



FUTURE TRENDS FROM THE CAPABILITY DEVELOPMENT PLAN

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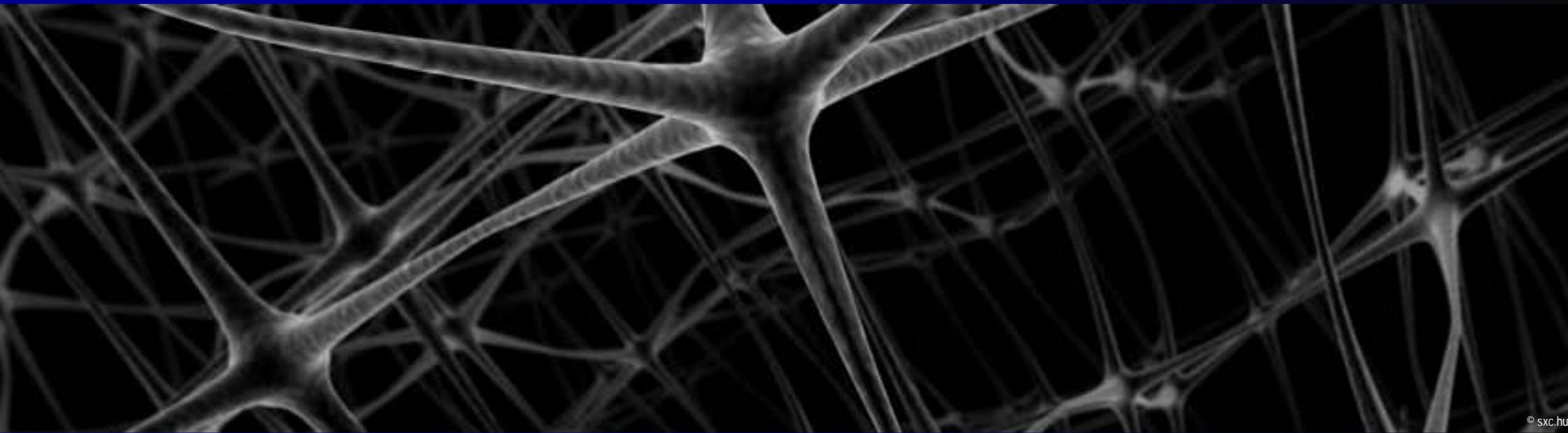
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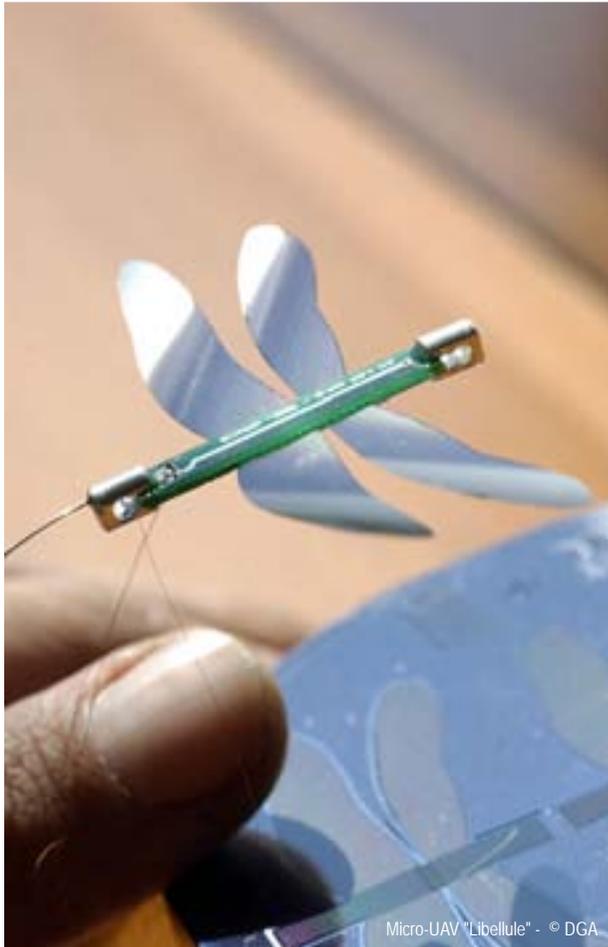


FUTURE TRENDS FROM THE CAPABILITY DEVELOPMENT PLAN



The CDP provides the picture all Member States need to take into account when planning future capability development agendas and finding the right balance between ambition and resources. Linking theory to practice is a job for everyone.

Javier Solana, Head of the European Defence Agency, Brussels, 8 July 2008



INTRODUCTION

The European Defence Agency has taken forward two important pieces of work, working closely with experts from the Member States, the EU Military Committee and the EU Military Staff. These are Long Term Vision (LTV), endorsed by Defence Ministers in October 2006, and the Capability Development Plan (CDP), which was endorsed in its initial version in July 2008 by the national Capability Directors. Both documents exist to inform the Member States' national capability development processes and provide a common baseline for collaboration within the defence and security area for Europe.

The LTV was published as an open document but the classification level of the initial CDP has prohibited the release of the full contents of the CDP into the public domain. However, many Member States have insisted that some of the more significant area of the CDP should be made available to a much wider audience within defence staffs.

In response to this need the EDA has prepared this publication. It represents a selection of non-classified material from the full version of initial CDP focussing on Future Capability Trends and Characteristics, as well as a selection of background documents prepared during the work that led up to the CDP. A core selection of documents is provided in printed format, and a larger set of documents provided in electronic format, on a CD-ROM.

The work to identify Future Capability Trends and Characteristics represents one of the four work strands underpinning the CDP, and the strand most closely linked to the LTV. The other three work strands of the CDP, which are not included in this publication, were inputs from the Headline Goal, Member States' plans and programmes and lessons from operations and contemporary experiences.

CDP CONTEXT

The EDA Long-Term Vision (LTV) report outlined the sort of capabilities which Europe's armed forces would need for possible European Security and Defence Policy (ESDP) military operations in the future. The broad endorsement of the LTV by EU Defence Ministers in October 2006 provided a solid foundation for ESDP capability development activities to be taken forward within a short-to-longer term perspective and set the baseline for an unique enterprise: to create a comprehensive and auditable overview of military capability trends and requirements, from today to 2025 and beyond, across all envisaged ESDP missions.

In order to start this endeavour, the EDA Steering Board at the end of 2006 tasked the EDA to establish an ESDP Capability Development Plan (CDP), based on the Headline Goal 2010 process and the LTV, conducting a more detailed and evidence-based analysis of future capability needs and the mutual disclosure of national medium-to-long term planning.

The detailed aim of the CDP were described as:

- to make the LTV capability guidance more specific (and thus more useful);
- to identify priorities for capability development; and
- to bring out opportunities to pool and cooperate.

The work was divided into four major strands:

- Establishing the baseline of shortfalls against the Headline Goal 2010 and their relative priority;
- Developing the LTV and by a series of capability studies on key issues;
- Collating a database of Member States' current defence plans and programmes; and
- Harvesting lessons for future capability from current experience.

The work itself was taken forward in a series of workshops and working group meetings, mainly chaired by the EDA. It has been a most successful co-operative effort by all 26 pMS, committed to a single objective and supported by the EU Military Committee, the EU Military Staff, the General Secretariat of the Council. As might be expected for such a complex exercise, wide consultation, coordination and commitment were required.

The initial CDP was presented to the EDA Steering Board on 8 July 2008. It will be a cornerstone of the Agency's activities as it defines a framework for European governments to work together to improve the military capabilities required for ESDP operations now and beyond, including priorities and actions to undertake.

The CDP is a unique tool, developed by the EDA's participating Member States for use by the

participating Member States. It provides a significant corpus of analysis of capability needs, capability trends and potential capability shortfalls up to 2025 and a database of national plans and priorities which will help pMS to identify and exploit areas of common interest.

Although the development of the CDP in such a short time must be considered as a remarkable achievement by the pMS, it should be seen as one of a number of components, albeit a crucial one, of a wider objective to develop an end-to-end, capability-based process within the EU in order to converge towards a more common understanding of military needs in the 21st Century. Where the CDP succeeds in adding is in assisting all pMS to develop their national capability plans in an appropriate balance of forces against ambition and resources, whilst providing a catalyst to identify and launch multinational collaborations for the development of new and enhanced capabilities. Therefore, the CDP is not, and must not be seen as, a Brussels-driven supranational plan with an aspiration to replace national decision-making.

With this shared sense of vision, the CDP attempts to address the well-documented fragmentation in demand for European military capabilities - the lack of harmonised military requirements and comprehensive priorities - whilst trying to evolve from a culture which focused too much on force size and not enough on the mutual dependency of the determinant factors contributing to capability. It does this by identifying risks and challenges facing Member States across the full range of ESDP missions, from the defined Headline Goal military requirements and lessons from recent and current operations,



EU NAVFOR-Atalanta safely escorts food aid convoy into Somalia, 9 February 2009 © EUNAVFO

to the potential but less tangible longer-term needs. It examines possible trends in the global strategic factors such as technology, demography, economy, global governance, to mention just a few, but considers them within the complex and unpredictable global security context highlighted in the LTV. Moreover, it takes into account a structured assessment of potential adversaries - not who or where, but what and how. A capability-based process is not an antidote to uncertainty that divorces threat and capabilities. It is necessary to integrate threat into planning in order to determine the necessary quality and, at times, quantity. Clearly it is difficult to undertake such an assessment but that does not suggest it should not be tried. The CDP takes on this challenge by providing a starting point for future debate and deliberations.

Taking all the detailed analyses into account, pMS identified the following as the principal conclusions emerging from this initial CDP:

- A clear and enduring need for appropriate conceptual work to support capability development;
- The need for persistent intelligence to support modern knowledge-based operations in complex environments, including full spectrum awareness, robust networks and appropriate architectures;
- The requirement for adaptive and co-ordinated inter-agency structures in order to support a comprehensive approach to EU crisis management operations;
- The necessity to maintain the initiative against a broad range of possible adversaries that are technically and conceptually agile and who will not be constrained by legal and western societal norms;
- The need for ever-greater flexibility, agility and responsiveness in order to be able to deliver the precise effects at the right time and place; and
- The human factor - the most critical requirement to recruit, train and retain a motivated workforce to meet the most demanding challenges.

Based on these conclusions, the participating Member States have agreed on a first series of actions in order to operationalize the findings of the CDP. With a wide remit to tackle real-time operational risks and recalibrate the future capability mix in order to reflect the uncertainty times that lie ahead. Some new capabilities are extremely expensive and raise complex investment issues. What could be given up in order to generate a future force that has more rather than less relevant defence capabilities? What could be a more appropriate balance of investment, and what force options could make the most sense? These questions involve difficult but important choices and must be answered at all levels, from tactical to strategic.

The endorsement of the initial CDP and its emerging actions demonstrate clearly the determination and commitment of pMS to make Europe more military capable.

The CDP is significant and unique but must be considered only as a starting point, to be further refined and regularly reassessed to ensure it remains pertinent and useful. The journey towards a more relevant capability development process in Europe is well underway. It is a long road, but the delivery of the Capability Development Plan clearly demonstrates that there is much to be optimistic about.

INITIAL TRANCHE OF 12 SELECTED ACTIONS

- Counter Man Portable Air Defence Systems
- Computer Network Operations
- Mine Counter-Measures in littoral sea areas
- Comprehensive Approach - military implications
- Military Human Intelligence and Cultural / Language Training
- Intelligence, Surveillance, Target Acquisition and Reconnaissance Architecture
- Medical Support
- Chemical, Biological, Radiological and Nuclear Defence
- Third Party Logistic Support
- Counter-Improvised Explosive Device (C-IED)
- Increased availability of helicopters
- Network Enabled Capability



POTENTIAL TRENDS IN FUTURE MILITARY CAPABILITY CHARACTERISTICS



REPORT ON THE CDP STRAND B

POTENTIAL TRENDS IN FUTURE MILITARY CAPABILITY CHARACTERISTICS

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INTRODUCTION

1. The objective of Strand B was to identify potential trends in future capability characteristics across the ESDP missions, and military tasks associated with those missions. The future is not predictable as the LTV made eminently clear. But it has been possible to gather information that provides an understanding about the future, including the context of future operations. However, making sense of this information is no simple matter. Trends are discernable but grasping their meaning and consequences remains the challenge. This Report does not pretend to offer a roadmap for the next 15 years. It aspires only to be judged as a starting point, to indicate directions that are sensible to move forward but which, in time, will require further development and reassessment.

BACKGROUND

2. Europe will remain one of the most important and stable regions on the planet. However, the global context is sobering, with the central predictions of demography and economics foreshadowing a Europe which, two decades hence, will be older, less pre-eminently prosperous, and surrounded by regions (including Africa and the Middle East) which may struggle to cope with the consequences of globalisation. Defence will need to contend with public finances under pressure from a growing pension burden; a shrinking recruitment pool; and societies increasingly cautious about intervention operations and the legitimacy issues associated with the use of force.

3. In order to focus upon the key future force and capability characteristics, it is necessary to acknowledge that whilst the nature of military operations will not change, these characteristics will. To that end, the conduct of future operations cannot be discussed without consideration of the political, social, cultural and technical contexts. In this technology requires a special mention. Within the current technological revolution, seeking competitive advantage through the exploitation of technology makes common sense. However, if reliance on the benefits becomes simply faith in the power of machines, incoherence and confusion will emerge. Strategic and conceptual thinking needs to converge with technological advances to avoid being overwhelmed by it. It is with this perspective that the Strand B results have been considered.

KEY TRENDS

4. The work conducted for Strand B highlights a series of key trends. Trends in areas concerning science & technology, global strategic drivers and threats have already been circulated to pMS.

5. Overall. An overarching observation from the conclusions of the Strand B is that the need for developed concepts, doctrine, procedures, training and architectures to generate the future new,

enhanced and interoperable capabilities is more dominant than the perceived requirement to acquire hardware. The main potential trends in future capability development are summarised below.

6. Knowledge-based operations. The ability to plan, prepare and conduct knowledge-based operations will be fundamental for the future to ensure that the EU is able to plan, execute and achieve the required strategic objectives. In order to support decision-makers to achieve this, persistent surveillance coverage must also be established where and when needed, day or night, as well as in denied or contested locations. This must then be made available to all and every actor that requires it, at all levels.

7. The aim must be to achieve wide-area, full spectrum awareness whilst being able to use the full benefits of improved levels of precision and enhanced selectivity. Appropriate intelligence architectures will be required, which can fully integrate operations from strategic to tactical level, whilst utilising a greater reachback facility to support all aspects of the operation but particularly a robust early warning capability.

8. Concepts. Throughout discussions, the need for consistent and appropriate concepts was repeated, regardless of the capability area under consideration. It was considered that joint concepts must depict how the force will operate in the future, addressing the role of the military across the full range of missions. They need to be developed with multinational utility in mind and must be coherent with a comprehensive, civil-military, inter-agency approach. They must be specific enough to enable identification of capability development priorities, yet flexible enough to absorb new ideas as new technology emerges, threats develop and strategic drivers evolve. Static concepts do not encourage intellectual development and will be made irrelevant by flexible adversaries.

9. Persistent Intelligence. Future ISR capabilities should be developed with the overarching intelligence needs in mind, rather than the platforms that carry the sensors or the medium that the sensors operate in. In future, these ISR capabilities in theatre should be co-ordinated by the Joint Commander to ensure he can substitute one capability for another to achieve the same effect, whilst fully supporting his subordinate commanders. This will improve the ability to integrate data from all sensors, including civilian ones and ensure timely intelligence is available to those who require it. Network enabled architecture and the ability to conduct spectrum management will be essential.

10. Operations against irregular adversaries are often less a question of force size but more about the 'fast beating the slow'. Furthermore, the diffusion of technology and the overall complexity of crisis management operations in the information age will induce an increased operational tempo.

11. Comprehensive & co-ordinated actions. Strategic and operational integration, co-operation of

POTENTIAL TRENDS IN FUTURE MILITARY CAPABILITY CHARACTERISTICS

different actors and an adaptive inter-agency structure are required. Military, civilian, diplomatic, economic, etc. components will need improved synergy, where sharing information widely is the norm, not hoarding it - working together seamlessly at all levels. To do this, relevant military elements may need to develop greater adaptability, and be more flexible and modular in response to meet theatre requirements.

12. Harnessing the benefits of network enabled capabilities will ensure the structure and connectivity required, enabling critical relationships in order to speed up business processes, decision-making and subsequent actions in order to deliver the required strategic effect. But such capability requires a shift from a military-focused effort to a strengthened, all agency-wide enterprise and a sufficiently flexible, but robust, information management strategy.

13. Maintaining freedom of manoeuvre. It was assessed that adversaries, irregular or traditionally-structured, are likely to adopt an anti-access strategy and anti-manoeuve tactics of varying degrees of sophistication, across all environments and domains. The aim is to deny EU forces the ability to manoeuvre and prevent them gaining and maintaining the initiative. These tactics may take the form of IEDs, snipers and the use of ManPADS to constrain mobility as well as novel variations of Information Operations, whether by clever motivation or brutal intimidation.

14. Within the littoral sea areas, access will be fundamental for EU forces due to the expeditionary nature of ESDP operations and the need to deploy, operate and sustain from the sea. Countering technically sophisticated mines and other innovative anti-access methods may be challenging. Adversaries are unlikely to feel constrained and will make use of urban conurbations, littoral sea areas, transport hubs and inland waterways to create a media-hyped, strategic effect from a tactical incident.

15. Future forces may be required to manage all aspects of threat, including these in the cyberspace and from weapons of mass effect. EU forces are likely to need capabilities to operate in such an intimidating environment in order to render safe and eliminate these weapons, to ensure freedom of movement.

16. Developing Adaptive Joint Forces. The development and generation of future military capabilities will need to anticipate or build-in redundancy in order to prepare for the challenges of an unpredictable future. In the nearer term this may predominantly be in the form of irregular and nonlinear actions from a variety of adversaries, but in the longer-term the re-emergence of a conventionally-structured adversary involved in a regional conflict cannot be discounted. This adaptability will increase the EU's ability to react, in appropriate timescales, to these challenges and to create the precise effects at the right time and place. This will ensure relevance and effectiveness. Our adversaries are adapting at the



speed of commercial business whilst there remains a danger of Europe operating at the speed of doctrine.

17. Achieving strategic and operational agility. Future military capability development will need to stress greater flexibility, versatility and speed in order to create the necessary rapid effects across the full spectrum of missions. Strategic reach and tactical mobility need to be sufficient to ensure credibility. All-weather, stand-off precision weapons must be balanced with a highly discriminate force usage that will require combinations of kinetic, non-kinetic and less than lethal means with the focus on the desired effect (e.g. to avoid collateral damages). Furthermore, the increased importance of Information Operations will necessitate a new and novel tool set. Although, the military must contribute to achieving an overall comprehensive effect, it must be designed to potentially realize a lethal capability to deter aggression and promote stability. Key to this is a potential reorientation of a balanced and refined force structure and available capabilities, which can rapidly come together to achieve a specific military effect and then quickly adapt with other capabilities to achieve what is required for the next operation.

18. The human factor - the most critical resource. People remain the most critical requirement. Higher-quality personnel will be needed to address the complexity of modern security operations, which place severe demands on the mental agility and ingenuity of military personnel. The era of the '3 bloc war' is here and now. To that end, it is assessed that the character of crisis management operations will further increase demands upon personnel at all levels.

POTENTIAL TRENDS IN FUTURE MILITARY CAPABILITY CHARACTERISTICS

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19. Despite the high quality that pMS' forces have historically generated, it is unclear whether, in a future of possible disincentives, armed forces can rely solely on traditional career profiles to provide critical skills. Furthermore, to tackle the difficulty of achieving the appropriate and sustainable balance of operations and training, innovative strategies and techniques should be considered. For example, using specialist-skilled civilians in areas where specific experience is necessary but where service personnel has traditionally been appointed.

20. Training and education requirements at all levels and across the full spectrum of actors are also changing, with traditionally skills needing to be supplemented with improved, broader proficiencies that can support emerging technological techniques, new operating concepts, and novel approaches to knowledge exploitation and decision-making. Furthermore, first-class training will be a key recruiting and retention tool.



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EDA FOOD FOR THOUGHT IN PREPARATION OF THE STRAND B PHASE 2

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MILITARY CAPABILITY NEEDS FOR THE FUTURE. At this time in the development of the initial CDP it is worthwhile to pause and reflect on its overall objectives. They can be summed up as - within the context of ESDP to assist pMS to identify priorities and collaborative opportunities for capability development, to guide research and industry and to provide a measure of progress. Currently, the Headline Goal (shorter-term) and the European Security Strategy (longer-term) articulate the ESDP mission set, strategic assumptions and future ambition which provides the baseline for EU capability development. If pMS are to provide real substance to this, they must be able to intervene in a regional conflict, prevent and stabilise potential conflict in Europe's neighbourhood, deal with proliferation of WME/WMD or address threats from terrorism. This provides a patent challenge to project force further afield, more quickly and more robustly. This, in turn, places a premium, for instance, upon knowledge, deployability and sustainability capabilities, sometimes operating with different cultures, in theatres where access cannot be taken for granted, where basing may be too sensitive for potential hosts or overflight is not guaranteed. Likewise, introducing network enabled capabilities and the ability to utilise non-kinetic options in conjunction with traditional kinetic methods will be important components for future mission achievement. Increasing demands on international intervention, post the Cold War, are expanding the range and breadth of military tasks, the geographic scope of normal deployments, and will require forces and their supporting structures to be more flexible and adaptable.

The challenges of achieving knowledge-based operations, as well as addressing the complexities of concurrent operations and the sequential nature of a developing crisis will place further demands on defence and security priorities. For example, it could be envisaged that within individual operations, military forces may be faced with several tasks simultaneously, conducting high intensity combat, stabilisation and humanitarian assistance operations - 'the 3 bloc war'. Such complexity demands highly adaptive forces that are able to quickly identify and meet the needs of both; the most likely missions (frequently occurring) and the most the challenging (large scale, high-intensity conflicts such as separation of parties by force or conflict prevention within an urban environment). However, despite the broad nature of ESDP strategic planning assumptions, the benchmark against which pMS are likely to plan and judge operational capability will, inevitably, be based on high intensity warfighting.

