majority of VIOLET population leave
- ORANGE lost control of the South
- 1 August, YELLOW invasion, ORANGE government collapses and escapes abroad
- ORANGE forces have been mauled
- NATO forces have withdrawn to defend LE HAVRE and DIEPPE to secure them for reinforcements
- This is the setting for the second vignette: Defensive Warfighting Operation

Theatre Threat Forces

- Mixture of regular and irregular forces
- YELLOW conventional Land Forces, supported by an Air Component
- Range of Irregular threat forces:
  - Southern Militias – equivalent to 3 Light Infantry Battalions – organised in 20 to 50 man groups
  - YELLOW paramilitary Border Battalions
  - VIOLET Militia – core remnants of an active organisation
  - Terrorists – bombings in public places against ORANGE populace
  - Criminal Gangs – large network covering full spectrum of activities

Studied Mission

The syndicates worked on the FNCF mission: to defend the town of Le Havre and especially the airport and harbour facilities and establish a bridgehead.

Vignette 3: Offensive War-fighting Operations

Crisis Development (1st September 2020)

- NCF forces have prevented YELLOW forces from taking LE HAVRE and DIEPPE
- The NCF Battalion isolated in EVREUX maintains its defensive posture
- NATO provides reinforcements to strengthen CJTF
- Reinforcements include:
  - 2 x Division sized Restoration Forces
  - Corps Troops
  - Air Component

NATO Coalition Deployment

- NATO Follow-on forces commence landings of:
  - Restoration Force 1 at DIEPPE
  - Restoration Force 2 at LE HAVRE
- Air Component of:
  - 40 Multi-role aircraft
  - 40 Transport aircraft

Theatre Threat Forces

- Mixture of regular and irregular forces
- Reinforced YELLOW brigade of conventional forces in Rouen
- Variety of irregular threat forces:
  - Southern Militias – equivalent to Light Infantry Battalions – organised in 20 to 50 man groups
  - YELLOW paramilitary Border Battalions
  - VIOLET Militia – much reduced core remnants of an active organisation
  - Terrorists – bombings in public places against ORANGE populace
  - Criminal Gangs – large network covering full spectrum of activities

Studied Mission

The syndicates worked on the RF2 mission to attack Rouen in order to restore the city integrity.

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ANNEX F - TERMS OF REFERENCE

I. ORIGIN

A. Background

Following the NATO Long Term Scientific Study on Land Operations in the Year 2020 (LO2020-LTSS/49), which identified the impact of emerging technologies on future land warfare, SHAPE requested, through the Studies, Analysis and Simulation (SAS) Panel, the establishment of a NATO Military Working Group to study joint and combined concepts and doctrine as identified in the LO2020 study. An exploratory team (SAS-E08) was set up to explore the utility of a subsequent study. Seven nations (CA, FR, GE, IT, NL, UK and US) as well as SHAPE and NC3A were represented in this Exploratory Team. Given that NATO nations collectively face increasing challenges posed by Urban Operations, the team agreed that a study into Urban Operations at the operational level would be of the most benefit for the Alliance. A Technical Activity Proposal has been submitted to the SAS-Panel.

B. Justification

The LO2020 study identified asymmetric threats, emerging key technologies and urban operations as major drivers and challenges for future Alliance operations. Urbanization trends and the nature of current and future threats will make it increasingly likely that NATO will have to conduct operations in an urban environment. Military concepts and corresponding doctrine do not address these operations for the full mission spectrum as expected in the year 2020. In order to generate the required operational concept the initial step should be to define a conceptual framework within which will be identified avenues for further subsequent studies. Once the concept has been developed this should allow NATO forces to respond to the challenges of coalition operations in urban terrain. This will also provide an input to the NATO Defense Planning Process and will inform the Defense Capabilities Initiative (DCI) and the Concept Development Experimentation Process (CDE).

II. OBJECTIVES

A. Scope

The study will focus on the operational level of command. Tactical considerations will be brought into play where necessary. The force structure that will be considered in this study is a NATO/Coalition joint operation comprising a Combined Joint Task Force (CJTF) Headquarters commanding a Corps size Land Component and an Air Component. Maritime considerations would be confined to littoral operations/power projection. Two scenarios will be developed and validated: the first will focus on force on force warfighting in an urban environment; the second scenario will focus on operations other than war in such an environment.