CAPABILITY-BASED PLANNING. To date, the evolving EU capability development processes have focused on being more capability-based than threat-driven. This should not be surprising, as its roots stem from the post-Cold War period when the mission sets became expanded and the taut defence fiscal situation required forces to consider output in terms of achieving military tasks not input in terms of quantity. The Headline Goal 2010 has taken this principle forward with great success within ESDP. However looking to the future, as set out in the ESS, the initial Long Term Vision for ESDP and the CDP Strand B Phase 1 work, it is becoming important to consider required operational outcomes in the form of strategic objectives or effects. In other words, what are the specific roles of military force in a truly joined-up, traverse-departmental, cross-pillar approach to crisis management? And thence, what joint capabilities



are required to achieve them? Such a challenge reflects the need to support a coherent civilian/military comprehensive approach to crisis management and reaffirms that the use of armed force is primarily to serve political ends.

Furthermore, a capability-based process supports, not competes with, this integrated civil/military, comprehensive approach to crisis management. After all, and without needlessly trying to impose or propose a definition, what is a capability but an ability to achieve a required objective, end or effect through a combination of means (equipment, trained forces, etc) and ways (concepts, etc and their implementation) . So, by using such logic the military must focus upon capabilities that can, for example, overcome and deter adversaries, which can disrupt an adversary's plans to use deception and asymmetry and which can prevent and stabilise a situation from political spiralling out of control - all as part of a coherent and co-ordinated civil/military operations plan.

THREAT WITHIN A NEW ENVIRONMENT. Pausing again, it is important to return to the issue of threat. Although threat-based planning itself is less relevant, threat and the risk it poses will remain a key consideration to the capability planner. For example, without an assessment of the potential threat how could pMS consider, in quantifiable terms, what a 'good' capability is - and how good does good have to be? In the Cold War, broadly similar forces were deployed with broadly similar equipment. The enemy, his ways of behaving and the axes of threat were all reasonably familiar and as a result

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assessments could be made to calculate his combat power and simulations made to predict probably outcomes. In a future environment, such capability measurements are no longer so easy. Identifying the adversary and defining the threat axes is more difficult. The regular, conventionally structured adversary may try to benefit from asymmetry not simply in concepts but goals and vulnerabilities, and the irregular adversary will, more likely, try to be unpredictable in every way possible. When applied to current capability considerations, as postulated above, the broad definition of capability takes on a different emphasis. The means, or equipment, whilst being a vital part of capability, may turn out to be a less decisive factor than the ways, which need to be brought together and harnessed cogently to achieve the overall results.

ACHIEVING EFFECTS. To deliberate how to contribute to an overarching strategic objective or effect does not necessarily require the support of a complex and overly complicated process, and should not be confused with national or other organisation's concepts of an Effects Based Approach to Operations (EBAO). During all ESDP missions, certain broad strategic effects must be achieved. What changes from mission to mission is the scale and significance of the effect and with which instruments (civil or

military, or a combination of both) the policy makers decide to achieve the effect. For the military to fully play its part, it must consider what its contribution could be to these future required effects and, in doing so, must take into account a number of more fundamental issues. Firstly, maintaining a broad perspective of missions to be prepared for, including the capacities of potential adversaries. Secondly, retaining a focus on joint force planning, in particularly in the development of military concepts and doctrine. Thirdly, moving away from like-for-like platform replacements but instead concentrate upon how technology and concepts are evolving and are likely to continue to evolve, and how they could influence the capabilities needed to deliver the required strategic effects, and how this comprehensive and integrated process is seamlessly fused together. And lastly, use the management or mitigation of risk as a strategic measure of effectiveness. It is already undertaken at the tactical level - consider the work on probability of kill ellipses, radar-cross sections, range and payload assessments, etc, and at operational level - generating alternative force packages, Special Forces versus air support for target engagement, etc.

Whilst trying not to establish a formal set of strategic effects but instead provide some food for thought for the forthcoming workshops, the following could be considered as appropriate effects necessary to bring to bear against an adversary during an ESDP mission.

- **Prevent** - stopping or limiting the emergence of a crisis or conflict, and reducing the adversaries ability to cause mission critical effects.
- **Stabilise** - contain and set the secure and stable conditions required for political, economic or other action to bring about a return to normal control and good governance.
- **Deter** - dissuade or coerce an adversary from a course of action that is considered detrimental to stability and order.
- **Disrupt** - dislocate and disable an adversary's ability to function effectively and deny him freedom of action.
- **Overcome** - reduce an adversary's effectiveness and willingness to conduct operations that undermine stability and order.

Re-balancing the mix of future capabilities. To address these planning challenges for the future and particularly addressing potential threats and challenges whilst maximising opportunities, EU Member States' forces must maintain a competitive advantage. To do this they will need to modernise their forces to ensure synergy (profitable combination and interoperability), agility, selectivity, survivability and sustainability across all capability development areas. This reorientation should build upon the changes already underway in Member States, the work being conducted within the IDTs, the capability shortfalls already revealed in various national and multinational processes (i.e. Headline Goal) in areas, for example such as Special Forces, ISR, C3I, mobility, amongst other areas, and the issues highlighted in this Food for Thought paper. All these issues and processes must be melded together to ensure a coherent analysis of the trends and characteristics of future military capabilities needs. The



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Annex contains some specific ideas based upon the material prepared for the CDP Strand B and the LTV, which pMS may wish to consider prior to the Workshops.

ANNEX

POTENTIAL TRENDS AND CHARACTERISTICS OF FUTURE MILITARY CAPABILITIES IN THE 2025 TIMEFRAME

Command and Control

- To improve combat identification in order to further reduce the potential for 'friendly-fire' incidents.
- To be sufficiently proficient at C4ISR to operate at a tempo that will outpace and dominate potential adversaries, including when faced with an irregular adversary or asymmetric tactics.
- To increase language and cultural awareness to facilitate the expansion of partner capacity and to develop a greater understanding of emerging powers and how they may approach strategic choices.
- The ability to communicate EU actions effectively to multiple audiences, while rapidly countering adversary agitation and propaganda.
- To plan and conduct complex interagency operations.
- To effectively disrupt and defeat adversary's networks.
- To secure broadband communications into denied or contested areas to support penetrating surveillance and strike systems.
- Capabilities to shape and defend cyberspace.
- Joint command and control capabilities that are survivable in the face of WMD, electronic-, or cyber-attacks.
- To employ robust and coherent, rapidly deployable force headquarters to meet the range of potential contingencies.

Provide Intelligence

- To provide knowledge at all levels of operations so that the response to contingencies can be planned, organised and executed effectively. This includes an understanding of the threat, the environment (political, social and physical) and combined capabilities.
- To gather, analyse and distribute information and to manage efficiently all aspects of operations - the heart of NEC.
- To exploit systems to the full to enhance fusion, analysis and accessibility of data collected, so as to improve responsiveness and provide better support to commanders.
- Improved stand-off sensors do not remove the requirement for timely and accurate human intelligence (HUMINT) and to discern the intentions of the enemy, particularly in the field at the operational and tactical levels.

- To ensure persistent surveillance to find and precisely target enemy capabilities in denied areas.
- To locate, tag and track adversaries in all domains, including cyberspace.
- To fuse intelligence and operations to speed-up action based upon time-sensitive intelligence.
- To exploit persistent surveillance, including systems that can penetrate and loiter in denied or contested areas.
- To locate, tag, track, characterise and secure WMD.
- To locate WMD delivery systems and related materials, including the means to move such items.
- To carry out persistent surveillance over wide areas to locate WMD capabilities.
- To establish an "unblinking eye" over the battlespace through persistent surveillance will be fundamental to conducting effective joint operations.
- To support operations against any target, day or night, in any weather, and in denied or contested areas.
- To integrate global awareness capacities with tactical level knowledge, with an ability to reach back to national intelligence collection systems and analytic capabilities.
- To develop supporting architectures that transfers intelligence data collected in the theatre to the users, rather than deploying users to the theatre.
- Future ISR capabilities must be designed to collect information that will help decision-makers mitigate



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surprise and anticipate potential adversaries' actions.

- The future force will define ISR needs by sensor or type of intelligence needed rather than the platforms that carry the sensors or the medium in which they operate. This approach will facilitate the substitution of one capability for another to achieve the same effect, and will allow the suppliers of sensor capability to meet the requirement more efficiently.

Conduct Manoeuvre and Joint Fires

- To deliver a decisive impact across the required spectrum of operations and to ensure the defeat of advanced threats.
- To exploit stealth and advanced electronic warfare capabilities when and where they are needed.
- To be proficient in irregular warfare, including counterinsurgency and stabilisation operations.
- To be able to sustain long-duration irregular operations, while exploiting reachback to non-deployed elements of the force.
- To project air power from both the land and the sea, offering capabilities across the range of air operations that have greater range and persistence; larger and more flexible payloads for surveillance or strike; and the ability to penetrate and sustain operations in denied areas.
- Long range stand-off precision strike capability will be required to conduct time-sensitive operations, by fusing intelligence and operations at the tactical level and with larger numbers of Joint Tactical Air Controllers to achieve a higher level of joint ground-air integration.
- An increased availability of 'smart' bombs must be available to ensure a high degree of accuracy in offensive operations.
- An appropriate force package may need to be generated for each operation, drawing from a flexible and balanced force structure of heavier and lighter forces. The heavy forces provide firepower, integral tactical mobility and protection necessary to carry out land manoeuvre but require a considerable effort to deploy and to be supported on operations. Whereas lighter forces can deploy more rapidly, but lack the firepower, mobility and protection to conduct decisive operations against an enemy equipped with armour and mechanised forces.
- To be modular in structure at all levels, largely self-sustaining and capable of operating both in traditional formations as well as disaggregating into smaller, autonomous units.
- Mobility will be central to effective manoeuvre in all operations in order to deliver the right effect at the right time and in the right location. Such effectiveness will be measured not in material moved but by the operational effects they helped to achieve.
- To enhance non-lethal capabilities.
- To perfect urban warfare capabilities.
- To strike at fleeting targets rapidly, placing a premium on capabilities that are responsive and survivable, able to destroy moving targets in all weather conditions, exploit non-traditional intelligence and conduct next generation electronic warfare.



Radio Frequency Transmission Line Test © BAE Systems

- In the maritime environment there may be an increasing emphasis on delivering effect from the sea onto the land, which includes a land attack capability, supporting forces ashore and on securing access to the theatre of operations and protecting the crucial sea lines of communications from the home base.
- To use undersea warfare capabilities to exploit stealth and enhance deterrence.
- To be able to operate in blue, brown and green waters.

Ensure Force Protection and Security

- In the face of continuing proliferation of WMD, capability to operate when threatened with the use of Chemical, Biological, Radiological and Nuclear (CBRN) weapons, by developing enhanced detection systems, physical protection, vaccines and other medical countermeasures.
- To have broad spectrum medical countermeasures to defend against genetically engineered or naturally mutating pathogens for which there are no current defences.
- To defend and respond against WME attacks, as well to deter such attacks by demonstrating the ability to deny an adversary's objectives.
- To train, equip, and advise indigenous forces.
- To manage the consequences of major catastrophic events.

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Ensure Strategic Reach and Freedom of Movement

- To have sufficient sea and air transport with the capacity to lift over-size loads in order to rapidly deploy land and air combat capabilities.
- To enhance riverine warfare capabilities and to deny adversary's use of waterways.
- To deploy rapidly, assemble, command, project, reconstitute, and re-employ joint combat power from all domains to facilitate assured access.
- To interdict air, maritime, and ground shipments of WMD, their delivery systems and related materials.
- To secure WMD sites so that materials cannot be removed.
- To shield critical and vulnerable systems and technologies from the effects of EMP.

Ensure Support and Logistics

- The likely increased frequency and duration of operations may emphasise the need to plan carefully and utilise logistic enablers to best effect and to improve synergy between stock-holding requirement and contracts with industry. This will reduce logistic risks.
- To minimise logistic demand by improving the inherent reliability and ease of maintenance of equipment, and the effectiveness and efficiency of engineering and asset management processes.
- To alleviate demands placed on specialist personnel.
- Security issues may increase the use of joint sea-based logistics, particularly for operations where Host Nation Support is limited or where, for force protection or for political reasons, there is a need to reduce the ashore footprint.
- Multi-role aircraft capability will allow deployed force packages to be smaller where coverage of multiple roles has previously required additional aircraft.



Logistic support © EUFOR Tchad RCA

AN INITIAL LONG-TERM VISION



FOR EUROPEAN DEFENCE CAPABILITY AND
CAPACITY NEEDS

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EXECUTIVE SUMMARY

1. A vision of the future nature and context of ESDP operations is essential to inform those near-term decisions which will determine Europe's long-term defence capabilities and capacities. The picture offered here will need further development, and regular reassessment – but may be judged a useful starting-point. (Introduction)

2. The global context is sobering, with the central predictions of demography and economics foreshadowing a Europe which, two decades hence, will be older, less pre-eminently prosperous, and surrounded by regions (including Africa and the Middle East) which may struggle to cope with the consequences of globalisation. Defence will need to contend with public finances under pressure from a growing pension burden; a shrinking recruitment pool; and societies increasingly cautious about interventionary operations, concerned with issues of legitimacy in the use of force, and inclined to favour "security" over "defence" spending. (Section I, The Global Context)



3. Defence will need to continue adapting to:

- the changing role of force. Traditionally, war and politics were practised sequentially- and war involved largely unconstrained violence directed towards destroying opposing conventional forces. Today and tomorrow, force will be intimately interwoven with political (and media) developments – and will typically be applied in opaque circumstances against an obscure enemy under tight rules of engagement and 24/7 media scrutiny.
- the technological revolution. Continued developments in micro-electronics, communication and sensing technologies, bio- and material sciences and energy technologies will provide modern Armed Forces with great advantages. But the adversary will work hard to adopt and exploit our own advances against us.

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Increasingly, defence will need to draw from the broadening flood of civil technological progress. (Section II, Challenges for Defence)

4. ESDP operations will be expeditionary, multinational and multi-instrument, directed at achieving security and stability more than “victory”. Information will be critical, whether informing the “war of ideas” in cyberspace, or facilitating effective command decisions. “Asymmetry” will apply not merely to an opponent’s tactics but also to his aims and values. In such circumstances, the military will be only one of a range of instruments applied to achieve the campaign goals. (Section III, Implications for the Military Contribution to ESDP Operations)

5. The key future force and capability characteristics may be:

- **Synergy** – going beyond combined-arms warfare to coordination of effects with nonmilitary actors;
- **Agility** – implying speed of reaction and deployability, but also the capacity to reconfigure for optimum force size and balance, and move quickly at the tactical level;
- **Selectivity** – meaning a wide range of capabilities, and the means to ensure an informed and appropriate choice at each stage of the operation; and
- **Sustainability** – suggesting the right logistic support, but also theatre access.

(Section IV – Implications for Capability Development)

6. These characteristics are translated into a Future Capability Profile for each of the main capability domains of Command, Inform, Engage, Protect, Deploy and Sustain. (Annex – Future Capability Profile)

7. In working towards this capability profile defence planners will need to concentrate on some key issues, including:

- **Knowledge exploitation** – improving intelligence, information and analysis at all levels, and developing appropriate forms of network-enabled capability;
- **Interoperability** – preferably through greater commonality of equipment and systems, and shared or pooled capability;
- **The manpower balance** – finding ways to enable greater investment by cutting manpower numbers and costs, whilst providing for “boots on the ground”;
- **Rapid acquisition** – in particular quicker exploitation of new technology;
- **Industrial policy** – averting a steady contraction and decline of the European defence industry by

increasing investment; consolidating the European technological and industrial base; harnessing Europe’s full potential; and targeting what we want to preserve or develop;

- **Flexibility for the unforeseen** – recognising the limitations to how far we can penetrate the fog of the future.

(Section V: Key Issues for the Defence Planner)

INTRODUCTION

1. Every day, defence planners, technologists and industrialists across Europe take decisions which materially affect the sort of defence capabilities, and underpinning technological and industrial base, that Europe will have at its disposal in 20 years time. Those involved in such decisions are, in the French phrase, “preparing the future” – and they need the best help that can be given them to understand the future for which they must prepare. Accordingly, the Ministerial Steering Board of the European Defence Agency (EDA) tasked the Agency, in November 2005, to lead a wide-ranging exercise to develop an initial long-term vision of European defence capability and capacity needs, looking some two decades ahead.

2. Any attempt to “forecast the future” – to assert with confidence that the world will be thus or so in 20 years time, or that defence ministries can accurately specify what capabilities will be required to meet the challenges so far ahead – would be self-deluding and dangerous. But we can reasonably aim to identify some of the most relevant and robust trends, and recommend them as guidelines for those working their way forward into the fog of the future. For example, a key hypothesis in what follows is that the phenomenon known as globalisation will continue. It is easy to think of scenarios which might invalidate this hypothesis: an uncontrolled pandemic; massive use of weapons of mass destruction; or perhaps regionalisation of the world’s economic system, with competition for inadequate resources leading to the emergence of mutually suspicious regional blocks. But, so many stand to gain so much from the continuation of the globalisation process that it seems a reasonable assumption to make, at least for now, about the world in which the European Security and Defence Policy (ESDP) will operate.

3. “At least for now” is fundamental. This document does not pretend to offer a route map to be followed over the next twenty years. It aspires only to provide a sort of compass bearing, to indicate the directions in which it would be sensible to move forward. Accordingly it is an initial vision, intended as something to be revisited on a regular basis, to check whether the directions indicated still seem appropriate. And it cannot answer the question how much effort and resource should be invested in insuring against the unexpecteds and the unknowns which will inevitably present themselves along the way.

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4. The European capability and capacity needs referred to in the Steering Board's tasking are those needed for the ESDP. They are only one part of the spectrum of what defence practitioners need to plan for, alongside, for example, separate national or NATO requirements. Thus, the initial long-term vision (LTV) makes no claim to influence the totality of Member States' defence planning. Nor does it attempt to anticipate how ESDP itself may evolve over the next 20 years. However, the Headline Goal and European Security Strategy envisage a broad and significantly challenging set of potential missions. These include separation of warring factions by force, on the sort of scale that would have been required had a ground invasion of Kosovo in 1999 turned out to be necessary. They may also encompass stabilising operations in a failed state in the face of a determined and capable asymmetric threat. So the demands of today's ESDP are already potentially deep and comprehensive.

5. Against that background, what is offered here is a basis, a proposed foundation upon which follow-on work can be built, involving progressively more detailed analysis and therefore more useful guidance to those developing the defence capabilities and capacities of the future.

THE GLOBAL CONTEXT - WHAT SORT OF EUROPE IN WHAT SORT OF WORLD?

6. Unless globalisation stops or goes into reverse, the world of 2025 is likely to be more diverse, more inter-dependent, and even more unequal. A forecast tripling of Chinese GDP will make China the second global economy; India may have overhauled Japan, to take third place. Europe will continue to grow modestly - in GDP and perhaps membership - but with its technological advantage in such areas as IT, biotechnology, and nanotechnology being steadily eroded.

7. Europe will in particular be held back by low fertility rates (currently 1.5). The population may remain roughly stable, compensated by lower mortality and greater longevity. But by 2025 the effective economic old age dependency ratio (retired over 65s as a percentage of the working population aged 15-64) will have risen from 37% to 48%; and the average European will be 45 years old. Europeans will by 2025 comprise a mere 6% of the world population. The aging of Europe's people will lead to fierce competition for young and skilled workers. The Armed Forces recruitment pool (16 - 30 age group) will fall by over 15% by 2025.

8. These demographic trends will have major implications for public finances, with increasing health care and pension costs. Future public benefits to the elderly could rise from today's spectrum of 11-16% of national GDPs to 17-33% over the next 4 decades. Low economic growth and high unemployment could further exacerbate fiscal pressures on national budgets as unemployment and social benefits are funded by a decreasing taxpaying population. Inevitably, costs of armed forces personnel will also rise.

9. Globalisation will produce winners and losers, as between countries and regions, and within societies (whilst universal communication will make these disparities ever more apparent). The regions neighbouring Europe will face particular challenges. High fertility should see Africa's population growing faster than anywhere else - up by 48% to 1.3 billion by 2025 - despite AIDS. The average African's age is projected to be 22. Desertification may increasingly concentrate this young population in urban centres (11 African mega-cities of 5 million plus by 2025) - many of them without hope of employment. The implications for despair, humanitarian disaster and migratory pressures are obvious.

10. The Middle East will see a comparable growth in its young population - a 50% increase in the working age population - with similar uncertainties as to how they are to find employment, and 70% of the population in cities by 2015. Russia, by contrast, looks likely to suffer a 10% population decline by 2025.

11. So the prognosis is for tensions and strong migratory pressures in the regions around Europe, at a time when Europe is becoming increasingly dependent on the rest of the world, especially for energy. Global energy demand is reckoned to rise by 50% by 2030 - oil consumption up 40%, gas up 90%. The resources are available but the question is whether investments will be made in time to avoid constant supply pressure at the margin and steady price increases. By 2025, Europe will be externally dependent for 90% of its oil and 80% of its gas. China and India in particular will drive global energy demand, and seek new sources in central Asia, Africa and the Middle East. In this and other ways, European security interests may be directly or indirectly challenged by tensions arising not only in the near neighbourhood but also further afield.



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12. Even as Europe becomes more dependent on the wider world, and the immediate neighbourhood becomes more problematic, so it may become more cautious about military intervention. The “CNN effect” and associated casualty aversion are already familiar. Military operations will be subject to ever-increasing scrutiny by elected officials, media and populations. Governments and societies increasingly concerned for internal security and social cohesion may be even more hesitant to undertake potentially controversial interventions abroad - in particular interventions in regions from where large numbers of immigrants have come. Continued proliferation of nuclear, biological and chemical capabilities may also be expected, complicating the calculus of interventions.

13. Caution may be reinforced by increased concern with the legality of military action, as globalisation disseminates the concept of international law. Military action, not explicitly authorised by the UN may become increasingly controversial. In the conduct of war, ever greater attention will be paid to proportion and justification in the application of force, with an increasing tendency to hold individuals responsible for their actions not just at head of state or military commander level but down the command chain. Attention to collateral damage will be ever more acute.

14. Increasing concern with homeland security will erode distinctions between what is regarded as the province of “defence” and what of “security”, and indeed may call in question the taxpayer’s willingness to fund “defence” if this is seen as wholly concerned with interventions abroad or deterring increasingly improbable conventional attacks on European territory.

15. Europe will remain one of the most prosperous and stable regions on the plan. But, as it ages, loses economic pre-eminence and becomes more anxious about its security, it may also find the problems on its periphery increasingly challenging.

CHALLENGES FOR DEFENCE

16. Against this background: what are the principal challenges for defence? Apart from the danger, noted above, of “defence” becoming perceived as peripheral to the primary security concerns of European citizens, we identify two key issues:

- Adapting to the changing role of force
- Adapting to the technological revolution

ADAPTING TO THE CHANGING ROLE OF FORCE

17. It is a familiar thought that war is the continuation of politics by other means. But we have become used to these activities being conducted in distinct phases. When the politicians and diplomats fail, they hand matters over to the military, re-entering to settle the peace when the military issue is decided. Twice in the 20th century war took over from politics for a period of years. Similarly, expeditionary operations traditionally involved dispatching the force commander with the broadest of objectives and the freest of hands, requiring him only to report success when the job was done.

18. The all-seeing eye of the camera and the speed of modern communication have changed all that. All parties in modern conflicts realise that the political outcome will be determined not just by the achievement of military objectives, but by the manner in which operations are conducted or are perceived to be conducted. There seems always to be a video camera at hand, and a TV station ready to broadcast what it sees to global audiences. And the operation itself will be impacted by reactions of local actors and onlookers to breaking news (or rumours), even from the other side of the world.

19. The interplay between the political, the military and the mediatic is now continuous; and military success achieved in the wrong way can mean political failure.

20. With this 24/7 scrutiny has come, as noted above, an ever-increasing premium on issues of legitimacy and conformity with international law – a not always precise but certainly expanding corpus of constraining standards. This may include the interpretation of the Right of Self-Defence and the Threat to International Peace and Security as stipulated in the UN Charter (Jus ad Bellum), and the future balance between Intervention and State Sovereignty. The way force is employed is increasingly constrained by legal and policy considerations based on general international law and the law of armed conflict when applicable. It is likely that policy could become increasingly restrictive about the conditions in which military force is deemed legitimate. In addition, international criminal law comes into play with the establishment of the International Criminal Court and a variety of ad hoc jurisdictions. All these developments will create an increasing level of complexity for the political and military operators and planners.

21. Allied to this is the widespread perception that technology is putting into military hands the means to conduct operations with ever greater precision and restraint. Warfare has been described as a mixture of intelligence and kinetic energy. The opening campaigns in Afghanistan and Iraq have confirmed beyond doubt that we are transitioning from the industrial age to the information age of war – that intelligence (or knowledge, or information) will become an ever more important resource for successful operations, whilst kinetic energy has to be applied in ever more precise and limited quantities.

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22. In the Kosovo air war only 15% of munitions dropped were “smart”; by the 2003 Iraq war, the proportions between dumb and smart were reversed. Serious thought needs to be given to the future utility of unguided munitions (and of aircraft that cannot use smart weapons), as well as cluster bombs, mines and other weapons of indiscriminate effect. The environmental impact of military action will also come increasingly into focus, including concern for effects on our own troops – as with the crises over the use of depleted uranium ammunition in the first Gulf war and later in Kosovo.

23. Thus the focus of military efforts will shift to complementing diplomacy in preventing wars from occurring, containing those conflicts that do occur, and discouraging the emergence of parties whose objective it is to contribute to the generation of a crisis.

24. All this has reduced the plausibility of scenarios, at least in the European context and for the foreseeable future, involving traditional state-on-state warfare, with conventional forces pitted against comparable opponents. And it has simultaneously encouraged all but the most technologically dominant (for now the US and Europe) to seek out “asymmetric” strategies – ways of preventing sophisticated forces from using their technological advantage (e.g. by denying them clear targets), and adopting and exploiting against them their own technology (and media). The most effective practitioners of such asymmetric strategies will often be nonstate actors.



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25. In sum, the operations for which European forces should primarily prepare for the foreseeable future will require force to be applied in opaque circumstances, against an opponent at pains to conceal himself amongst civil populations, under tightly constraining rule of engagement and 24/7 media scrutiny.

ADAPTING TO THE TECHNOLOGICAL REVOLUTION

26. Just as globalisation is altering our geo-political landscape and our familiar rule set, so science and technology continue to transform the world we live in at a pace which we have difficulty comprehending. The proliferation of technology and knowledge is proceeding outside the control of governments and with the commercial sector fully in the driving seat. Unilateral advantages do not last long. Information technology has been the main revolutionary driver and pushed forward globalisation and its overall effects.

27. Science and technology are playing a key part in driving the changing role of military force; and exploitation of what they have to offer will be a key to successful adaptation to that changing role. Most of the technologies which may be the key determinants of the military capabilities needed in 2025 are, according to the scientific consensus, already known about today. There is little doubt that continued advances in microelectronics (Moore's law shows no signs of slackening) and in sensing and communication technologies will support the increasingly dominant role of knowledge in military operations. Similarly, the precision, speed and safety of military operations should benefit from rapid progress in bio- and material sciences (in these areas often associated with nanotechnology, a generic descriptor of technological advance being pursued amongst ever more minute elements). Developments in power sources will enable us to materialising many of these other new opportunities into useable equipments.

28. The “dark side” is obvious, too. The risks of proliferation of weapons of mass destruction are well-known: while the difficulties of obtaining the materials act as some brake on nuclear proliferation, protection against new forms of biological agents should be a particular concern. Our own universal means of communication are already thoroughly exploited by opponents both as platforms for propagating ideas and ideologies and as communication networks. Commercially available applications such as GPS and Google Earth (high resolution satellite imagery on your home PC) are manifestly open to abuse. And the more dependent we become on technology the more interest our opponents will have in attacking us via our technologica infrastructure.

29. Science and technology will also raise false expectations about how far damage can be eliminated from military operations. Just as increasingly any death in hospital is ascribed to a failure by the medical profession, so it will be even more difficult in future for publics to accept that casualties

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sustained are not the result of specific negligence.

30. As the stream of civil technological advance broadens and quickens, so the traditional role of defence R&T as a motor of wider progress is reversed; technology will be “spun in” to defence more than “spun out”. Maintaining the military technological edge will therefore require better exploitation of civil technologies – and ever more rapid exploitation of technology, whatever its source, before the opponent works out how to adopt or negate it.

31. The civil world of science and technology has another important lesson to offer – that technological advance will increasingly come as much from combining technologies as from linear development in one particular field. Yet no one institute, still less one person, can be competent across the broadening river of technology. Innovation will increasingly depend upon networks of excellent researchers collaborating to combine their expertise in different disciplines.

32. In sum, our Armed Forces can expect from future science and technology the universal availability of communication and knowledge as well as new levels of precision of and protection against lethal effects. However, what they cannot expect are sustained unilateral advantages – be they measured against conventional opponents in classical state-to-state conflict or against asymmetric threats. The proliferation of knowledge remains endemic to open societies and a global economy.

IMPLICATIONS FOR THE MILITARY CONTRIBUTION TO ESDP OPERATIONS

33. What do the changes in the economic, social and military world around us – and those at home – mean for the future of ESDP operations in, say, 2025?

34. The typical ESDP crisis management operation will be expeditionary, multi-national and multi-instrument. The EU has recognised the need to be a global security actor. For such purpose it envisages a capability to project forces over strategic distances and to austere areas of operation. Interventions will be based on common objectives among Member States, thus sending a message of a shared EU commitment to resolve the crisis. Therefore, deployment of forces needs to be based on the principle of wide multi-nationality. Furthermore, the EU will increasingly utilise a comprehensive approach combining its hard and soft power instruments and coordinating civilian, military, governmental and non-governmental bodies to collectively achieve the necessary political effects.

35. Indeed interventions will not necessarily involve fighting battles. The presence of multinational forces, backed by, and indeed symbolising, the collective political commitment of the Union, may well prevent hostilities from breaking out. Or they may help to stabilise a country or region after a political accord. Indeed, the scope of ESDP missions requires military contributions to be appropriately tailored, trained and readied to conduct a broad range of operations, in potentially austere areas and against diverse threats. In cases of intervention by force the main task will be to gain control of the dynamics of conflict, reduce its destructive power and break the cycle of violence. The objective is not “victory” as traditionally understood, but moderation, balance of interests and peaceful resolution of conflicts – in short, stability. That said, the level of force required to achieve such outcomes may, in some scenarios, be substantial.

36. While the success of such interventions will be influenced by our military capabilities and actions, it will increasingly depend on our actions, or inaction, in a much broader range of domains such as the promotion of human rights, rule of law, security sector reform, good governance and the fight against international crime. It is unlikely that EU Member States’ forces undertaking a crisis management operation will be denied military success - but we may be denied overall mission achievement because we have failed to understand and plan adequately in this complex environment, or bring other crisis management instruments effectively to bear. Armed Forces are but one component of a wider, comprehensive and integrated approach to ESDP operations.

37. In the information age, knowledge will be the vital resource in armed conflict. Commanders will be able to exploit opportunities and manage operational risk in an informed manner. But network and knowledge systems only provide the opportunity for quicker decision-making – they are not a sufficient condition for better decisions. Moreover, the benefits and the costs of the information age also apply to

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the opposition. Today, not only has the most profound technological development occurred in information technology but the rate of diffusion has been even more surprising. New applications and continued convergence of IT products will arise and become quickly assimilated, at least by some in all societies. Such new IT products require minimum infrastructure, and their diffusion will also empower non-state actors - whether benevolent or malevolent.

38. Conceptually, the information age has created a new common environment that states and organisations aspire to access and control - analogous to the sea in previous centuries. The cyberspace is a much more complex environment, not simply represented by the internet. Like its predecessor, the sea, it has an international character where trade and intercontinental communication are conducted. However, its entry fee for access and influence is very low, and the space can be used by, almost literally, anyone. It is expanding non-linearly almost daily. Irregular enemies know they are able to maximise their asymmetric opportunities by creating their own networks; they will try to achieve their own information superiority and counter our attempts to do the same. The benefits of globalisation in the information age have provided them the opportunity.

39. Asymmetric warfare has become a familiar term in recent years. It designates high-tech against low-tech, Goliath against David, centrally-controlled and network-enabled operations against disruptive tactics of local or regional – and sometimes transnational – guerrilla groups. More relevant, however, for understanding asymmetry is the divergence of goals to be achieved and rules to be observed. Whereas one side strives to establish or re-establish its own concepts of stability, rule of law and democratic structures, opponents will often aim at a radically different political order. They will not play by the rules of the Law of Armed Conflict such as the proportionality of force or the protection of the civilian population. Nor will they necessarily refrain from terrorist tactics, or even use of weapons of mass destruction. And they will seek to deter or deflect interventions by exploiting perceived weaknesses in EU resolve.

40. In sum, the increasing complexity of ESDP operations – with the concurrent characteristics of multinationality, expedition and asymmetry – call for an integrated and comprehensive approach to the planning and conduct of interventions. The role of the military will be determined within a wider campaign plan that includes close consultation with other – civil – instruments of power and influence.

IMPLICATIONS FOR CAPABILITY DEVELOPMENT

41. What are the guiding lights of the development of future capabilities for ESDP operations as described above? Capability development will always try to balance two different approaches: one maintains that past experience is a reliable guide to the future (“learning from history”); the other suggests that the ever-increasing speed of change in our societies puts a high premium on the

adaptability and flexibility of capability planning. In reality, both perspectives count. For example, reliance on well-trained and competently-led troops remains a constant in warfare. While that will not change, the characteristics that create new competitive advantages are changing. These characteristics are as valid at the tactical as at the operational and the strategic level. And they are as applicable in prevention, stability and reconstruction, and peacekeeping as they are in high intensity combat.

42. Which are these future force and capability characteristics? In general, such future forces and their capabilities must be founded on comprehensive and effects-based planning: it is not just equipment, but more comprehensively strategic concepts, doctrine, training and organisation that will, in their combination, yield the desired effects. In particular, four main characteristics need primary attention: Synergy, Agility, Selectivity and Sustainability.

43. Synergy. In the future, joint forces composed of land, air, space and maritime elements will increasingly use precision firepower, intelligence and focussed logistics in order to deliver military effects in a more discriminate way. And the capabilities of other agencies and actors, including non-governmental organisations, will contribute to the management of conflict. The media, with its increased reach and effectiveness, need increasingly to be taken into account. Synergy between these different capacities will create the effects necessary for mission accomplishment within acceptable levels of risk, while minimising undesired effects. Synchronisation across organisational, institutional and component boundaries moves the joint force from traditional de-confliction and coordination procedures to the integrated, comprehensively-planned operations required.

44. The traditional combined-arms warfare can be broadly considered as the employment of complementary weapon systems to achieve a synergistic effect. Its most important consequence is to bring about dominance over an opponent at critical time and critical space. The components of combined-arms warfare have already changed from the traditional infantry, armour and artillery mix to other force elements such as combat UAVs, precision weapons and, perhaps more significantly, an ever-increasing array of sophisticated sensors and command and control systems. However, the proliferation of technology will also accelerate how adversaries can develop technological and operational reactions to counter the weapons systems and tactics of European forces. Advanced technologies in areas such as stealth, signature reduction, thermal masking and their respective interdependencies require research and adaptable approaches to acquisition.

45. Agility. This refers to the ability to achieve rapidity of reaction, tailorable force packaging and deployability. Agility embraces concept, machine and mind. EU Member States' military forces will need to operate in a multinational and multilateral environment, working with EU and non-EU Member States and with national and international organisations, including the UN and NATO, and even within

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ad hoc coalitions. They will need to demonstrate strategic reach (expeditionary operations) and strategic agility, being able to quickly move strategic distances and enter directly into the theatre of operations, readied and prepared. Inevitably there could be instances where very short lead times apply prior to deployment, as well as minimal infrastructure provided in theatre (e.g., few adequate ports or airfields, limited host nation support).

46. Forces may need to be responsive, reacting quickly, decisively and with precision, being knowledge-focussed and appropriately digitised. Such joint forces may need to be quickly tailored to meet a wide range of contingencies. Continued co-ordination between the Maritime, Land, Air, Special Forces and Logistics components will assist the trend towards jointness in smaller tailored units and task forces, if required. Such agile packages save lift, put fewer people in harm's way, permit a higher operational tempo and the speedier application of combat effect. They will be able to show intent whilst maintaining sufficient combat power to prevail in contested operations. They will also possess the necessary command, control, communications, intelligence, surveillance and reconnaissance (C3ISR) to enable mission planning and rehearsal en route.

47. Future joint forces will need agility at the operational and tactical levels as well as the strategic. Once deployed, EU Member States' joint forces may need to be able to operate at will within all domains and across the depth and breadth of the operational area, possessing combinations of stealth, speed, information superiority, connectivity, protection, and lethality. They may need to operate in complex terrain and inside cities. In all cases, forces must be capable of moving quickly in order to capitalise on fleeting tactical and operational opportunities, apply continuous pressure and set an operational tempo that suits own forces but, at the same time, degrades the enemy's decision-cycle processes and operating concepts.

48. Selectivity. The selective use of kinetic and non-kinetic means to generate the desired lethal or non-lethal effects will be essential for future operations. Future forces need to be able to graduate and vary the application of force as necessary, and in accordance with legal and political constraints. Therefore, future capabilities may also effectively incorporate such nonkinetic capabilities as computer network attack, electromagnetic or directed-energy, offensive counterspace, military deception and psychological operations. Such capabilities should provide EU Member States' forces with enhanced flexibility and allow them to better engage targets whilst constrained by concerns of collateral effects. They should be prepared to operate in less densely populated environments as well as in complex terrain and cities with discrimination, precision and minimal collateral damage.

49. Selectivity makes it particularly important to determine the overall effectiveness of force application. There is a need for the assessment of battle damage, munitions effectiveness, collateral damage and effects, consequence analysis, behavioural modification analysis and the overall reassessment of

mission requirements. Future analysis, linked to a comprehensive (civilian & military) EU operational lessons learned process, may need to measure the effects on behaviour and attitudes of opposing leadership, forces and populations.

50. Sustainability. If an adversary can impede or deny access of European forces to needed facilities or to the local operational area, the potential impact on the crisis and its management may be decisive. The adversary gains time, extra latitude and a greater probability of success. If European forces are compelled to operate from distant areas, then their capabilities will be affected in scale, speed and endurance. The converse is that, to the degree that the EU can demonstrate an ability to deal with area denial threats, the deterrent is made more credible.

51. Multinational and agile sustainability will require building sufficient capacity into sustainment pipelines, and exercising sufficient control over the pipeline from end-to-end, to provide a high degree of certainty of supply to the forces in theatre. The results could provide a more timely and precise delivery of mission-ready forces, a reduced combat support and combat service support footprint in theatre and a more cost effective fighter-to-support ratio within overall force structures. Even if sustainment pipelines remain national, a high degree of interoperability, co-ordination and use of agreed standards will be vital to achieve a unity of effort and purpose. In any case, and although there



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may be the desire for short decisive campaigns, it will be essential to have a sufficient rotational base to sustain operations in long-duration contingencies.

52. In this context, reduced theatre footprints may require an emphasis on the sea as a sphere for manoeuvre and sustainment. This reflects the problems that civilian opposition and insurrectionary movements can pose for the land as a military base, the geo-political shift away from historical bases and alliances, and political sensitivities over deployment and host nation support of troops in the territory of allies.

53. Finally, the political sustainability of ESDP operations will depend on a conspicuous and successful focus on force protection.

54. The characteristics of synergy, agility, selectivity and sustainability are translated for each of the six Capability domains of Command, Inform, Engage, Protect, Deploy and Sustain into the Future Capability Profile for ESDP operations at Annex.



KEY ISSUES FOR THE DEFENCE PLANNER

55. There has never been a more difficult time to be a defence planner. As described above, the role of force and the context for its employment is rapidly evolving – as are the technologies available to both sides of a conflict. Only a fully comprehensive planning approach with a long-term perspective can offer an opportunity to balance forces appropriately against ambition and resource, and to identify and manage risk, be it operational, technical or financial. Imbalances, shortfalls or risks will not be addressed through technology advances alone. Education and training will also be crucial to ensure that culture change parallels conceptual and technical advance. And the European industrial base will have to serve as a reliable and efficient fundament of all efforts to provide the needed capabilities in the long term. In this wider planning context a number of key issues, ranging from knowledge exploitation to industrial policies, will determine how Europe can meet its future defence needs.

56. Knowledge Exploitation. Knowledge has been argued to be a fundamental resource for future operational success. The term needs to be widely interpreted. It embraces the horizonscanning and assessment functions that will enable us to identify and monitor gathering clouds, and to take properly-informed decisions about the risk-versus-opportunity balance of possible interventions. It also encompasses cultural awareness, to allow a proper understanding of the mindsets and motivations of actors in the theatre, and to facilitate effective engagement with them. And it includes situational awareness in the conduct of operations, from the operational headquarters to the street corner, as key to good decisiontaking and the safety and effectiveness of deployed forces.

57. The objective of knowledge management is to turn data into actionable information - available at all levels of decision-making, to be shared and not hoarded. But in its more ambitious forms this objective will not come cheap, involving as it will the development of systems of systems. Dominance in this area is not built upon only computers or CIS architectures, sensors or innovative training. It is based upon all these and much more - all welded together by agreed doctrine and common standards. Thus network-enabled capability must be a fundamental development priority for ESDP operations. It will be essential to ensure interoperability with the leading efforts of the US in this area, interpreted through NATO. But a more characteristically European approach may need to be developed, different in ambition and character (for example, with a stronger emphasis on civil-military interoperability, and on the tactical level), albeit nested within NATO conceptual frameworks and standards.

58. In order to realise the full potential of the information age, emerging trends from recent operations indicate that if money is saved on information technology, we could substantially pay many times more in other areas. "Uninformed" forces must ultimately resort to mass warfare. They must confront their opposition in contests of attrition rather than maintain the initiative and seize opportunities to achieve effects by speed, surprise and dislocation. Uninformed forces and their supporting organisations must

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constantly react, rather than capitalise on opportunity. To reduce own casualties as part of the overall political objective, they must spend enormous resources in securing themselves against the unknown, reserving little for achieving objectives. To achieve the necessary degree of information superiority, European forces will need to maintain an appropriate level of ISR persistence and fidelity. This will require a broad range of sensors and systems, including satellites, manned aircraft, the full portfolio of UAVs and land systems. But again, technology alone will not provide the capability. Human intelligence and the development of reliable local intelligence networks will become more fundamental as European forces operate amongst the people in theatre.

59. Interoperability. This needs to be at the heart of all European capability development work. Expeditionary, multi-national operations, with strong inter-action with civil instruments, require interoperability within national forces, between national forces, and with civilian actors. Just as equipment is only one element of capability, so the interoperability requirement relates to all other aspects of capability, from language to procedure to training.

60. The best form of interoperability for equipments and systems is commonality – using the same kit. This operational perspective matches the defence economic imperative to consolidate the demand side of the European defence equipment market. Experience shows that common acquisitions are most successful the further “upstream” they are started – attempting to harmonise technical requirements is difficult or impossible if the underlying thinking on conceptual requirements, and financial and timescale expectations, has not been converged from the outset.

61. But the quest for operational and economic efficiency through cooperation should not be confined to new equipment developments. It should, in the interest of enhanced interoperability, embrace pursuit of mutually-advantageous opportunities for pooled purchase of off-the-shelf equipment; or taking shares in a jointly-owned capability; or moving towards role specialisation or integration in a coherent and complementary fashion. Identification of such potential opportunities will require Member States to educate each other on the content and priorities of their national forward defence plans and programmes.

62. The Manpower Balance. It is now conventional wisdom in Europe that there is a need to increase the proportion of defence budgets going on investment – which implies the need to reduce operating costs. A significant part of these, of course, can be the costs of deployments – which, if met from defence budgets, are particularly damaging to coherent capability development in that they are usually unpredictable and short notice. In some Member States, such costs are met from the central government reserve; wider adoption of that practice would be a powerful support to the development of the defence capabilities ESDP needs.

63. But the largest element of operating costs is for personnel – over 50% of collective EU defence spending. As armed forces professionalise, and as the falling birth-rate increases competition in the labour market for young men and women, personnel costs will in practice pre-empt more and more of defence spending unless manpower is reduced. With approaching 2 million men and women currently in uniform in Europe, there is scope to do this. Approaches include out-sourcing; increased automation (from warships to robots); and reducing superfluous capability (do Europeans between them really need nearly 10.000 main battle tanks, and nearly 3.000 combat aircraft?).

64. But driving down personnel costs by manpower reductions needs to be managed with an eye to the demands of operations that could require numerous “boots on the ground” (for the widespread imposition of central authority immediately post-conflict in a failed state; or for the sustainment of long-running stabilisation and reconstruction missions). Alternatives to maintaining an unaffordable permanent force structure may have to be considered, such as greater use of reservists.