B. Goals

The goal of the Urban Operations in the Year 2020 Study is to develop a conceptual framework to address operational level needs in urban terrain. The specific objectives of the study are to:

a. Construct agreed and appropriate scenarios that will include OPFOR, terrain and mission.
b. Identify the key mission tasks to be undertaken within each scenario.
c. Identify the requirements deriving from these tasks.
d. Identify current capabilities and capability gaps.
e. Identify the types of equipment/technologies that would most usefully be employed.
f. Identify structural and procedural changes that may be most appropriate.
g. Construct a Conceptual Framework together with a Road Map that would identify avenues for further exploitation and detailed work.
h. Map outputs against agreed lines of development (such as people, structures, doctrine, training,

and leadership) and the components of capability (such as ground manoeuver, air manoeuver, logistics, C4I, fire support, protection).

i. Provide input for NATO and national defense planning processes.

C. Deliverables

Deliverables will be the identified operational level mission needs and a road map to address those needs. These will take the form of a report. The final conclusions and recommendations will be briefed through the NATO chain of command. Members are responsible for briefing their respective nations as appropriate. SAS-030 will make intermediate (mid-course) and final Short and Long Presentations to the SAS Panel. After review and approval by the SAS Panel the Short Presentation will be proposed to the Military Committee.

D. Duration

The study will be conducted in 18(+) months from June 2000 (after formal approval by the SAS-Panel).

III. RESOURCES

A. Membership

Initially the participants include: CA, FR, GE, IT, NL, UK, US and SHAPE. Each nation will be asked to identify both military and analytical/scientific Points of Contact. The UK has accepted lead nation status with provision of the Study Director.

B. Resources

Each nation is responsible for the funding of the participation of their own team members. Wherever possible, the team will draw on national programmes and studies. It is the intention to conduct a series of focused working sessions using structured seminar wargames wherever appropriate. Subsequently, an editing meeting will be conducted to draw together all the results and to draft the final report. Individual nations will be invited to host one or more working sessions. In addition each nation will be asked to identify particular resources that could support the study such as wargame facilities as well as analytical tools. Also the establishment of an unclassified website will be considered.

IV. SECURITY CLASSIFICATION LEVEL

The intention is to conduct an unclassified study. However, during the study there may be a need to examine classified subjects up to NATO SECRET; the results of which will be published in a classified Annex.

V. PARTICIPATION BY PARTNER NATIONS

The SAS-E030 Study will initially start as “non-open” to Partners/PfP nations. However, should Partner/PfP Nations input be required, they may be invited to attend specific sessions or meetings or on a case by case basis.

VI. LIAISON

Liaison with SAS-026 (Applicability of the code of best practice for Command and Control to Civil Military Cooperation) and SAS-027 (Analysis of Small Scale Contingencies) to exchange information and ideas will be highly desirable both for analytical purposes and logistical savings. Full cooperation and involvement of SACLANT, SHAPE and NC3A would be highly beneficial.

The group intends to cooperate with FINABEL with respect to their study into Urban Operations. Cooperation with civil agencies and/or institutions has to be further investigated.

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Interoperability
Joint operations
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Military training
Models
NATO forces
Operations research
Scenarios
Tactical warfare
Threat evaluation
Trends
Urban Conceptual Framework
Urban operations
Urban System Concept
Urban warfare
USECT (Understand, Shape, Engage, Consolidate and Transition)
USW (Urban Seminar Wargame)
War games

14. Abstract

This is the final report by the SAS-030 Study Group into Urban Operations in the year 2020. In this study recommendations are given to RTA and NATO. The recommendations are based upon the approach as explained underneath.

The study group examined the future urban environment, stresses the growing importance of Urban Operations and derived capabilities needed at the operational level to successfully operate in such an environment. In the study the conceptual framework USECT (Understand, Shape, Engage, Consolidate, Transition) was analysed and future and more traditional operational concepts were developed and selected. Based on the operational level capabilities, new System Concepts were developed and these materiel solutions were analysed during an Urban Seminar Wargame where also non-materiel solutions were examined. During the study extensive ranking was helpful to determine the most promising System Concepts and other solutions.

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