65. Rapid Acquisition. Rapid exploitation of technology is vital. It has been argued that distinctions between defence and civil R&T will become increasingly blurred; that the latter will become increasingly important for satisfying defence needs; and that the pace of civil technological advance is constantly increasing. Defence needs to quicken the pace at which technological opportunities are exploited into fielded equipments, if only because the opposition will undoubtedly do so. And we need to adjust to an era in which major new equipment programmes become less and less frequent, with the capability edge maintained by technology insertion into older platforms. A key aim of effective capability development must be to radically shorten the timeframes involved in moving from innovation to practical embodiment.

66. To do this we must consider not only new equipment but also be clear on what aspects our legacy equipment will need to be modified and at what rate in order to maintain relevance. Some elements will remain relevant over a long time, perhaps the whole length of its inservice life, whereas other assets will need to be refreshed and replaced to maximise benefits drawn from emerging technologies - such may be the case in the areas of sensors and information management. Upgrading and updating to avoid obsolescence in capabilities which benefit from IT and other rapidly developing technologies will remain a challenge in both legacy management and new design. Access, modularity, plug-and-play architectures and a focus on network enabling capability would be examples of such flexibility.

67. Industrial Policy. Today, Europe retains a widely capable defence technological and industrial base (DTIB). But the prognosis is not encouraging. If Europe is to preserve a broadly based and globally competitive DTIB (which means competitive with the US, and, increasingly, producers in the Far East) it must take to heart the facts that US is outspending Europe six to one in defence R&D; that it devotes some 35% of its defence expenditure to investment (from a budget more than twice as large as that of

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the Europeans combined), as against the European level of about 20%; and that it is increasingly dominant in global export markets.

68. Government has a very special relationship with the defence industry – as customer, regulator, and principal source of research and development funding. But less and less does it remain owner; and, as defence companies move progressively from government to private ownership, and as shareholder funds become increasingly prominent in the control of companies, so one may expect the normal laws of a globalised economy to apply; capital will migrate to optimise returns. This pattern of “industry following the money” is already apparent in, for example, BAe Systems’ significant acquisitions in the US, and the developing presence of other European companies in the UK market.

69. Un-arrested, the trends points towards a steady contraction of the European defence industry into niche producers working increasingly for US primes. A combination of countermeasures is necessary. Higher levels of European investment are essential (in the interests of military capability as much as industrial policy) – if necessary by rebalancing within constrained defence budgets. The need for this is particularly apparent in the field of R&T, where we are now living off the fat of investments made during the Cold War, and expenditure has fallen to a trivial 1.3% of overall European defence spending.

70. Increasing investment needs to be complemented by investing to better effect. In part this is a matter of ensuring that investment is directed towards future capability needs; there is ultimately no future for a defence industry in Europe that does not supply what our future armed forces actually require, and what export customers may be interested to buy. But “better effect” also implies overcoming the notorious fragmentation of the European defence industrial scene, to eliminate wasteful duplications and achieve economically viable scale. The recent commitment of 22 Member States to the first introduction of competition in the European defence equipment market is a brave step in the right direction, provided that it is followed through. But redoubled efforts are also required to achieve consolidation on the demand side of the market, and to facilitate further progress towards supply side consolidation (where industry, facing these issues not just as an intellectual problem but as a matter of daily survival, have shown themselves typically more aware of the need to change than their sponsoring governments). The need, in short, is to accept that the DTIB in Europe can only survive as one European whole, not as a sum of different national capacities.

71. The European DTIB’s survival also depends on exploiting all the resources available in the enlarged Union. Pre-eminently, this means drawing on the advances of civil and dual-use technology, such as that funded by the Commission in the security sphere. It also means emulating the speed with which several industries (automotive, IT) have realised the benefits of cheaper production in Eastern Europe and, given the central importance of technology, it means exploiting the abundant human capital and sources of innovation to be found in universities, SMEs, and enterprises not traditionally

regarded as “defence industries” across Europe – as well as the wealth of excellent engineers and researchers who have joined the Union with its last enlargement.

72. Finally, we must be realistic and selective; at the European level, we need to understand that even if we invest more, invest better, and harness all the potential that Europe has to offer, we may still be unable to sustain a European DTIB which matches in every particular the best that the rest of the world has to offer. In those circumstances, we need to take conscious decisions about what we wish to preserve and develop in Europe, and what we are content to source from the global market.

73. Flexibility for the unforeseen. Finally, since all we know for sure about the fog of the future is that it conceals things that we do not expect, or have not even considered, we must aim to build into our capability development sufficient flexibility and adaptability to cope with whatever may emerge. The deployment of military force presupposes an opponent – and that opponent will be actively seeking to frustrate our assumptions, plans and operational methods. There is a dilemma here: to identify the nature of the flexibility and adaptability that will be most efficacious against a range of risks that we cannot anticipate; and to decide how much resource should be invested in this form of insurance. The regular revisiting of this “living” Long Term Vision may help keep this in the forefront of our minds.



Talisman A001 UUV © BAe Systems

AN INITIAL LONG-TERM VISION FOR EUROPEAN DEFENCE CAPABILITY AND CAPACITY NEEDS

ANNEX FUTURE CAPABILITY PROFILE

The following Future Capability Profile is presented within the 6 capability development areas associated with the EU's Integrated Development Teams.

COMMAND

- a. Command and Control capabilities form the decisive element in the battle for information superiority and decision superiority. It is aimed at employing EU MS forces, assets and facilities commensurate with the mission and its demands, so that the desired effects can be achieved.
- b. During the preparation and conduct of an EU led operation, command and control must be continuously ensured in near-real time and between all levels of command and bodies of the EU. This will need to be based upon a streamlined C2 organisation, clear and standardised C2 procedures and a secure and efficient command support. The command capability must support rapid decision-making. The EU MS need to generate joint and combined headquarters that are easily deployable and sustainable, with the capability to plan, conduct and assess multinational operations. The availability of planning, decision support and command instruments will be necessary for global multifunctional crisis management.
- c. There will be a requirement to conduct operations, supported by network enabling capabilities as well as to establish, maintain and share real-time situational awareness. This command capability must be secure and flexible, and must minimize the constraints of distance, terrain and weather.
- d. The Operation Commander will need the ability to exercise command and control authority over relevant EU instruments in a defined area and/or during a defined time period. The ability to communicate seamlessly with partners at all levels, as well as the ability to plug in to joint and combined headquarters will become priorities.

INFORM

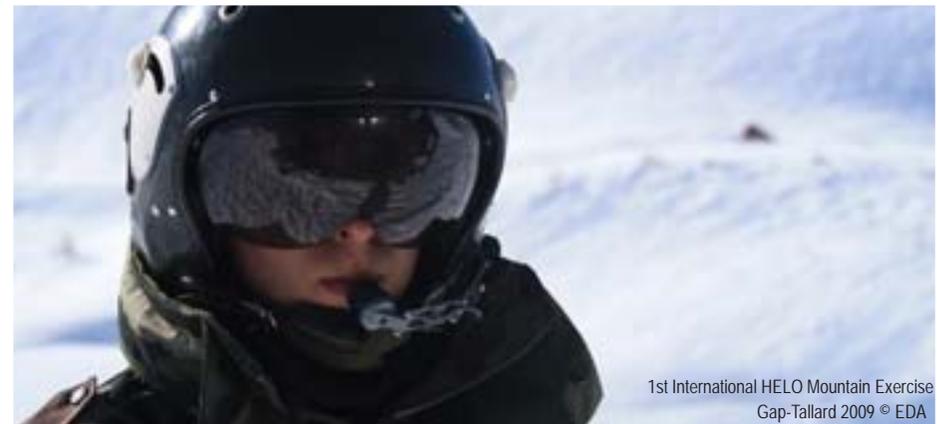
- a. Future operations undertaken by the EU will rely on the capability to collect, process, select, share, disseminate, retrieve and store information. Information management systems should optimise this process, tailoring the desired output to the specific mission. The information needs to be inter-departmental, inter-agency and readily accessible.
- b. The intelligence and findings gained through collection and reconnaissance efforts are both an

indispensable contribution to ensuring an independent capacity to make judgements, take proper decisions and appropriate action, as well as representing common interests within an increasingly complex environment. This requires EU MS to have available a broad spectrum of recognition and surveillance capabilities, including analysis of cyberspace with regard to military relevant information. It should be the aim to achieve a greater coverage than now, focussing on the areas of strategic interest for the EU.

- c. Developing reliable strategic communication and intelligence capabilities and protecting them against physical and non-physical threats as well as having access to reliable navigation and geographic positioning data will be critical. Merging these capabilities, may provide the EU MS with the basis for common information dissemination and reliable and secure communications.
- d. The result of this capability for obtaining and securely managing information might become apparent in a noticeable increase in the responsiveness of the decision making process of the chain of command, and making the manoeuvre of military forces progressively more effective.

ENGAGE

- a. To be effective forces may have to deny, or possibly control, limited in both time and space, the sea, land, air and information domains, to impair opponents' capabilities, both on contact and remotely, while simultaneously achieving the desired effects on targets. This requires the ability to rapidly engage on the ground, in the air, and at sea. Precision, high speed, engagement capability is needed.



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b. Within a joint environment the military capability as a whole takes priority over the capabilities of the single services. Therefore standoff engagement has to become an option for all services. All military capabilities should reflect the growing likelihood and relevance of fighting within complex terrain, such as urban and littoral areas. Forces need a range of capabilities from physical destruction to non-lethal. Future operations will necessitate capabilities for precise and selective targeting and engagement thereby optimising commit-to-effect times and minimising collateral damage especially in urban areas.

c. The preparation and conduct of future EU led operations will require continued consideration of space related aspects, such as communication, and the detection and identification of potential threats in advance of an appropriate response.

d. Combat identification capabilities in order to reduce casualties amongst friendly forces, partners, civilians and local population are increasingly important in the complex operational environment.

e. Where feasible, the EU MS must also aim to reduce the impact of military operations on the natural environment.

PROTECT

a. Good prior knowledge of the overall situation is a prerequisite for effective ESDP operations. Hence, it could be advantageous for MS to have access to appropriate surveillance and advanced alarm capabilities.

b. It is critical to have the ability to detect, and then counter, those weapons which, for legal, moral or ethical reasons, are not available to EU MS forces (such as biological weapons) but which may be freely employed by an adversary. Thus it is important to protect our forces against the bio-hazards that they may face. High standards of casualty handling and the ability to recover stranded personnel become priorities, even in geographically remote areas.

c. Recognising the expanded nature of the future battlespace, EU MS may need increasingly to safeguard networks and the area of operations against both physical and cyber attack.

d. The consequences of Weapons of Mass Destruction attacks will be particularly difficult to manage. Preventing proliferation will be important as well as the ability to counter their subsequent employment. CBRN defence and protection capabilities may be essential for some ESDP missions.

DEPLOY

a. Deployability is the precondition for ESDP operations, including the reinforcement and sustainment of forces. EU MS should have at their disposal viable means for strategic deployability over long distances. Responsive Reception Staging Onwards movement and Integration is required to maintain tempo during operations. This requires adequate, timely and securely available air, sea and land transport capacities and procedures.

b. Strategic deployment is planned and should be coordinated on a joint and multinational basis, using all modes of transport and available civilian resources. An ensured deployability forms the basis for a rapid, credible expeditionary capability, which should be one of the main efforts of the EU to manage crises and prevent conflicts. It will need to be based upon strategic air transport, on in-flight refuelling capabilities, and on strategic sea transport capabilities, as well as overland force projection assets.

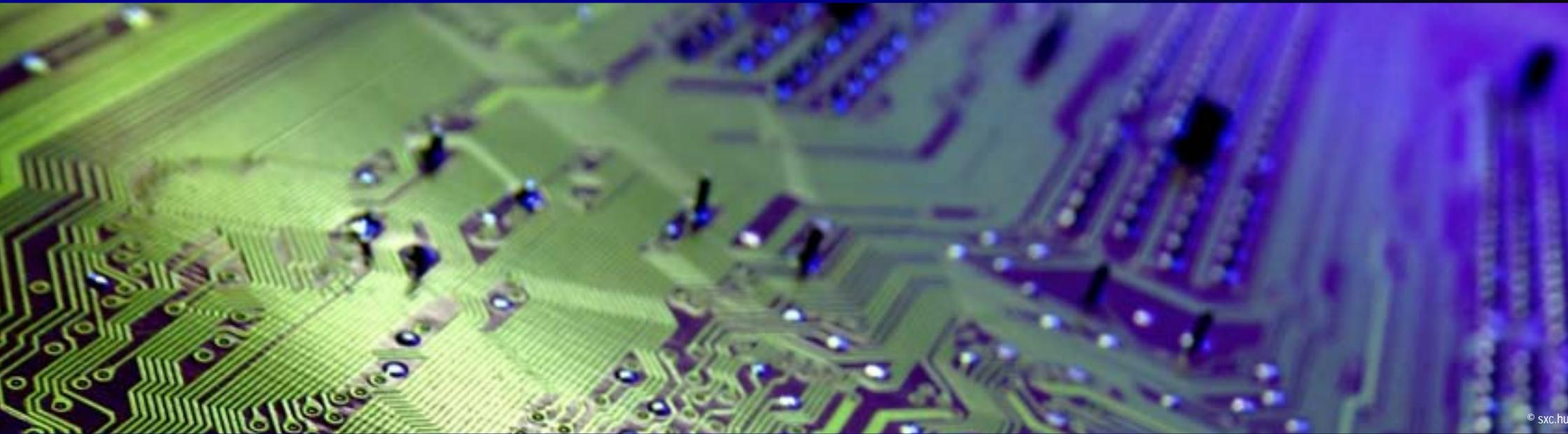
c. For intra-theatre movements, capabilities of mobility and land mobility support, tactical air transport and air mobility is a requirement.

SUSTAIN

a. The success of operations will also depend on the sustainability of deployed forces. Sustainability will encompass the provision, replacement and rotation of forces with the necessary means and facilities, according to operational demands. Even if the operational area is a long way from EU MS territories, sustainability must be ensured for the duration of the deployment, irrespective of the threat situation or availability of infrastructure and other factors in the operational area.

b. The joint/combined support arrangements should be capable of ensuring the required quality and quantity of support over long distances and protracted timeframes. This capability may be enhanced through the provision of accurate asset visibility and tracking. Beneath that, a multinational logistic component may allow the reduction of the overall logistic footprint. Any unit has to be capable of ensuring sustainability for a limited period of time by utilising organic assets. Harmonisation, and in the longer-term standardisation, of logistic requirements and procedures may ease multinational joint/combined logistics.

STRATEGIC DRIVERS



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INTRODUCTION

1. The future is fundamentally uncertain, yet there are discernable directions, even if signs point to conflicting and multiple outcomes. For some, uncertainty justifies not thinking about the future, while others see it as a source of opportunity. What is clear is that without a concerted effort to be future focused, organisations run the risk of increased irrelevance – including the development of military capabilities which do not reflect the changing nature of armed conflict.
2. Lead times in defence are such that capabilities we will or we will not have in 20 years time, must, in practice, be determined by informed decisions in the near-term. But these decisions must not only draw upon our past experiences and current thinking. Here we seek to inform these decisions.
3. The workshop tried to ensure that strategic drivers are analysed in comprehensive way. Therefore a two dimensional approach was selected. Strategic Drivers and potential consequences for defence were analysed both within each strategic driver and then across capability profile areas (command, inform, engage, protect, deploy, sustain). The workshop confirmed that potential consequences for defence overlap across capability profile areas. Due to the nature and close interdependencies of LTV Strategic Drivers some overlap with trends and potential sources of conflict exist.
4. Key findings of the workshop are presented in this report. Potential consequences for defence are presented across capability lines of development.
5. Key findings are presented with broad indication of likelihood of such development. These likelihood indicators are emboldened in italics within the text. Three likelihood categories are used – will, likely to and may. When will is used it is assessed that this development is going to happen. Likely to refers to a probable development, which may vary due to changing circumstances or other driving factors. May involves a number of unpredictable or unknown variables or policy change.

ENVIRONMENT

MAJOR TRENDS

1. The global warming will continue over the next 20 years. Frequency and intensity of extreme climatic events will continue to rise. There will be an increase in the number of hurricanes and tornados and they are likely to be more violent. Global warming, accompanied by the melting of polar ice, will lead to an increase in average sea levels.
2. Developing countries, especially densely populated and urban areas close to littoral, will be the

most severely affected and the least well placed to be able to respond to the effects of global warming. They will need support from developed countries.

3. Climate change, in combination with demographic trends and pollution, will cause an ever increasing imbalance between the requirement for, and the supply of, strategic resources. The provision of the necessary food at the global scale may be endangered and therefore the exploitation and pressure on resources of all kinds are likely to grow.
4. The political sensitivity and awareness for environment issues of the public opinion will further increase and may become a means of exerting pressure against the non-compliant.
5. Industrialisation and urbanisation will become the main causes of degradation in the environment. In the developing countries, pollution will strongly increase and give rise to water shortages, health issues and problems with food supplies. The exploitation of resources and the less performing standards of environmental legislation outside Europe are likely to increase pollution in potential future theatres of ESDP operation.



Salt land in Trombay - Mumbai © sxc.hu

STRATEGIC DRIVERS

POTENTIAL SOURCES OF CONFLICT, THREAT AND HUMANITARIAN TRAGEDY

6. Climate change, in combination with demographic trends and pollution, will contribute to future food/water shortage which will consequently lead to increased migration and to contest of resources. These tendencies will also lead to a higher frequency of humanitarian disasters and therefore are likely to lead to an increased need for active intervention.
7. Climatic change will affect the availability of arable land, water and energy in the medium term. Therefore greater tensions and disputes over the availability of resources are likely to rise. This contest, in combination with migration, is likely to lead to tensions and stresses, even at the higher end of armed conflicts.
8. Extreme climatic events will threaten oil extraction and refining infrastructures, for instance in the Gulf of Mexico and the Persian Gulf. Major disruptions of oil extraction and refining activities are likely to lead to a considerable rise in the cost of petroleum.

POSSIBLE CONSEQUENCES FOR DEFENCE

9. Concepts – Increased need to conduct disaster relief and/or humanitarian assistance operations will emphasize a need for a comprehensive approach (Civ–mil, inter-agency co-operation and co-ordination).
10. It is likely that availability of resources in future theatres would be limited (Host Nation Support). In addition, there will be a competition for appropriate strategic transportation assets, also on the civilian market. The availability of these assets, required for the transport of energy sources, food and water over great distances, will gain strategic importance.
11. Medical healthcare will become increasingly important. This will include healthcare against pollution and possible future hazards related to the increasing number of nuclear facilities at the global level (need for additional CBRN protection, e.g. as well as physical security).
12. Environmental legislation will have to be taken into consideration when planning and conducting ESDP operations. This may limit the freedom of action (use of weapons, transportation means etc.) of EU forces and may include the necessity to foresee a “cleaning” of the theatre after the operation.
13. Training - Increased likelihood of disaster relief/humanitarian assistance operations will emphasize



need for appropriate training. Additionally, due to changes in the environment, the conditions in which operations will be conducted, are likely to be more hostile than today. These conditions may include pollution and emerging diseases, related to degradation of the environment.

14. Surveys of public opinion indicate that it is possible that armed forces' resources are likely to be used in missions involving environmental protection and pollution control, fishery protection and in contributing to the national effort to safeguard the environment.
15. Equipment - Future operations will be conducted in more demanding climatic conditions. The equipment of EU forces will need to be adapted to these conditions. This adaptation may include need for improved dependability and need for “easy-care” solutions.
16. The military will have to adapt to the more demanding levels of environmental legislation. The armed forces will be required to adhere to a process of control and planned development. The development of military equipment and the training of forces are likely to reflect a need to reduce the damage to the environment by military activities.

CULTURE & SOCIETY

MAJOR TRENDS

1. The ongoing globalisation will continue. Although that process will create many opportunities for

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states and citizens worldwide, it will also put societies under stress. There will be those who are able to utilise the possibilities that emerge, but there will also be those who do not.

2. Geographical cleavages between successful communities and states and less successful communities characterised by high unemployment rates, low income levels, and high levels of criminality will continue to develop.
3. Many citizens within and outside EU are feeling socially and economically insecure. Increased corruption, shift in values, and the increased importance of formal and informal non-governmental institutions and social networks are likely to exaggerate this development. Modern information and communication systems will strengthen these trends.
4. Due to migration, developed countries will continue to get more heterogeneous.
5. Changes in values and personal interests of young people may make them less fit as soldiers both mentally and physically.

POTENTIAL SOURCES OF CONFLICT, THREAT AND HUMANITARIAN TRAGEDY

6. Ongoing migration streams will increase cleavages within Europe and will form a breeding ground for ethnic and religious radicalisation.
7. When disadvantaged communities develop into isolated enclaves within states, or on the level of states within the global community, failed or extremely soft extremism is likely to flourish, which may lead to violent conflicts where opponents engage in urban guerrilla warfare, terrorism and organised crime.
8. A state losing legitimacy among its citizens is problematic in several ways. Without strong legitimacy, a state may experience difficulties in sustaining its institutions including the armed forces. And at the extreme end other institutions and organizations may even challenge the state's monopoly on violence by developing their own armed forces.

POSSIBLE CONSEQUENCES FOR DEFENCE

9. Concepts – Shifting values, ethnically mixed society, pressures in public spending, 24/7 media coverage over horrors of war and on the other hand missing tangible military threat may lessen public willingness to sacrifice scarce resources to defence (spending and people). Armed forces will need to justify the demand for capabilities to be developed and maintained.

10. Operational concepts may need to be adapted to allow more flexible co-operation with other actors in theatre. These actors will include Private Military Companies and other institutions responsible for "traditional" military duties (outsourcing).

11. Training – Troops will increasingly need to be able to cope with multicultural societies. That may increase need to integrate immigrants to armed forces structures in order to gain public support. On the other hand, the immigrants may have diverging cultural and educational background that will have to be taken into account in training.

12. Armed forces may become less attractive career choice. As a result people recruited to armed forces may have poorer educational background. At the same time complexity of operating environment and military tasks will continue increasing. EU forces will need to be able to take appropriate action timely and in concert with other actors.

13. Equipment – Increasingly heterogeneous recruitment base will have to be taken into account when equipment is developed.

14. EU forces, down to the individual level, will have to be able to negotiate with complex situations often among civilian population. Soldiers will need to be able to minimise collateral effects and grade the force used in combat situation.

DEMOGRAPHY

MAJOR TRENDS

1. In the timeframe of the next twenty years the world will experience a population increase. The total population in the developed world is likely to remain broadly stable but an increase will occur in developing countries and in particular Asia and sub-Saharan Africa.
2. Population ageing will be the main demographic feature in the developed world but also in China. In contrast however, the population of the developing world will remain relatively young and the working-age population will expand.
3. Life expectancy and health care is likely to improve but there will be new challenges to face in both the developed (pollution) and developing world (epidemics, urbanisation, pollution).

STRATEGIC DRIVERS



4. Migration movements will continue within Africa and the Middle-East but these may stay within the same geographic areas and that which does transit to the developed world may be a relatively small proportion. The control of migration will remain challenging.

5. It is likely that nearly two-thirds of world's population will be urban dwellers and are likely to be no further than 200 kilometres from the coast. Many of the largest cities in the developed world are likely to grow more slowly than the expanding mega-cities (over 10 million) in Asia, South America and other developing countries.

POTENTIAL SOURCES OF CONFLICT, THREAT AND HUMANITARIAN TRAGEDY

6. Governments and international organisations will be challenged by demographic trends. The increasingly young population within the developing world, linked with poor economic prospects, unfulfilled aspirations created by global media and globalisation, and an uneven regional and local wealth distribution are likely to lead to tensions and may contribute to future conflict. This is likely to include inter-communal and inter-ethnic tensions (cf. Culture and Society).

7. Increased populations, pressures on resources and infrastructure, and a failure of authorities to cope with this growth will create an increased risk of human tragedy in vulnerable areas. This may include communicable diseases, epidemics, pollution, famine and extreme fresh-water shortages. This is likely to be made worse by the effects of climate change (cf. Environment).

8. Increased urbanisation will create and exaggerate many issues mentioned above. There may be an

increase in mortality through new viruses and diseases, and a re-emergence of the old ones. Overall, urbanisation is likely to increase the need for external humanitarian assistance.

9. Enlarged levels of poverty, exacerbated by climate change, will lead to incidences of human tragedy and is likely to lead to further population displacement. This is likely to provide a breeding ground for increased organised crime as societies question their traditional civic values and responsibilities to the state and governmental organisations. This may exploit weak and corrupt governments as well as consumer markets in growing economies wherever they present themselves. Such exploitation is likely to be more aggressive.

10. Migration, legal, illegal and forced migration (through conflict and local tensions), is likely to increase and with it the opportunities for further human catastrophes. Linked to the increased populations in the developing world, the inadequate infrastructure and poor governance, this may lead to the destabilisation of existing communities and possibly even states.

POSSIBLE CONSEQUENCES FOR DEFENCE

11. Manpower - Member States will be faced with a serious recruitment problem as a result of the near-static population growth, an ageing population, diseases and direct competition with the commercial sector. This trend is likely to be exaggerated by extended full-time education and changing attitudes on single career paths and a desire for variety and flexibility. This will require the military to reevaluate their manpower policies and structures, particularly with respect to retirement age, females and the employment of migrants.

12. Retention will continue to be a constant pressure on militaries. Changing social aspirations, competition for skilled manpower for the commercial sector, evolving family values and a desire to achieve a more balanced work-life ration will challenge the demands of a career in the armed forces.

13. Differentiation of gender-roles will generally diminish but tensions in traditionally male-dominated societies, such as the armed forces are likely to continue. Although a female role in combat support and other arms is likely to normalise during the period, their role in actual combat is likely to remain limited.

14. Migration may provide new possibilities for recruitment and may bring a greater ethnic and social mixture within the armed forces. However, this is likely to be accompanied by additional education and training requirements.

15. Training - The theatre of operations will become ever more complicated due to urbanisation, ethnic

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and religious diversity within all states, and will lead to a need for intensive and specialised training at all levels. Language training and a familiarisation of local customs, sensitivities and traditions will become essential in humanitarian and stabilisation operations where forces are likely to operate amongst the people.

16. Operating within ungoverned space, whether in urban environments or not, will provide critical challenges, such as countering child soldiers, which are likely to need to be addressed at the local level and may have strategic impact upon the information operation and media campaigns. Training will need to be comprehensive at all command levels.

17. Concepts - A comprehensive, civil-military approach will be required to address most strategic challenges in ESDP throughout the timeframe. This will most likely only be achieved by developing the necessary concepts involving all the appropriate actors and players, including the military, defence policy staff, civilian authorities (judiciary, police, etc.) and non-governmental organisations. Full interoperability will be the overarching aim.

18. Emergence of communicable diseases may require the military to work closely with local authorities, NGOs and IOs beyond providing security.

19. The military will be required to provide and sustain stability in order for the 'softer' capabilities to provide the required end-state. To this end the military will require maximum precision and maximum flexibility, which may include both kinetic and, perhaps more likely, non-kinetic capabilities.

20. Equipment - An increase in operating amongst the people within an urban environment is likely to provide an opportunity to utilise new technologies to support military operations, although the emphasis will remain to provide a sufficient ground force presence to provide suitable security and deterrence.

21. Satisfying the need for greater selectivity and precision in ISR and target acquisition will require novel approaches and techniques. However, such equipment is likely to be seen to complement an increase in the need for military intelligence. The recognised operating picture within urban terrain will be crucial to mission success and will require considerable coordination with civilian organisations.

22. Novel technological solutions may change the way operations are conducted. However, there will be a need to ensure that a key planning assumption of any re-structuring plan is to be able to deploy 'boots on the ground' in any crisis management operation.

23. Access to theatre - The importance of being able to operate within the littoral and to ensure access to it will remain vital in all types of future operations and for the delivery of joint and combined effects.

24. Manoeuvre is likely to remain a key objective to any military force. This challenge may need to be addressed through a variety of ways and means appropriate to a highly populated urban operation or one in a vast, semi-barren and ungoverned space.

ENERGY

MAJOR TRENDS

1. By 2025, the predicted global economic growth will result in a greater demand for energy. A sharp competition for energy supplies amongst the primary consumers, in particular within the emerging economies (e.g. China, India), is likely to escalate worldwide.

2. The growing competition for diminishing resources is likely to lead to rise in energy prices. At some stage, this may severely slow down, or even stop development in less-dynamic states, in particular in those who are deprived from possessing natural resources.

3. Primary consumers of fossil fuel will become increasingly dependent on external and distant sources of supply. Strategic partnerships between consumer and producer states will be crucial and will seek to guarantee supply. In some cases, guaranteed access to strategic resources may compel consumer states to deal with unsound political regimes.

4. Despite foreseen regulative actions, consumption of carbon based fuels will contribute to global warming increasing related environmental challenges for both developed and developing economies. Fossil fuels will remain the major source for transport fuels.

5. Nuclear power plants will continue to be an attractive alternative. Alternative energy sources, as well as exploitation of oil and gas fields located at areas of difficult access (e.g. polar region) will become more cost effective. Shortage of oil & gas will expand the exploitation of other energy sources (e.g. renewable energy).

POTENTIAL SOURCES OF CONFLICT, THREAT AND HUMANITARIAN TRAGEDY

6. In emerging economies where welfare and access to energy is likely to remain unevenly distributed conflicts may materialise, internally or between competitors on emerging markets.

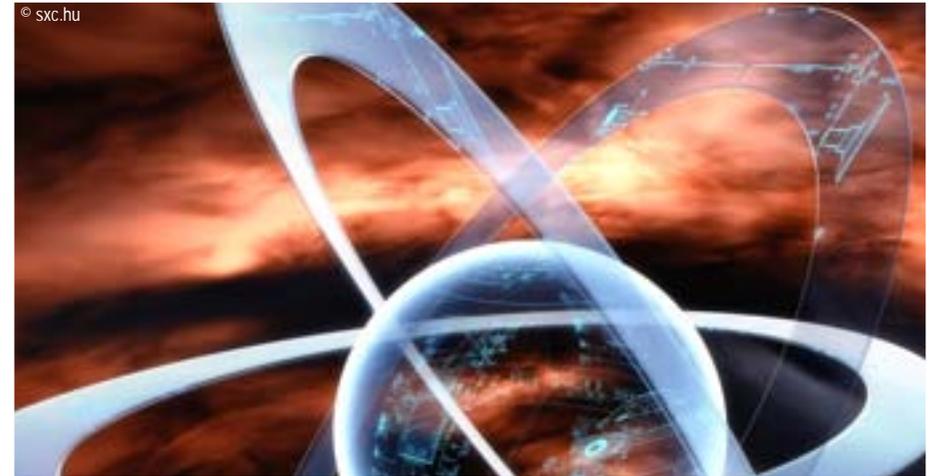
7. Players competing for the same markets and partners may become strategic rivals. Equally, they may combine their efforts in order to exclude other interested parties from the area.

STRATEGIC DRIVERS

8. In the Middle East (representing half of the world's oil production by 2025) the US is likely to safeguard its interests, particularly the region's energy resources. If national and collective diversification policies turn out to be unsuccessful the competition for these resources will become even more intense.
9. The extended use of nuclear energy will increase the risk of nuclear accident and potential terrorist type of attacks against nuclear power plants. If proliferation regimes do not strictly enforce their own regulations it may allow vindictive parties' access to nuclear material.
10. Bio-energy production may become a contradictory issue. Bio-energy production requires cultivated land that is scarce in many developing regions. Conflicting interests of bio-energy producers and those who need food is likely to lead tensions and humanitarian tragedies.

POSSIBLE CONSEQUENCES FOR DEFENCE

11. Concepts – A substantial rise in energy prices may increase pressure to cut down defence spending. Consequently, this may lead to smaller armed forces, reduced ability to launch cutting edge equipment replacement programmes and undertake defence research.
12. The ability to secure and maintain free access to areas of strategic interest will remain vital. However, in the face of political, human and financial risks of intervention developed states may be increasingly reluctant to expend resources and manpower on failed states and ungoverned space.
13. Most of the world's trade, in particular energy transports, will continue to transit by sea. The Straits of Hormuz, the Suez Canal and the Straits of Malacca will remain maritime choke points of strategic importance. International cooperation, including the ability to deploy and sustain maritime power worldwide is likely to be of strategic importance.
14. Political instability in oil production regions is likely to force developed countries to seek political and/or other solutions to increase stability. These solutions may include military intervention. In some cases, it may be required to secure routes of supply at strategic distances (mainly at sea) and/or to secure the integrity of exploitation spots.
15. Equipment - The need for reducing both fuel consumption and carbon dioxide emissions will translate into binding regulations that armed forces are likely to have to comply with. Also, alternative liquid fuel and fuel cell solutions are likely to be imposed on defence equipment. This will necessitate equipment retrofit and will influence the development of new military capabilities. Cost will be an issue.



16. Modern armed warfare (Network Concept) in the future will increase demand for stable and sufficient power sources going down to the individual level. This may increase logistics burden in the nearer term.
17. The development and fielding of novel power sources and propulsion systems will improve performance (in particular longer endurance) and mobility of military systems (in particular weight & volume) and may reduce the logistic burden.

ECONOMY

MAJOR TRENDS

1. The world economy will continue to maintain a sustained growth over the 2005-2025 timeframe, sustained by globalisation. The average income per inhabitant will increase. Simultaneously, this increase in global wealth will be accompanied by a growing inequality in its distribution and size (at internal and international levels).
2. The standard of living in the new European Member States is likely to converge with the level prevailing in Western Europe. The increase in global wealth will be accompanied by an upward trend in the level of inequalities. The standard of living in sub-Saharan Africa will have the tendency to decline due to unresolved structural difficulties.

STRATEGIC DRIVERS

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3. The growing economic strength of the developing countries, in particular in Asia and South-America (China, India and Brazil), will lead to an increase in the competition on resources with the developed countries. The geographical areas, where resources such as gas, oil and minerals resources will be drawn from, are likely to remain unstable regions.
4. Markets for goods, services and labour will continue to see a growth of internationalisation, reinforcing the worldwide economical dependencies and integration. This will result in increasing interdependencies, competition and economical linkages between economic regions which are currently traditionally separated. Due to these interdependencies, the probability for large scale traditional interstate warfare is likely to decline.
5. International criminality will cross national borders in a stronger way and will try to benefit from inefficiency of interstate mechanisms founded to fight organised crime.

POTENTIAL SOURCES OF CONFLICT, THREAT AND HUMANITARIAN TRAGEDY



6. Economic instabilities will remain one of the main sources for conflicts. Although there will be an increase in global wealth, the gap between the haves and the have nots, within each country is likely to grow and is likely to provoke internal social crisis. In the densely populated, developing countries in Asia, a massive growth in inequalities may create an eruption of social and political tensions, thus endangering internal stability and social cohesion.
7. The standard of living in sub-Saharan Africa will decline. As a result migration from the sub-Saharan African region is likely to increase as that area becomes more and more excluded from the benefits of globalisation.
8. The competition for resources between developing countries and the developed countries will lead to a growing relevance for security and access to the supply routes of energy and raw materials, in order to sustain the economical growth.
9. As world economy becomes more tightly integrated the collapse of national economies is likely to have repercussions in the world overall economical system and therefore is likely to create tensions as states try to react independently to domestic crisis and the wider effects of economic collapses.
10. Economical criminality is likely to present a challenge as it may support the financing of terrorism.

POSSIBLE CONSEQUENCES FOR DEFENCE

11. Concepts - Defence budgets will further decline due to weak economic growth or even in growing economy as a result of growing competition of natural resources. States may not be able to sustain a full range of capabilities by themselves. Possible opportunities for co-operation and specialisation will have to be evaluated.
12. In order to gain more financial flexibility for defence budgets, core military tasks will have to be identified and then possibilities, constraints and conditions for outsourcing will have to be identified and evaluated.
13. Limited financial resources will influence doctrines and concepts. How to conduct operations may have to be considered more innovative ways.
14. Armed forces may have to pay special attention to, and to participate in the securing economic flows as well as supply routes. The aim would be to guarantee access to energy supplies and raw materials despite the resources being located in unstable regions of the world.

STRATEGIC DRIVERS

15. Training - Armed forces may be tasked to address criminal activities through closer international and interagency cooperation in crisis management operations. This may include growing relevance of internal security activities of armed forces, which may result in new conceptual and doctrinal considerations.

16. Equipment - In an international context where the numbers of crises outside Europe is likely to multiply, it may become necessary to review the capabilities of the armed forces to deploy to overseas theatres of operation.

17. Manpower - A recruitment problem may arise for the armed forces in Europe as competition for skilled young personnel is likely to increase. The commercial world will often be able to offer more attractive conditions and pay.

GLOBAL GOVERNANCE & INTERNATIONAL LAW

MAJOR TRENDS

1. The world will continue to grow more interdependent and more complicated. Transnational pressures, competition and globalisation will challenge the robustness and resilience of governance and social mechanisms at every level.

2. The strategic outlook and interests of key state actors may grow more divergent and their willingness and ability to enter multilateral commitments is likely to vary as new players, such as China and India, alter the balance of power.

3. The exercise of national sovereignty will increasingly be expressed in support of collective international action but regimes and policies will continue to act to protect their citizens and their vital interests. A range of weak or failed states, on the other hand, will continue to pose a security problem.

4. States will remain central actors of global governance but non-state actors are likely to acquire more influence and affect the context in which states and inter-governmental organisations operate. Co-operative, competitive or conflictive interactions between government, business and trans-national civil society is likely to grow in intensity and scope. Terrorist networks and trans-national organised crime will continue to exploit and abuse this increasingly complex patchwork of arrangements and may weaken the state's monopoly of violence.

5. Against the shortcomings of global institutions, the role of alternative forms of governance will be required to cope with complex, inter-connected global and regional problems.



6. The international law on the use of force will need to adjust to these developments. Striking an acceptable balance between effectiveness and legitimacy will be the key challenge, not least because the very notion of legitimacy is likely to be contested. In addition, there may be a broadening of the criteria for the use of force in the case of anticipatory self defence.

POTENTIAL SOURCES OF CONFLICT, THREAT AND HUMANITARIAN TRAGEDY

7. States and communities will be increasingly challenged by wide-ranging and complex transnational risks such as the challenges of a globalised economy and some will not cope. Strategic state failure will be a feature of the geopolitical landscape. In a world with a pervasive electronic communications, mobile populations and 24/7 media interest, local challenges to stability and order will have increasingly regional and global ramifications and therefore local and regional solutions may be insufficient to address emerging problems.

8. Governments will increasingly seek co-operative and international solutions to the challenges. However, some regimes will take whatever unilateral action is necessary to pursue their interests in the face of abrupt or catastrophic change.

9. Inter-communal conflicts will tend to take on a transnational dimension. Although large-scale interstate warfare is unlikely, competition for finite resources and intolerance to market forces may lead

STRATEGIC DRIVERS

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to tension and greater potential for confrontation and conflict.

10. Failed states are likely to exist in regions weakened by poverty and internal conflicts, which will lead to the emergence of ungoverned spaces. These ungoverned spaces, many of them increasingly urbanised, will become vulnerable to endemic criminal activity, the basing of terrorist groups, irregular activity and conflict and will add to the complexity of the international system as well as increasing the burden of maintaining integrity.

11. The risks associated with these poorly governed spaces are likely to increase and to undermine the security of rich countries. State failure and extreme poverty in peripheral regions may not pose a direct threat to the developed world but will likely undermine, over the long term, the broader requirements for the security of rich countries.

12. Humanitarian crises, both natural and human in origin, will affect the sentiments and sensibilities of media audiences. Growing pressure for intervention will be exerted by these audiences and a hyperactive, obtrusive media, operating in both physical and virtual dimensions, especially when audiences are linked to those affected by identity or interest, or where they feel threatened by potentially wider or collateral impacts.

POSSIBLE CONSEQUENCES FOR DEFENCE

13. Concepts - Future conflicts will involve a more complex set of actors with blurred distinctions between combatants and non-combatants in an extended and heavily populated battlespace. Irregular actors will include terrorists, insurgents, criminals, armed followings, gangs, semi-official militias and Private Military and Security Companies (PMSC). The trend for using PMSCs will continue but their growing use may lead to public and political unease with a dilution of the state's traditional monopoly on the use of force. Liability issues are likely to be perceived to be unclear.

14. There will be an increased sponsorship of irregular activity and groups by states seeking to utilise and exploit through proxy forces. Armed criminal, terrorist or insurgent groups, trained and experienced in struggles around the world will be an enduring part of the strategic landscape which will have to be considered.

15. Transnational and locally based terrorism will continue. The casualties and the amount of damage inflicted will remain relatively low but the effect will be magnified by the adversary by reach, physical and psychological, achieved through their own brand of Information Operations. Military capabilities may be used to pre-empt these acts or to mitigate possible consequences.



16. Threats such as terrorist strikes on the 'nodes' of globalisation (i.e. energy or transport infrastructures) and risks such as major epidemics or natural disasters will entail ripple effects affecting the security of humans and infrastructures, the economy and society at large.

17. International organised crime will grow in volume, reach and profitability, while exploiting new ventures and markets in areas of accelerating economic growth and opportunity, particularly in failed states. EU forces will require concepts to ensure coherence with other governmental agencies.

18. For the most globally integrated states there is a strong incentive to uphold application of international law in all its dimensions, including the laws of armed conflict. International law is likely to be forced to adapt to the increasing complexity of the environment within which it will be applied. However, it is unlikely, that developments in international law will keep pace with the rate of change and complexity in the nature of conflict itself.

19. Non-state actors, such as terrorist networks and also organised crime, will pose a new set of threats, which are at the same time more circumscribed and more ubiquitous than traditional military threats. More circumscribed because attacks by non-state actors are likely to be of a limited scale, short of their access to WMD.

20. Collapsing non-proliferation regimes will have a dramatic impact on the diffusion of WMD. The proliferation of CBRN weapons possession beyond the existing powers, particularly to weak and unstable states will increase risks.

21. The possession of nuclear weapons by such states, whose capacity for ensuring their safety and security may be inadequate, will increase the risk of these technologies and associated materials being incompetently handled or acquired by third parties including non-state actors such as terrorists or criminals.

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BACKGROUND AND AIM

This paper is based on A1 and A2 workshop documentation, the ACT Long Term Requirements Technology Forecast (2006), the Long Term Vision Strand 3 and Savants interview for the LTV.

This paper intends to discuss the impact of developments in science and technology (S&T) on future capability trends and it tries to do so in terms relevant to capability planners. It is intended to be used as background material for the remaining CDP workshops within Strand B, WS C1 and C2 planned for April 2008.

APPROACH USED

Many of the sources used discuss future technologies in terms of defence-related performance consequences or engineering possibilities by technological area. While undoubtedly an important starting point for drawing capability-relevant conclusions, such material in itself is not enough. Therefore, an attempt has been made to restructure the WS A1 and A2 material under more appropriate headings. In trying to assess capability-related consequences of future developments in S&T, the basic difference between tasks and capabilities must be remembered. When discussing capabilities, the environment and level of ambition matters, not just an inward-looking definition of the tasks themselves. An important part of the environment is our future adversaries and their modus operandi. Thus, an S&T-led enhancement of our performance in engineering terms does not lead to automatic increases in capability. In other terms, there is every reason to assume that the battle between measures and countermeasures will continue, and that smart adversaries of the future will continue to try to find and exploit our weaknesses using means at their disposal.

Where the source material primarily focused on S&T-led enhancements of technical performance, this primarily meant adding cautious notes, or balancing a technologically optimistic text with tactical and operational scepticism, including the question of maintainability of equipment based on new technologies. Doing this by no means lessens the importance of S&T or says that S&T developments are irrelevant to the developments of military capabilities. What it does mean, however, is recognizing that some S&T-led improvements may be needed just to keep pace with developments around us, and that S&T are but one piece of the puzzle when it comes to developing and enhancing capabilities.

GENERAL OBSERVATIONS

- Civilian developments in S&T are increasingly important, but basic developments need to be monitored and adapted to be put to defence applications.
- Not all areas have civilian developments. S&T advances in some areas, such as energetic materials,

rely almost entirely on defence-initiated developments.

- S&T developments pose threats as well as provide possibilities.
- It is difficult to project the capability consequences of very basic and/or broad technologies. A case in point is nanotechnology, in itself a broad field, which seems poised to influence developments in e.g. materials, ICT hardware, sensors and life sciences. While all of these areas are important to defence applications, expected influences seem to be diffuse in capability terms and be more in terms of relative performance enhancement.
- Developments happen both by technology push (an application is found for a new technology) and capability pull (a solution is found for an identified, specific capability need), corresponding to the market pull of the civilian applications.
- The technologies considered are presently at different levels of readiness or development. Time and cost to fielded systems, and the certainty of projections can thus vary a lot.

CONSEQUENCES FOR CAPABILITIES AND FULFILMENT OF TASKS

DOMAIN OF KNOWLEDGE AND NETWORKING

In the knowledge area, civilian technology trends are likely to be of dominant importance. Many of the S&T developments that will be leveraged mean that Network Enabled Capabilities (NEC) will progressively be possible to be more fully implemented. Given the on-going conceptual developments in the NEC area, capability planners to some extent already know what they "plan to do" with increased bandwidth, greater network reach, increased numbers of sensors and similar broad developments in this area.

Networks and decision support. In the area of networks and decision support, expected developments and their capability implications include:

- Improved decision support tools by means of increased computing power and advances in software. This will include improved modelling and simulation capabilities "in the field" to assist in tactical and operational planning by allowing "playout" of actions and predictions of effects. Also, such planning can increasingly use frequently updated high resolution sensor data regarding the situation on the ground.
- Reactions based on planning and high-level decision making can become faster by using these decision support tools.
- Improved situational awareness in real time or near real time by improved communication, positioning and various types of sensors, covering the field of C4ISTAR. This will include both the status and location of blue forces and the location and action of adversaries and other actors. Computing power, image analysis and decision support tools will assist and simplify the exploitation of such data.
- Situational awareness and sensor data will also enhance assessment capabilities, such as improving

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the quality of battle damage assessment.

- An increase in communication bandwidth and size reduction and increased numbers of communication equipment will make voice, image and data communication easier, particularly between mobile units, and make it possible (or easier) to establish direct links between commanders and individual soldiers, when required. The amount of information available to any single unit will mainly be controlled by the units' needs rather than limited by the equipment.
- Network reliability and robustness is expected to increase by using backup modes of communication. Part of this backup will come from UAVs and other unmanned vehicles (communication relay drones) and satellites. Optical (laser) communication, which requires line of sight but is virtually impossible to intercept or jam, will be used to some extent.
- Various types of cooperation tools will become available, that can be compared to "videoconferencing in the field" (giving many of the benefits of face-to-face meetings), and will allow improved access and reachback to experts "at home".

While the bandwidth and reliability of communications network is expected to improve, also for mobile applications, it cannot be ruled out that technically advanced adversaries may be able to disrupt our networks using electronic warfare (EW) or otherwise exploit the networks' limitations. Full reliability of any mobile network under attack by both conventional weapons and electronic warfare can not be guaranteed even if there are redundancies in the system. Therefore, there will always be a need for fall-back modes and the implementation "graceful degradation" of the networks, and our forces may in



1st International HELO Mountain Exercise
Gap-Tallard 2009 © EDA

some circumstances have to operate in a classic rather than fully networked mode.

A limiting factor in leveraging developments in this area in some circumstances may be data overflow, where communication systems overload front line units in data to an extent where it is considered more of a nuisance than a help in stressful situations. The limited capacity of the human mind to handle overwhelming information may reduce the added value of some new technical applications unless human factors get close attention and advances in behavioural sciences are leveraged together with technology and physical sciences. Predicting the extent to which these limiting factors relating to human operators will be felt is difficult.

There is also no reason to assume that decision support will remain anything else than decision support, or that improved situational awareness will mean omniscience on our force's part. The need for human judgement, situational and social understanding and leadership experience will remain, but personnel involved in this will be more freed from routine tasks and less hampered by lack of information and communication.

Sensors and information gathering. Within the sensor and information gathering area, four main areas of developments will have capability implications relevant to an NEC concept:

- Improved performance of new generations of sensors both at the high end (e.g., large platform-mounted sensors) and low end (e.g., those carried by individual soldiers);
- A proliferation of the numbers of sensors, since smaller, simpler and cheaper sensors can be mounted on more vehicles, including unmanned vehicles, carried and used by soldiers, or be deployed as unattended sensor nets;
- Increasing processing of data from sensors including sensor fusion, i.e., using information from several different sensors to assemble a more complete and accurate picture;
- Networking of sensors and sensor data (as described above).

The increased use of networks will also allow individual soldiers to function as sensors to a higher extent. Observations and judgements made on the ground can be available in the network together with technologically gathered information, thus harnessing the benefits of using HUMINT.

Situational awareness based on the proliferation of sensors and networks will be able to assist in combat identification and assist in reducing the risk of fratricide.

Technological developments in the sensor area will by no means end the ongoing duel between measures and countermeasures (including electronic warfare) in the sensor, information and knowledge area. Where future developments will take the balance between measures and countermeasures in the sensor and information area will be case-dependent, and influenced by the

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opponents' level of sophistication and amount of resources, the operational environment and other factors. As an example, technological developments such as multispectral imaging and improved image processing will make our detection of targets using present camouflage techniques easier.

Relatively resource-poor opponents can also be expected to have increased access to sensors, partly due to civilian developments in the area. This will especially be the case with electro-optical sensors including night vision but to some extent also simple radars. Equipment such as web cameras and mobile phones will simplify the construction of sensor nets of opponents. Superiority with regard to situational awareness for our forces is therefore not guaranteed in all situations.

Information warfare. Technological developments offer many possibilities for enhancing various kinds of information warfare including electronic warfare (EW) and computer network operations (CNO). However, such developments and the means to counter information warfare (e.g., by using robust C2 architectures and cryptography) are also available to many adversaries. On balance, it seems likely that information warfare and signals intelligence against many future adversaries will become more difficult. Information warfare directed to the disruption of civilian communications used by adversaries will therefore become more important.

Support for knowledge and networking. Future networking needs associated with a NEC concept will increase demand for stable and sufficient power sources going down to the individual soldier level, to power communication and sensor equipment. While significant civilian developments are expected in the areas of batteries and fuel cells, the logistical footprint implied by the need to maintain (or fuel) power sources at the soldier level may be significant, unless solar cells and other technologies are able to be leveraged.

DOMAIN OF ENGAGE, PROTECT AND PHYSICAL EFFECTS

The general trend common to all types of platforms and arenas/services is that platforms will become increasingly integrated into networks. This means that various platforms both will deliver information to the network and make use of information from the network, as appropriate for their role and the effects to be achieved in each situation.

Since platforms may be space borne, fly in the air, travel on the ground, on the surface of the sea, or be submerged in it, they differ from each other in terms of speed, endurance, stealth, vulnerability against certain threats, and suitability as carriers of certain sensors and weapon systems. Which families of platforms will be the most efficient and cost-effective will vary with operational environment, the tasks to be achieved and the adversaries encountered. There is little evidence to suggest that foreseeable S&T developments will universally favour one family of platforms over all the other types in

most or all operational environments. While some national capability planners may come to the conclusion that they wish to rebalance their forces with respect to different families of platforms, in general terms, all of them will remain relevant.

One common S&T-related trend in the platforms area, apart from the networking trend, is the increased availability of unmanned platforms, including platforms of small size and the possibility to expand the use of such platforms for a wider range of tasks. How wide a range is mainly dependent on future technological limitations on the quality of communications network between the unmanned platforms and their operators? Many functions of the unmanned platforms will become more autonomous as a result of onboard intelligence, but for the foreseeable future, there will always be the need for a man in the loop to control these platforms, including strict control of when lethal effects from unmanned platforms will be applied.

There is however no evidence to suggest that platforms, manned or unmanned, will be able to replace the individual soldier – “boots on the ground” – in all (or even most) tasks and situations. This is especially true for ESDP operations, where social interactions with local populations are both desirable and necessary to fulfil the goals of such operations. The individual soldier will at the same time increasingly take on the characteristics of another kind of platform integrated into the network.

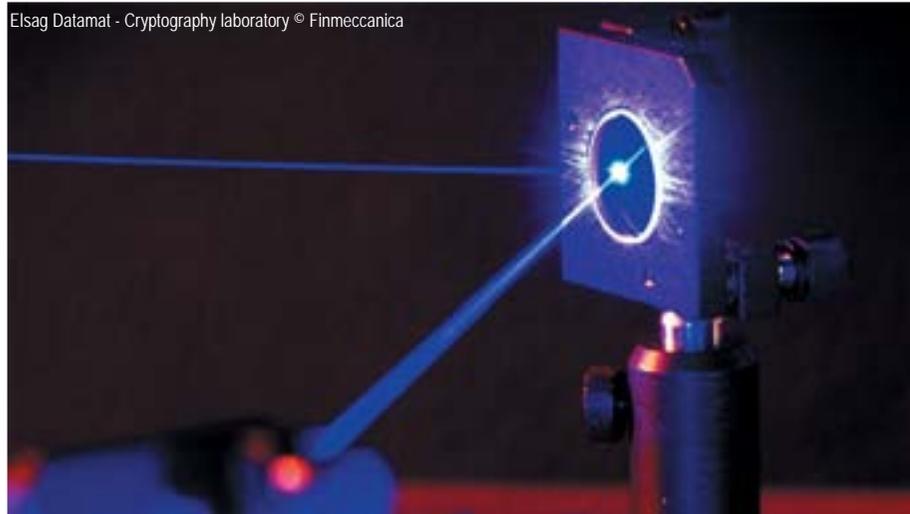
Ground vehicles. The main S&T-related issues relevant to land vehicles are protection and integration into networks.

With regards to protection of vehicles (and personnel carried by them), S&T in terms new materials can contribute to increasing passive protection for a given vehicle weight. There also exists the possibility to improve camouflage materials (a multispectral protection portfolio, i.e., against several enemy sensor modes) to significantly reduce the signature of vehicles against intelligence and weapons sensors. Some contribution to reducing vehicle vulnerability could also come from increased use of newly developed insensitive munitions. However, protection of vehicles is highly likely to remain more of an engineering issue requiring a trade-off between degree of protection, mobility, logistical footprint and cost.

Active protection measures, including directed energy weapons (such as HPM or lasers) integrated on vehicles, seem to offer better promise against some types of attacks. However, question marks remain as to the effectiveness of such measures against the full range of threats (including short-range threats such as IEDs) as well as their side effects, which could limit their application in urban areas.

No breakthrough is therefore expected that will make light vehicles more or less invulnerable against close-range attacks or afford them the same level of protection as heavy armoured vehicles, such as

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Elsag Datamat - Cryptography laboratory © Finmeccanica

MBTs.

Protection of land vehicles and their personnel, for example against IEDs at close range, will therefore to a large extent remain a question of tactics and force posture. S&T contribution in terms of sensors and networks, appropriately used together with tactics to assist in situational awareness, are likely to provide more promise in order to reduce overall vulnerability than passive or active protection measures. Overall, a multi-pronged approach will therefore be needed.

Other issues with land vehicles include on-board sensors (discussed under knowledge), weapons (discussed below) and power sources and propulsion.

In the area of power sources and propulsion, no fundamental breakthrough is foreseen. The civilian sector is leading developments with respect to new fuels and hybrid solutions, which are driven by environmental concerns. Such developments are not expected to provide any new capabilities as such to the military sector, but may be needed in order to conform to environmental standards or fuel availability. The military may however very well be the last user of conventional fuels given the long life cycle of platforms. There is the risk that such developments could increase the logistical footprint of future forces, if they need to run on specialty fuels not available in-theatre.

Aerial platforms. The main S&T-related issues relevant to aerial platforms are their role in air-to-ground operations, both for ISTAR purposes and as weapon carriers, and their protection against ground-based threats. Developments in the aerial platforms area, relevant to this purpose and made possible by technological developments include:

- Increased use of UAVs, small and large, both as reconnaissance and weapon platforms;
- Increased use of stealth technologies for both manned and unmanned aerial platforms to enhance their survivability against ground-based threats;
- The use of improved sensors against ground targets.

ISTAR by aerial platforms against ground targets will become enhanced by means of developments in both the radar and electro-optic area. Electro-optic sensors will develop towards higher resolution (alternatively allowing detection of a certain target at higher range), better possibilities of penetrating camouflage by using a broader part of the wavelength spectrum and the introduction of laser sensors (so-called Lidar).

Synthetic aperture radars (SAR) will allow higher resolution, better discrimination between different types of targets, have improved all weather surveillance capability, will be capable foliage penetration and will be effective against many camouflaged and certain underground targets.

Small unmanned platforms will increasingly be able to carry both electro-optic and radar sensors due to the reduced size, weight and power requirements of the latter. The most advanced radars, including the most advanced SAR equipment will however require specially adapted and geo-referenced platforms, rather than being integrated on any (multi-purpose) aerial platform or smaller UAVs.

Sensor developments will make such sensors increasingly multifunctional (i.e., appropriate against several types of targets and adaptable to various environments) and allow appropriately equipped aerial platforms to use passive receiving modes, which will enhance stealth.

Increased use of NEC will allow the planning and decision cycle for engaging ground targets with air-launched weapons to be shortened.

Situational awareness by means of networked sensors will lead to improved Next Generation Identification Friend or Foe (NGIFF)/Combat ID in air-to-ground engagements, reducing the risk of fratricide.

It may still be possible for adversaries' to hide from airborne sensors and weapons to some extent, but for less advanced adversaries, it will require more effort to do so, and such efforts will reduce their efficiency. More technologically advanced adversaries may be able to field countermeasures, wage

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information warfare against our aerial platforms, or even pose a physical threat to them with advanced ground-based weapon systems.

Space platforms. Space platforms bear many similarities to high altitude UAVs as ISTAR platforms and many sensors mentioned for aerial platforms could be used in satellites as well. As part of the network, satellites will also continue to be used for communication purposes with increased bandwidths.

Naval platforms. Naval platforms are expected to be used primarily in support of land operations, but also for protection of logistical bases and sea lines of communications within and to operational areas. Developments in the naval platforms area, relevant to this purpose and made possible by technological developments include:

- The use of unmanned surface and underwater vehicles (USVs and UUVs) as reconnaissance and mine counter measures (MCM) platforms;
- Means to counter underwater threats to naval platforms and civilian ships;
- The use of improved sensors for both above and below surface targets.

The underwater sensor area will benefit from data processing and networking; key geographic areas could be guarded against the emplacement of mines and the intrusion of submarines.

While the technological possibilities increase, very few adversaries are expected to acquire ASW capability. Therefore, underwater platforms will continue to enjoy a higher degree of stealth and protection than surface platforms, but will also continue to be at a disadvantage for high-bandwidth



communication and with respect to certain sensors.

UUVs and similar technologies can also pose a threat as sophisticated drifting mines.

No major breakthrough is expected with respect to fundamental technologies for ship propulsion; the alternatives will remain mainly as today. Some gains in efficiency may be possible, but the design considerations and trade-offs involved in ship endurance will be the same as today. This also applies to nuclear power; nuclear propulsion will have the same characteristics as today.

Some sea mine counter-measure (MCM) activity will be improved by the use of anti-magnetic materials, which will allow certain platforms to be constructed having little or no magnetic signature. This will likely be easier to implement in small platforms, such as unmanned surface or underwater vehicles (USV or UUV).

Soldier systems. Although soldier systems will continue to exist primarily in order to assist the individual soldier, it is fair to say the development in this area will mean individual soldiers increasingly get a "platform role" from a technological point of view. Thus, there are certain similarities in the developments of soldier systems and ground vehicles, with respect to S&T implications. Here just as for vehicles, protection and integration into networks, are two the most important aspects, although endurance and possibilities for training need also to be taken into account.

If a comprehensive approach to soldier equipment is taken, protection, survivability and endurance for individual soldiers may be enhanced by a range of equipment using new technologies (including nanotechnology), such as body armour based on new ballistic protective materials, water and air filters, biocidal/antibacterial and catalytically active surface and garment coatings, functional clothing and camouflage equipment. Such improvements are also likely to lead to improved performance of troops which may mean that for certain tasks, fewer troops would be needed.

Much of the developments related to increased situational awareness with respect to soldier systems will be directed toward the urban environment. Expected developments include man portable radars for mine detection, looking-through-wall sensor and, sniper detection and location.

Improved target recognition will mean less risk for fratricide, particularly important in the urban environment.

Low cost sensors for commercial applications will allow adversaries to field soldier systems to increase their sensor capabilities, including night vision.

IMPACT OF SCIENCE AND TECHNOLOGY ON FUTURE CAPABILITIES DEVELOPMENT

Power sources for soldier systems are an important issue. This is discussed as part of the domain of knowledge and networking.

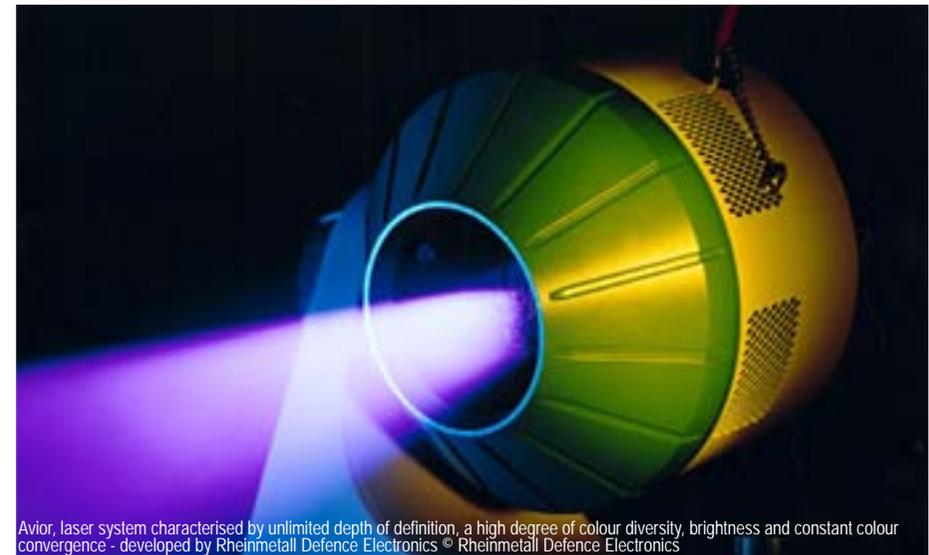
Weapon systems – destructive effects. The main S&T trends are related to using weapon systems together with sensor and network data in order to better produce the desired effects, which may both be destructive (lethal) and non-destructive (non- or less lethal).

In terms of destructive effects, this primarily means continued evolutionary developments of precision guided munitions (PGMs) for increased precision, lower failure rates and resilience against countermeasures, in order to reduce collateral damage and the risk of fratricide. There is however also some developments directed at introducing new kinds of effects or “weapon cores”, better suited to achieving appropriate destructive effects for future operations. This includes weapons for self-defence purposes, intended for the protection of platforms.

If fully pursued, new developments in the area of novel energetic materials could lead to increased weapon performance by using increased explosive performance (expected to be 20-25%):

- It is possible to increase in armour penetration of up to 60% by use of new liners in Shaped Charge Jet (SCJ). This would make it possible to produce much smaller and lighter AT weapons with the same performance as today, which would be of relevance to dismounted soldiers as well as to small-size unmanned vehicles.
- It is possible to develop weapons based on Enhanced Blast Explosives (EBX), using novel energetic materials and different metals (possibly made more reactive), to enhance effects in confined spaces and urban warfare. This could be used for small, man-portable weapons with exceptional performance for urban warfare e.g. larger blast effect in a confined area and less collateral damage outside this area (because of less shrapnel). Another use for this technology is large bombs with exceptional performance in heavily fortified enemy strongholds (caves, bunkers).
- Other developments in the novel energetic materials could mean more gradual increases in the capability of new weapons: increase in range of rocket engines up to 50%, increase in performance of underwater weapons (such as torpedoes or mines) up to 25% (plus effects of using EBX), or increase in muzzle velocity of guns leading to better penetration, increased range, shorter in flight time resulting with better hit probability.

Besides the well established kinetic energy weapons and explosives, a completely new family of weapons, Directed Energy Weapons (DEW), is emerging. DEW mainly takes the shape of High Power Microwaves (HPM) and laser weapons. In general, DEW can be used for both destructive and non-destructive purposes, depending on the power of the weapon and for which purpose it is used. Some DEW systems are useful for both purposes, if they are given a tuneable effect, while some will only be useful for a narrower purpose.



Two attractive aspects of DEW is that the energy beam travels with the speed of light (although the weapon system could still take time to aim and to fire up) and that DEW do not consume ammunitions as such. They do however require significant energy supply and high-power DEW will likely consume more electrical power than any other mobile system in service installed. The power source aspects need to be taken into account when the total system size and logistics footprint of DEW is estimated, which makes the future role of DEW still uncertain – wide applicability or niche.

The effect of HPM is to destroy or disrupt electronics, such as that of an incoming missile, while laser weapons either blind optical sensors of platforms or weapons, or heat up their target to achieve a disruptive or destructive effect, such as prematurely igniting the warhead of an incoming weapon. HPM effects are mainly short-range but need not be as carefully aimed, while laser weapons are long-range but are dependent on careful aiming to achieve their effects.

Close-range self-protection of valuable platforms against incoming weapons could be achieved by integrated HPM functionality into the platform, provided that the electronics systems of the platform will not be harmed when the HPM is engaged.

Other uses to which HPM charges or weapons may be put include clearance of mines and IEDs, and disruption of adversaries' electronics equipment, such as communication systems and radars.

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Conversely, HPM weapons, including improvised HPM charges, may pose a threat to our forces, both to C4ISR systems and to platforms. While it is a threat to our equipment rather than our troops, widespread disruption or destruction of electronics equipment could quickly translate into a loss of effectiveness and coherence that will lead to casualties in an operational environment. A reasonable resistance against HPM and some redundancy of systems will therefore be desirable.

High-power laser weapons will mainly be used for ground- and sea-based air defence purposes against ballistic missiles and aerial platforms. The attractive aspect of laser weapons in comparison to surface-to-air missiles is that they are not dependent on a flight time to intercept. The practical range of such weapons, if they become medium- or long-range, will depend on what power level that can be implemented, the management of the laser beam (in terms of collimation and divergence) and if the problems of atmospheric disturbances can be managed.

Laser weapons of somewhat lower power levels can be used to disrupt adversaries' optical sensors in order to disrupt their ISTAR activities and weapons use. Due to the possibility of eye injury when directed against troops and manned platforms, there are some legal and ethical limitations to this use, which do not apply in the case of targeting missiles and unmanned vehicles used by adversaries.



CBRN Exercise Jambes - Belgium 2008 © EDA

Weapon systems – non-destructive and less lethal effects. As was noted above, directed energy weapons can be used for non-destructive/less lethal as well as destructive purposes, depending on the power level. Developments in information warfare have been covered previously.

Developments in non- or less-lethal weapons, for use against personnel or equipment, depend on the use of several technologies, which from an S&T point of view are quite diverse and therefore need to be separately assessed. Some of the technologies that would produce the desired effects will not be possible to field because of legal or ethical considerations, such as the Chemical Weapons Convention. Some of the developments are civilian and are intended for use in law enforcement where ethical considerations also apply.

CBRNE threats and protection. With regards to threats from non-conventional effects, civilian S&T developments may mean increased possibilities for adversaries. This will mainly affect the area of biological weapons, due to rapid advances in biotechnology, which may lead to weapons/agents that are very virulent, or which escape effective treatment or conventional means of early detection. While technological advances directly related to C, R and N threats may seem slower in comparison, we should not forget that civilian advances in production technology and computing, as well as the general proliferation of technological knowledge may bring various kinds of non-conventional weapons and their carriers within the reach of an increasing number of actors. However, an assessment of the future in-theatre CBRN threat must also take the will, ambition and level of resources of adversaries into account. Some adversaries are expected to be less constrained by ethical considerations, albeit not every potential adversary will necessarily pursue CBRN weapons even if the technology exists.

With respect to protection against CB attacks, S&T developments may provide some improvements with respect to protection equipment, decontamination and treatment of injuries but primarily, S&T developments in the CBRNE protection area as a whole are related to detection and improved situational awareness. Here as for other threats, large number of networked sensors will provide the situational awareness. Also, it will be increasingly possible to perform stand-off CBE detection using lasers and other means of detection.

The conventional and often asymmetric, threat from explosives (E) including IEDs has already been mentioned in connection with the protection needs of vehicles and soldiers. However, in terms of detection there are similarities between detection of many non-conventional threats and the detection of explosives. Therefore, the E area belongs together with at least C detection from a technological point of view, and also for E detection, increased standoff detection is expected. However, standoff detection will have limited sensitivity with respect to detection of "encased" explosives. Also, the rate of false alarms in CBRNE detection is likely to remain an issue, which means the situational awareness will be enhanced rather than complete.

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DOMAIN OF MOBILITY AND SUSTAINMENT

Logistics will also become increasingly networked. Our forces will increasingly rely on modern integrated deployment and logistic management systems and these will mean more efficient logistics practices but also a need to protect such systems against information warfare.

Continuous and comprehensive status monitoring for humans and for technical systems can become more common due development and mass production of smaller sensors. Self monitoring systems (and possibly self repairing materials) may also contribute to reducing the logistic footprint by allowing maintenance to be better targeted.

New technologies and equipment leading to increased protection for individual soldiers and vehicles may lead to fewer casualties, at least unless this gain is outweighed by new threats.

Network and other ICT developments can be leveraged for medical support in the form of telemedicine and patient tracking, leading to improved of at treatment of injuries, in particular in-theatre. Development in biotechnology will also lead to improved treatment of casualties. There also exist the technological possibilities to enhance human performance (e.g. reduction of stress and fatigue, improved attention) by using biotechnology, as well as assisting personnel selection by using genetic testing. Whether such uses of biotechnology will be widespread in use depends mainly on legal and ethical considerations, and the acceptance for general use in society.

The maintainability and logistic footprint of systems based on new technologies are difficult to assess before the development of such systems have advanced to a rather mature stage. Historical experience indicate that maintainability aspects, not the least because of their impact on the total cost of ownership, often dictate which systems that can be fielded in large number and which will be relegated to niche roles. These aspects contribute to the uncertainty of estimates of future S&T contributions.

While developments in material could allow lighter equipment and vehicles to made, it can be expected that some or most of such potential weight reduction will actually be used for increased and new functionality. Thus, in terms of mobility and deployability, no significant changes at system or unit level are expected.

Novel designs for faster ships and transport aircraft of large capacity are being explored, but these developments are more related to engineering considerations in new generations of vehicles than S&T advances as such. Power sources and propulsion for vehicles, where in general no major technological breakthrough is expected, but civilian trends towards alternative fuel will likely take place, has been

discussed for the various vehicle categories.

Deployment into areas of otherwise unsuitable terrain may be enhanced by the use of novel surface hardening agents.

ADDITIONAL CONSIDERATIONS

ACQUISITION

Since in many areas, the civilian sector is leading developments, this may have implications for how acquisition is organised. An example is the need for platforms to be designed for simple upgrades (through life design), since civilian components may have shorter life spans. This will be assisted by modular design.

TRAINING

The possibilities for providing realistic and time-efficient training to forces will benefit from developments in the area of computing, information systems and software. Practical consequences may include e.g. better simulators which provide more realistic and varied environment, fully representing complex environments, and easier integration of simulator/training functionality into regular systems and platforms for in-theatre training.

Developments in the area of novel energetic materials could make environmentally benign energetic materials possible, which will allow realistic live training to be compatible with more strict environmental regulations.



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THREATS AND CHALLENGES DERIVING FROM POTENTIAL ADVERSARIES



Irish patrols in Goz Beida © EUFOR

THREATS AND CHALLENGES DERIVING FROM POTENTIAL ADVERSARIES

Evolution of threats

Conflicts during the Cold War can be characterized by smaller-scale conventional wars, insurgency campaigns and counter-insurgency operations - a representation of armed conflict in a modern world. They can also be characterized by the relative restraint shown by the superpowers in the sort of wars they fought - avoiding escalation into total war which had been experienced between 1914 and 1945. They even pressurised allies to end fighting because of concern that it may intensify and draw them into the conflict on opposing sides (1973 Arab-Israeli War). Indeed, the outcomes in Korea, Vietnam and Afghanistan (Soviet intervention) demonstrated how countries were willing to limit their effort in terms of available weaponry, geographic scope and objectives pursued.

The end of the Cold War was followed by a number of wars in Europe and Africa employing relatively low-tech weaponry but which were brutal in nature with heavy death tolls. It seemed that this savage, novel form of conflict would typify the post-Cold War, postmodern period but reality was to be far more complex. The globalised architecture of world order changed and with it, the associated custom of armed conflict. Adversaries in the modern era were fought by formally organised, hierarchically structured forces of the state. In post-modern era armed conflict there has been a dispersal of control of this organised violence to many forms of non-state actors. A disparate array of informal, stateless forces including guerrilla armies, kin/clan/tribal-based irregular forces and paramilitary groups nurtured by criminally funded warlords, national armies and de-territorialised terrorists' networks. Although irregular in their form, their objectives are usually as political as those of states themselves.

Given the tragedy of 9/11 and the consequent operations in Afghanistan and Iraq, and the multitude of conflicts that have and are occurring globally, it is imperative that the EU considers a generic threat assessment for its strategic future military planning. This would enable Member States to structure and train their future forces accordingly, utilising comprehensive, end-to-end capability-based processes.

Indeed, a lack of attention to detail on threat often leads to a misinterpretation of what the objectives are in a capabilities-based approach. For instance, improving what we have and hope that it will suffice to defeat the future threats is likely to support current plans but does not necessarily support the development of new capabilities to tackle new threats. The CDP aims to address this possible shortcoming.

There are many potential regularly-structured adversaries that maintain large conventional forces and can be potentially associated with a regional conflict. Currently, the capability gap between them and a European coalition is significant but Workshop B illustrated how this may close towards 2020-2025. By 2025 these potential adversaries may well have access to cruise missiles, vast number of tube and guided rocket artillery pieces, small long-range missile boats, submarines and 4th generation aircraft.

Additionally, some may be able to mobilise massed manpower if the operation is within or adjacent to their borders - quantity can be a quality of its own. But, perhaps more importantly, many rising powers are demonstrating a willingness to employ a new generational concept of armed conflict rather than just to try and overcome their oppositions lead in a past era of military strategy.

This latter quality can also be associated with current insurgency approaches. Hard to detect, based upon a broad ideology, with a novel structure and robust capacity to regenerate, they cut across ethnic, class and national boundaries and adhere to no specific rule book. Comprised of a network of groups they are extremely difficult to target or decapitate, learning quickly to withdraw, adapt and be patient for a prolonged struggle where they will confront the enemy on their terms. Not only networked in leadership, they will be able to make extensive use of networked organisations - political, social, and financial, whether legitimate or not. They will be unpredictable and determined, and capable of causing great destruction and death - without scruple, requiring enormous resources to be spent on protection by countries that are notably risk and casualty adverse.

However, the reality is more likely to be a combination of the shades of black and white portrayed above. Potential adversaries will have considered the implications of directly challenging EU Member States' conventional forces. They are very unlikely to seek conventional superiority but rather will look for ways to use networks, alliances and human ingenuity to overcome a perceived EU technological lead. They will seek to be as asymmetric as they can. Emphasis may be on urban guerrilla fighting as much as cyber warfare, information attacks, financial terrorism or the unrestricted use of military and non-military means. By using conventional forces but in ways that are ethically unacceptable to western standards, they could attempt to achieve a profitable combination to achieve their objectives, avoiding a needless definition of their centres of gravity but focussing on the EU's, limiting our access and ability to concentrate forces and effects. The use of proxy forces and disruption techniques would further exacerbate the EU's problems of dislocation.

So this could be the sort of adversaries that EU Member States' forces could face; firstly regular-structured forces relying upon conventional concepts or adapting in light of lessons from current operations, modern defence-thinking and their brand of comprehensive planning. Next, there could be sophisticated irregular adversaries, insurgents or non-state actors that grasp a clearer and, perhaps, deeper understanding of 4th generation warfighting. And finally, EU Member States forces may face a civil war or conflict associated with the collapse of a failed state where brutality and attrition is the adversary's only tactic to rule a given territory. Despite the passage of time, such analysis tends to confirm that the character of warfighting may change but not the nature of armed conflict.

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Workshop B

The above is considered as a plausible, but not predictive, summary of a possible generic threat assessment to inform Workshop C. It is based upon the output of the successful Strand B Workshop B but repackages it (as set out below) in an attempt to better assist and benefit the participants of Workshop C. Providing a more flexible focus was the main objective. Although re-packaged it is considered as a faithful representation of the outcome of the workshops proceedings. Annex A is structured by possible Principles of War in the Information Age. Readers should try not to focus on the format but instead consider how these issues could shape future potential capability trends and characteristics in the 2025 timeframe. Annex B tries to provide broad indications of specific capability trends for potential regular and irregular adversaries. Again it is trying to paint of picture for the participants of Workshop C and should be read in that context.

PRINCIPLE OF KNOWLEDGE AND IGNORANCE

Knowledge concerns the information and intelligence we have about ourselves and the adversary. Ignorance is the converse of knowledge - either because we do not know, cannot know or choose not to find out. The balance of knowledge and ignorance has dominated warfighting throughout history and will continue in the Information Age. Today, the principle of knowledge can be based upon the proposition that given time and resource, we can know everything about our adversaries but as conflict is competitive, to collect, fuse and analyse the whole plethora of information may not be time, or cost efficient.

Therefore, to achieve a balance between knowledge and ignorance forces must consider the issue of economy. Ignorant adversaries must resort to massing, having to confront their enemy's strengths in contests of attrition rather than manoeuvre and dislocate. Ignorant forces must react and not capitalise on opportunity, spending considerable time and resource on protection and security rather than seeking positive activity in order to achieve their objectives. But the ability to attain knowledge only exists as a system of systems. It is not built upon computers, communications, ISR sensors, networks or focused training. It is all these things and much more - welded together by agreed and coherent doctrine.

1. Globalisation and the technological revolution will enable adversaries to dramatically improve their situational awareness. They will have access to the latest technological solutions and applications, which is likely to make it possible for them to gain information superiority momentarily, either by time, function or position.
2. Identification of Friend or Foe will be more challenging. Reliable target data and target identification



will become more difficult due to the adversary use of advanced solutions (modern technology / deception means), unconventional modus operandi, a lack of discrimination between military and non-military activities.

3. In this information struggle, information assurance and verifying that one's own information is reliable will be essential.
4. An increase in confused battle space may be predicted, which may lead to losses caused by 'Friendly Fires'. The risk for EU forces being targeted inadvertently will increase in interpositioning missions where the potential for misidentification of EU units by conflicting parties is likely to be high.
5. Within different cultural environments, HUMINT will remain a key challenge for expeditionary operations. The adversaries 'playing at home' will create a natural and absolute advantage for them. This will include gaining intelligence on their logistic footprint and tracking their supply pipeline. This is likely to be small in most cases and therefore is likely to become a more serious issue.
6. Adversaries may have versatile operational/organisational structures but will be able to create their own network structures, even conduct their form of network enabled warfare. It will be a challenge to prevent adversaries from collecting, processing and distributing intelligence.
7. Their communications are likely to be both varied, and flexible, with considerable redundancy in

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concept and equipment, making extensive use of commercial C2 assets such as internet, cell phones and mass media, which, for example, may be used to instigate and profit from local and tactical level incidents such as riots.

8. The adversary's global access to information and their ability to conduct disinformation activities will be a significant challenge for EU force to gather actionable intelligence and secure an accurate common operational picture (COP) with the necessary confidence.

9. Due to adversaries' flexible and dispersed organisation it may be difficult to address the local leadership structure.

10. Military deception, cyber attacks (including cutting edge cryptographic methods) or electronic warfare (including 'hard kill' assets such as directed energy weapons or HPM) will be developed to deny information collection opportunities to the EU force and is likely to be a challenge for EU's situational awareness.

11. Simultaneously, adversaries will develop their ability to protect their systems, e.g. denying access to accurate information, discriminating information by use of new technology, cyber attacks on EU force C2 systems (hackers), jamming and deceiving sensors, improved stealth technology, camouflage applications.

Better knowledge leads to greater emphasis upon dislocation.

12. Moral Adversaries may not be restrained or limited by Rules of Engagement but may take benefit from the EU force's application of their ROEs. They may try to provoke EU forces to use unnecessary force to undermine perceived legitimacy of EU forces.

13. Adversaries are likely not to respect drawn borders, physical and ethical. This may include collaboration with organised crime actors and use of behaviour influencing drugs - applying 'no limitations' to their activities.

14. Adversaries will try not only to undermine the legitimacy of EU operations but also the morale of EU forces. This may be through their form of psychological operations directed at European public opinion and local populations. In this respect, adversary's information operations may focus on civilian instruments of EU operations, which may be less prepared for such actions.

15. Increasing cooperation with Private Security Companies may reduce perceived EU forces legitimacy. EU forces may be held accountable for Private Security Companies that may be employed in theatre by a third party.

16. Adversaries may try to infiltrate CIMIC structures and/or NGOs with the aim to undermine EU

INTERDEPENDENT PRINCIPLES

Given these observations and the conclusions of the initial ESDP Long Term Vision, the principle of knowledge and ignorance gives rise to other principles that are interdependent. These principles are a balance - an economic and profitable combination - facilitated by the opportunities and challenges of the technological revolution and the new global strategic environment considered possible in the 2025 timeframe.

PRINCIPLE OF DISLOCATION AND CONFRONTATION

Dislocation is the art of making your opponent's strengths irrelevant. Confrontation is the direct engagement of the opponent's forces, kinetically or non-kinetically and lethal or less-lethal, in order to reduce, delay or immobilise his strength. It is the symmetrical element in what could be an otherwise asymmetrical conflict. Dislocation is an economical way of achieving your objectives by using moral (including using a different 'rule book'), functional (causing dysfunction), and temporal or time (manipulating time) and positional (i.e. being out of position).



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mission legitimacy by trying to make EU forces look partial.

17. Adversaries are likely to use child soldiers and other “non-ethical” means.
18. Adversaries may also try to take advantage of cultural differences and constraints (e.g. use women for protecting privacy of housing).
19. Adversaries may use civilians or refugees to block or crowd port facilities, roads, and trails.
20. Adversaries may use toxic substances in concentration levels that are below detection levels of fielded detectors to provoke long term health issues, which may lead to massive internal unrest and social disruption.
21. Functional. Adversaries will conduct all types of information operations against the EU force in order to gain and maintain the support of local population.
22. In a structured campaign dedicated to win hearts & minds of local population, adversaries may provide humanitarian aid and assistance. However, they are as likely to intimidate their own local populations. They may try to influence or to take benefit from NGOs and other IOs. By doing this, adversaries will limit the EU force's ability to win public support to crisis management activities.

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23. Adversaries will attempt to find and attack critical links, nodes and vulnerabilities in an EU system of systems with the aim to level the playing field. They will try to interfere ISR capabilities that are linked directly to fires (kinetic and/or non-kinetic), and tailored operational formations and manoeuvring their units that are tasked to affect specific capabilities whose loss or degradation will significantly reduce overall blue force effectiveness.
24. Adversaries' ability to hide their activities among NGOs and local population will make CAS missions more difficult to conduct (increased risk to collateral damage). CAS in urban environment will be challenging.
25. (Weapons of Mass Effect) Adversaries may seek novel ways of inflicting massive casualties and causing horrific damage. They may not be beyond using weapons of mass effect against their own people to create the perception at home and abroad that the EU is employing such weapons against civilians.
26. They may not see the use of chemical weapons as an escalation of the conflict. They may try to use a variety of methods (UAVs, AC, food, water, persons and animals) to disseminate toxic, newly engineered agents, highly infectious diseases, such as smallpox, etc.
27. Adversaries may use biological agents to target food and livestock (e.g. foot and mouth disease), using infected persons, vectors (e.g. food, water) and animals to disrupt operations in sites and facilities.
28. Adversaries may use gene-manipulated micro-organisms which cause disease in people, plants or animals or cause deterioration of materiel and may seek to pollute the environment to hamper the operations
29. Adversaries may use CBR substances to assassinate key decision-makers.
30. Adversaries may try to use CBRNE weapons and devices, and industrial and environmental hazards with little restraint.
31. Adversaries may try to circumvent CBRN defence measures by provoking false alarms up to a time when CBRN detectors are considered unreliable, and thus be switched off due to the loss of confidence.
32. Adversaries may try to interfere with medical transportation chain, food and water supply chains

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and tele-medicine.

33. Adversaries may use differing vaccination policies to target the part of the forces with lowest immunisation levels.

34. The use of hijacked ships or similar weapons to EU forces to create the impression of a major environmental incident (such as 9/11) may not be ruled out within theatre or within Europe.

35. Temporal. Adversaries will attempt to dictate where and when the integrated fight takes place. At critical times of his choosing and preferably at a location that allows him to capitalise on his strengths while minimising his vulnerabilities.

36. Adversaries' improved situational awareness and advanced intelligence will provide them with an increased ability to influence the tempo of operations.

37. In very complex and rapidly evolving mission situations, the decision-making process will become highly time-critical. An inability to provide timely mission instructions from remotely located command may result in mission failure or in casualties to both force personnel and civilians. On future battlefields, even lowest-ranking soldiers may be faced with complex spectrum of challenges.

38. Positional. Adversaries are likely to conduct operations from areas of moral and physical sanctuary, e.g. command posts established within civilian hospitals.

39. Adversary targets and key sites may not be in the joint area of operations. They may develop capabilities to engage assets even at home base (global threats) and are likely to engage EU forces, their assets and infrastructure at home base (terrorist threat, IEDs) and by that way could try to interfere with deployment of EU troops and assets.

40. Potential poor road infrastructure and long distances will provide the adversaries with plenty of opportunities to try to engage EU forces by use of various means: e.g. CBRNE agents, weapons and devices, displaced persons, virtual and false mines (incl. sea mines), and robots.

41. Operations in urban environment will be more challenging as the adversaries will have plenty of opportunities to try to limit EU forces' ground mobility. In addition the adversary may be less dependent on ground mobility (e.g. use of UAVs / modern communications).

42. Adversaries will try to take benefit from hiding amongst civilian population, refugees, displaced people, etc. and therefore identifying adversaries may be difficult. This may include the use of civilian

infrastructure to conceal military targets and thus make their engagement more difficult (collateral damage).

43. Adversaries will try to attack, or limit access to, lines of communication/lines of supply and points of deployment (APODs and SPODs), and may try to limit EU forces' access to Host Nation Support (HNS). In particular, this may apply to staging areas within third countries.

PRINCIPLE OF DISTRIBUTION AND CONCENTRATION

Concentration is the garnering of combat power in order to apply it at a specific time and place. Distribution is the dispersal of forces and effort, geographically and by time, in order to achieve the required effects - apportioning forces to achieve specific objectives. This is highly reliant upon knowledge - intelligence and technological.

The more that is known then the faster and more confidently forces can be concentrated where and when required. Adversaries will have access to modern combat power (i.e. 2nd generation MBT, attack helos, 4th generation combat aircraft).



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- a. Their utilisation of modern solutions is likely to make it possible for the adversaries to gain potentially devastating effects with limited effort.
- b. Adversaries will have access to equipment and systems that enables them to operate at night with night vision equipment and other nocturnal capabilities.
- c. Adversaries will be able to use robotics and unmanned platforms, CBRNE weapons and devices, ballistic missiles, thermo-baric weapons, rockets and mortars to threaten EU forces and local population.
- d. Adversaries will have increased access to electronic attack systems (EW, DEW) and thus, they will conduct electronic warfare against individual equipment, active protection systems (e.g. DIRCM) and C2 structure.
- e. Adversaries will be able to conduct deep operations. Adversaries may use advanced target acquisition systems and advanced stand-off capabilities and are likely to have access to greater quantities of precision munitions.

44. Adversaries will try to choose an environment that minimises EU superiority of firepower and where forces lacking adequate force protection (i.e. lack of fire power; reduced mobility; light armour) can be confronted. They will avoid situations in which they compete with blue forces head-on.

45. Adversaries may try to engage EU forces with attacks performed from underground.

46. The current trends of using sophisticated IEDs, mines, autonomous systems, will continue. These will range in sophistication from command-detonated, bottom-dwelling sea mines to acoustically

detonated, pressure-activated wooden landmines. The use of semi-active laser-guided rounds, fired from single mortars or single guns or pairs of artillery systems will be used from concealed positions.

47. Adversaries will have access to novel littoral and blue water capabilities. This will increase threat against all maritime assets.

48. Adversaries will try to use speed boats / intelligent mines / cheap small arms / civilian assets and sophisticated land-based systems (UAVs, missiles, RPGs) and sea-based assets (UUVs, submarines, torpedoes) to disrupt maritime operations, inc. replenishment and sustainment activities.

49. Adversaries will have access to modern smart mine technologies, which will create access challenges to EU forces and may increase the burden of mine clearance in order to provide safe passage within the littoral. New mines are likely to be used against LOCs and SPODs. Adversaries may conduct disinformation about mine threat levels and could use virtual and false mines.

50. Adversaries' ability to hide their activities among NGOs and local population will constrain EU forces' ability to conduct air-to-ground missions (collateral damage).

51. Adversaries may prioritise targeting MCM assets in order to deny freedom of movement.

52. Adversaries may try to get access to temporary storage and disposal of weapons and ammo in order to cause collateral damage, which will reflect poorly on EU conduct. Conversely, they will have access to cutting edge and untraditional concealment methods, thereby making the detection of weapons and ammo more challenging.

PRINCIPLE OF INTERACTION AND REACTION

This considers the interplay between the conflict belligerents. Interaction is the activity that furthers the achievement of the objectives. Although necessary, perhaps even essential at times, security and protection, in itself, does not contribute to this aim. Exploiting opportunity to gain advantage is what all sides need to do - albeit their tactics may differ massively. Reactive activity also tries to contribute to the interaction by recapturing the initiative. Both are directly affected by the balance of knowledge and ignorance.

Well informed forces dominate the tempo; they make use of all opportunities presented and avoid risk. Less informed forces find themselves reacting to the operational rhythm, trying to create opportunities based upon risky offensive actions. Again - a balance is required.

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53. The integrated fight will be literally close, quick, and violent. Leaders will have minimal decision-making time. Failure to recognise adversaries' intent and then act is likely to be fatal.

54. Adversaries will have access to modern and sophisticated air defence systems including Surface-to-Air Missiles, Directed Energy Weapons (DEW), and electronic attack systems (EW, DEW). Adversaries' increased access to electronic attack systems (EW, DEW) is likely to hamper, in particular, the use of High Value Assets like AEW and AAR aircraft (e.g. jamming communication and navigation systems).

55. EU forces' SEAD capabilities may be challenged by adversaries' use of a broad spectrum of combination of old and new and technologies (ad hoc hybrid solutions, dispersed command and control).

56. Adversaries' predicted use of CBRN weapons and devices may require the EU force to operate in contaminated areas for longer periods of time.

57. Due to enhanced mobility of adversary the area of operations is likely to be extended and thus may augment the effort required for Force Protection.

58. Adversaries may be able to counter EU forces' non lethal capabilities.

59. Adversary's access to long range guided precision weapons will increase need for site defence capabilities.

60. Adversary's tactics in the urban environment will reduce the advantage in range and accuracy of stand-off PGMs. In this form of close interaction, long-range, airborne-launched weapons would be of limited use because of the proximity of friendly forces and the scarcity of significant targets. This is likely to require attack helicopters or other aircraft to move in closer to strike with the associated risks.

61. Adversaries will have access to sophisticated AAM (Beyond Visual Range Missile) giving them the ability to engage aircraft, which for example, will allow them to enter no fly zones to intercept support aircraft such as AAR.

62. Adversaries' access to ManPADS and other air defence systems will pose elevated threat to helicopters and other low-level flying aircraft, incl. UAVs. It may even pose a significant threat to medium and high level aircraft.

63. Adversaries may try to saturate air space management system with small targets. Increased use of



UAVs will complicate airspace control and management. Identification of Friend or Foe will be more challenging.

64. Adversaries will develop electronic warfare capabilities and cyber attack capabilities that are likely to be used to deny EU forces' ability to control airspace. Adversaries' access to new technologies (stealth etc.) will contribute to this.

65. The modern sophisticated logistics applications and technologies and increased number of specialist contractors (civilians) within the EU forces will provide the adversaries with plenty of high value targets. For example, pipelines, which are rather arduous to monitor and protect, may become more attractive targets for adversaries.

66. There may be limited possibilities to get HNS due to potential infiltration and other actions of terrorists and insurgents.

POTENTIAL CAPABILITY CHARACTERISTICS OF GENERIC REGULAR AND IRREGULAR ADVERSARIES

For the sake of the CDP Strand B Workshops only, the EDA developed a system of classification of capability in order to categorise potential adversaries using a wide range of factors. This is to provide a generic assessment of the possible capabilities of differing potential adversaries by extrapolating data based on the assessment of each. For ease of analysis each potential adversary is categorised as 1, 2, or 3.

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CATEGORY 1

A Category 1 state is considered to be at the forefront of military technology, industry and equipment. The following points define a Category 1 state:

- Advanced industrial economy enabling procurement and replacement of antiquated technology if required;
- Advanced industrial presence, particularly on the high technology and electronic end of industry; ability to manufacture and produce advanced, next-generation military equipment and systems;
- Well equipped with modern equipment and participating in advanced, ongoing projects such as next-generation platforms (F-35 for example);
- Has evolved beyond C2 and C3 into at least an early C4I environment, and is actively involved in developing its Network Enabled Capacity and other advanced force multipliers;
- Fully professional military force, or in the process of moving towards one;
- High levels of training and technical aptitude among personnel, reflecting an ability to make the most efficient use of advanced systems procured;
- Well established Maintenance, Repair and Overhaul procedures ensuring platforms and systems in-use function up to and beyond their intended service life without significant loss in effectiveness.



Specifically, such adversaries may develop new and enhanced capabilities, for example:

- Qualitative improvements for ground forces are envisaged including the upgrade of existing MBTs by the installation of active protection systems – a feature that could increase the usefulness of MBTs in conventional and insurgency operations;
- They may procure heavy AFV with, for example V-shaped hull and sufficient armour to protect troops against RPGs and ATGW, and with active defence systems. But as a whole, these initiatives may not create new capabilities but rather increase and complement current capabilities.
- Battalions (armoured and infantry) will receive organic UAVs primarily for a tactical role. The usefulness of such equipment is its complete mobility and ability to be mounted on a light vehicle or similar platform, enabling direct control by units rather than by rear-echelon controllers. With a wide range of electro-optic equipment it can provide rapid deployment ISR capability to units on demand and is ideal for deployment in complicated and cluttered environments.
- High Altitude Long Endurance (HALE) and Medium Altitude Long Endurance (MALE) platforms will be introduced for use as communication and ISTAR relays to enhance coordination.
- UCAVs may be introduced in the next 15-20 years, although there may be greater concentration upon the ISTAR abilities of UAVs rather than the combat capability. Advanced adversaries are not expected to field UCAVs until appropriate advances have been made in the development of autonomous flight and operation. This is not expected until early-2020s.
- The success of the attack helos in the recent insurgency operations has convinced countries to procure or upgrade attack helicopters, which includes the installation of surveillance and target acquisition radar systems to concentrate on their primary task in anti-armour and to support infantry operations, including in urban environments.
- Procurements will likely focus on the upgrade of its existing fleets until the entry into service of the 5th generation aircraft (F-35). This will include life extensions, fitting of advanced electronic systems, including Advanced Electronically Scanned Array (AESA) radar and a number of advanced weapons and bombs.
- Significant capability boosts may be encouraged in areas of airborne SIGINT and AEW, as well as improving missile defence capabilities to protect against rockets attacks etc.

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- Adversaries may significantly increase their force multipliers. Prime among them is the continued development of a Network Enabled Capacity (NEC) and the fielding of a fully functional C4ISTAR system. This NEC will be complemented by other systems such as the development of a future soldier system as well as the additional fielding of a number of types of UAVs

CATEGORY 2

A Category 2 state lags behind Category 1 states in its access to, and fielding of, advanced weapon systems. It has procured a number of advanced systems but largely lacks the ability to develop systems of similar quality. Additionally, though involved in the production of some military equipment as well as the developing an advanced defence industrial base, equipment produced locally still lags in capability behind that available for procurement from Category 1 states. The following points define a Category 2 state:

- Developing industrial economy enabling some procurement of advanced systems, although financial situation can require procuring used or early generation systems as an alternative
- Developing defence industrial base, although production of high end technology items is either still beyond capability or technology produced still lags behind Category 1 states
- Mix of modern equipment and legacy second-user or early generation platforms; may have some involvement in next-generation platform development
- Is firmly entrenched in the C3 realm with no nascent development of C4I capability
- Mix of professional, paramilitary, and reserve forces populated largely by conscripts
- Mixed levels of training and equipping of forces, with priority placed on professional forces being well trained
- Some technological aptitude among personnel, with evolving MRO practices; some reduction in effectiveness for older platforms, although sufficient practice in place to keep cannibalisation of platform parts to a minimum

Specifically, such adversaries may develop new and enhanced capabilities, for example:

- Some more advanced adversaries may develop into integrated and capable organisations,



characterised by employment of key assets in the current inventory that will have been upgraded. Whilst not being expected to achieve single-procurement source status from the western supplier nations, they will have established modern, western doctrine, concept of operations, training and maintenance, repair and overhaul practices.

- Procurement decisions are expected to be hindered by the availability of defence funding, such that platforms in the existing inventory will be upgraded to extend their service life rather than replaced.
- Previous military failures have in some part been attributed to the rigid hierarchy of command and control. Some small effort to address this issue will be made, though the extent to which tactical commanders are given the autonomy required when facing the enemy remains uncertain. They will be forced to address its own command and control features in order to prevent being out-manoeuvred in any future conflict.
- Adversaries are expected to upgrade its trainer/light strike aircraft in order to operate as close air support assets and so enhance combined arms operations significantly. Such programmes would involve modernising the avionics suite, including a Heads-Up Display (HUD), mission computer, GPS and radio navigation systems.

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- Ex-Soviet high altitude interceptors maybe to upgraded to, for example MiG-31 'Foxhound' interceptors in the E export configuration, in exchange for the older Foxbats. Such aircraft has beyond visual range air-to-air missiles and phased array radar (facilitating the simultaneous engagement of up to four targets, including those with aspects below and behind).
- Other contenders may include surplus MiG-29 or Su-27 variants. Should funding allow, then a new-build and customised Su-30 variant-type would be a likely contender to fill this role.
- Ex-US aircraft could be replaced by F-16 upgrades. An active Electronically Scanned Array (AESA) radar would dramatically increase the target identification and engagement capability of the aircraft. Specifically, an AESA system offers advantages in terms of simplicity of design, maintenance and operation due to the lack of moving parts. Systems also offer a much faster scanning rate as they are not restricted by the physical rotation of the system, a much higher range and larger number of targets able to be tracked and engaged due to the possibility of multiple agile beams. Lastly, AESA systems offer a lower probability of intercept and improved resistance to ECM measures due to the agility of the beam emitted.
- Current air lift capability is nearly always both insufficient and nearing the end of its effective service life. Such adversaries may select Antonov An-70 and/or An-74s to provide the capability required.
- There is potential for C-130J to be sourced as surplus from allied nations who have replaced them



with next-generation lift aircraft currently under development such as the A400M.

- It is expected a primary area for system procurement is in its air defence assets, including modern mobile air defence systems from Russia. Such systems are capable providing good, low-medium altitude coverage as part of a wider air defence umbrella.
- Some adversaries will seek to obtain an advanced area high-altitude air-defence system. The most desirable is, perhaps, a Russian fourth generation system, optimised to defeat a range of advanced threats including ballistic and tactical missiles, low signature stealth aircraft, AWACs-type aircraft and stand-off electronic warfare aircraft.
- It is expected that vehicle fleets will be upgraded around wheeled 8x8 hull design able to field variants capable of fulfilling numerous roles. As more advanced nations using such a vehicle replace them with network centric platforms then large numbers of surplus vehicles will become available on the market. The addition of a remote weapon station or manned turret affording Infantry Fighting Vehicle (IFV) capability. There would be growth potential into the area of linked data transfer systems associated with the first stages of network centrality.
- It is likely to see some procurement is that of Mine-Protected Mobility Vehicles to provide high-mobility units with suitable protection. Furthermore, such procurement would allow the opportunity to replace existing mobility firepower assets operating in ATGW and air defence roles.
- There is some potential for substantially increase attack helicopter capability. Millimetre wave fire control radar was designed to provide target acquisition and engagement of (predominantly) armoured vehicles with missile fire whilst the parent aircraft remained behind cover.
- Heavy armour upgrade is likely. Systems and capability upgrades may be included in any such programme include external command and control communication systems, a battle management system with appropriate tactical displays, improved internal intercom systems, an under-armour auxiliary power unit, improved crew compartment cooling and conditioning systems and an optronics package including infra-red thermal commander's sight.
- It is not expected to have made significant strides towards network centrality. However, there are areas in which advancement is expected to be made. Firstly, the adoption of western doctrine may bear fruit in the planning and execution of combined arms operations featuring armour, infantry and airborne assets. This development will be assisted by advances in the basic command and control process and procedures, including the first steps in sharing of data and communications systems between platforms such as close support aircraft and armoured vehicles.

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CATEGORY 3

Category 3 states are unable to effectively field basic military equipment and are often unable to procure or operate advanced platforms. Effectiveness of platforms is considered to be low, and defence industrial bases are limited or non-existent. The following points define a Category 3 state:

- Struggling industrial economy; often relies on exports of natural resources and imports manufactured products
- Little available funding for procurement of defence equipment; any equipment procured is often second-user and is early generation or antiquated
- Some procurement of modern equipment, although complex technological systems require foreign assistance to operate
- Primarily antiquated, legacy platforms in-service with no participation or involvement in development of next-generation platforms
- Limited Command and Control, with no tactical networks and limited communication abilities for deployed forces
- Primarily conscript and paramilitary forces, although a core exists of relatively trained professionals
- Limited technological aptitude among personnel; uncertain MRO practices in evidence; widespread cannibalisation of platforms and severe reduction in service life is common.

Specifically, such adversaries may develop capabilities, for example:

- Will make only modest improvements to their capabilities, with the focus remaining very much on the return to service of existing platforms with some improved armoured vehicles able to effectively protect against mines and modern explosives.
- There will be a minimal procurement of antiquated systems being retired from the inventories of more militarily developed states;
- Heavy armour fleet may get a substantial boost in terms of the reliability of the platforms, the added armour and the more powerful power packs and engines.

• Adversaries may acquire relatively modern rotary-wing capability. Though this will be a minimal capability increase in terms of conventional warfare, the ability to provide air cover and ground attack capability in a counter-insurgency role against irregular opponents will be a boost in capability.

• With programmes of upgrades and life extension work to keep the ex-Soviet attack helos operational, it is anticipated to procure a small number of more modern attack helicopters. A likely candidate for such replacement would be the Mi-28 'Havoc' with night fly-and-fight capability would offer a step change close support capability

• With a little assistance, they would be able to maintain an effective APC capability well beyond 2015. The current use of a basic platform would mean a transition to upgraded models would also require minimal retraining. This may involve conversion to C2 posts, TOW carriers to provide an anti-tank capability, and possible mortar carriers or Infantry Fighting Vehicles (IFVs).

• The acquisition of an effective air-defence capability to counter an opposition's combat aircraft operating will be a priority. It is conceivable they could seek to procure a number of surface-to-air-missile (SAMs) from neighbours or reverse engineered missiles acquired from Russia in the 1960s.

• The financial constraints will continue to hinder procurement are unlikely to disappear in the 2025 timeframe but it is anticipated that small equipment improvements could advance their capability considerably in selected areas.

• Related to the implementation of combined arms operations, the development of a C2 network would be comprehensive across all service branches and units. This may be implemented by 2025.

AN IRREGULAR ADVERSARY

The following points could define the future capabilities and modus operandi of a possible irregular adversary:

- No defence industrial base with little to no capability to manufacture weapons; what is manufactured is largely in the form of crude explosives and Improvised Explosive Devices (IEDs);
- Given its irregular status, must often purchase weaponry on the black market through unorthodox sources;
- Military organisation is limited, often revolving around a small core of semi-professional or

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EU NAVFOR Atalanta prevents hijacking - 4 March 2009 © German Navy

professional fighters who form the basis for a much wider reserve base;

- Limited training beyond basic firearms techniques; limited to nonexistent tactical awareness for most members, although higher echelons and professional cadres will have some comprehension;
- Equipment usually limited to small arms, anti-tank and occasionally limited number of anti-aircraft missiles and ammunitions;
- Budget is limited to the above mentioned purchases, with limited resources available for large platform procurement;
- Likely to remain focused on maintaining stocks of missiles, unguided artillery rockets and anti-tank guided weapons;
- May train a greater number of operatives to use relatively complex weapon systems, this process will have been undertaken with the support of sponsoring states or organisations.

Specifically, such adversaries may develop capabilities, for example:

- Will increase stocks of man-portable ATGWs. These may include, for example the Metis-M (AT-13) system with its thermobaric warhead, the Konkurs (AT-5) and Kornet (AT-IX-14) anti-armour missile systems;
- Adversaries are likely to have made the first moves into establishing some C4 capability, improving command and control systems and procedures that allow for greater ease in conducting coordinated operations. Data sharing between units and positions can be expected to resemble the rudimentary elements of C4I, probably utilising primarily commercial off-the-shelf (COTS) systems and equipment;
- There may be a drive to enhance defensive and intelligence gathering via a process of acquiring Signals Intelligence (SIGINT), Electronic Counter Measures (ECM) and Electronic Counter-Counter Measures (ECCM) equipment;
- They will establish and maintain encryption in the practical methods of data gathering and input into the network (such as forward observation of artillery fire, radio and sensor operation, etc);
- Adversaries will continue to pioneer many of the methods of Improvised Explosive Device and will seek to obtain the materials and equipment required for the creation of IEDs with Explosively Formed Penetrator (EFP) warheads;
- They are likely to pursue the transfer of a substantial number of advanced air defence systems, such as Russian-made IGLA Man Portable Air Defence Systems (MANPADS) and its follow-on replacement. Additionally, they are likely to acquire of these weapons in order to deter and prevent helicopter operations, interdict gunship and UAV strikes and to prevent the insertion of Special Forces;
- Irregular forces are likely to be familiar with the use of UAV assets;
- They are most likely to employ tactical doctrine that creates civil unrest so they are in a position of being the 'only choice' in authority. Disrupting civil population and the utilisation of civilian agitation will be a force multiplier for them when territory is taken by their enemy.
- A burden will placed upon regular forces attempting to take and hold territory containing civilian supporters of irregular adversaries, requiring the combination of a military and civil command response. EU forces may even be placed on the streets for law enforcement which is likely to complicate rules of engagement and reduces the forward fighting power.

BACKGROUND NOTE ON EDA

The European Defence Agency was established under a Joint Action of the Council of Ministers on 12 July, 2004, "to support the Member States and the Council in their effort to improve European defence capabilities in the field of crisis management and to sustain the European Security and Defence Policy as it stands now and develops in the future".

FUNCTIONS AND TASKS

The European Defence Agency, within the overall mission set out in the Joint Action, is ascribed four functions, covering:

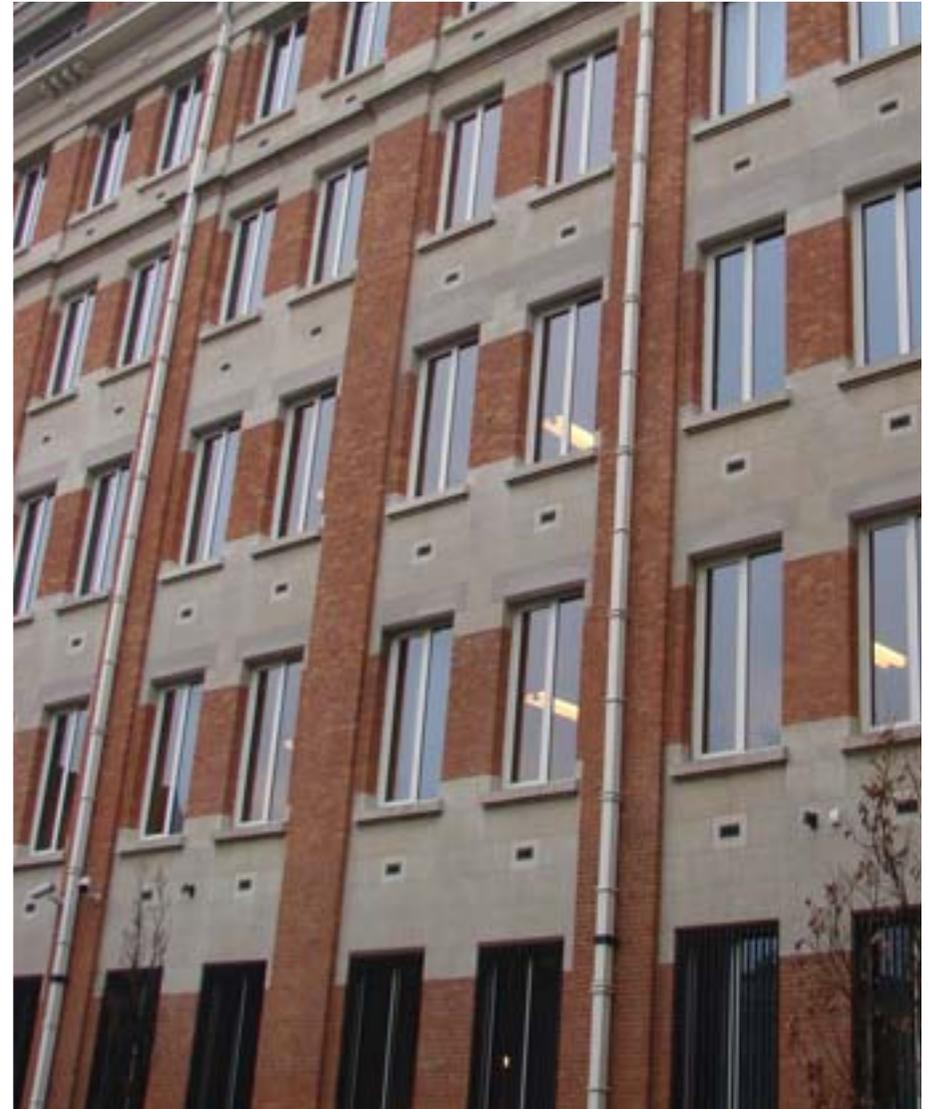
- developing defence capabilities;
- promoting Defence Research and Technology (R&T);
- promoting armaments co-operation;
- creating a competitive European Defence Equipment Market and strengthening the European Defence, Technological and Industrial Base.

All these functions relate to improving Europe's defence performance, by promoting coherence. A more integrated approach to capability development will contribute to better-defined future requirements on which collaborations - in armaments or R&T or the operational domain - can be built. More collaboration will, in turn, provide opportunities for industrial restructuring and progress towards the continental-scale demand and market, which industry needs.

On this basis, the Agency's tasks include:

- to work for a more comprehensive and systematic approach to defining and meeting the capability needs of the European Security and Defence Policy (ESDP);
- to promote European defence-relevant R&T, as vital both to a healthy defence technological and industrial base and to defining and satisfying future capability requirements. This will involve pursuing collaborative use of national defence R&T funds, in the context of a European Defence R&T Strategy which identifies priorities;
- to promote European cooperation on defence equipment, both to contribute to defence capabilities and as a catalyst for further restructuring the European defence industry;
- to work, in close cooperation with the Commission, on steps towards an internationally competitive market for defence equipment in Europe.

The Agency's "comparative advantage" should be its ability to comprehend all these agendas, and relate them so as to realise their synergies. Its special position should allow it to develop uniquely cogent analyses and proposals across the range of its activities.





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