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EU research and innovation policy and the future of the Common Foreign Security Policy

**A Report Commissioned by the Science and Technology Foresight
Unit of DG Research, European Commission**

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Disclaimer

The views expressed within this Report represent those of the authors alone and should not be construed as representing the position of the European Commission.

EU research and innovation policy and the future of the Common Foreign Security Policy

Genesis

In 2004 ISIS Europe was awarded a tender under the Sixth Framework Programme for RTD to conduct a study into 'EU research and innovation policy and the future of the Common Foreign Security Policy'. The main objective of the study was to analyse the future challenges for CFSP, to provide the European Commission with scenarios related to a European Foreign and Security Policy, and to examine their implications for EU research and innovation policy. In addition to issues relating to crisis management, the European Commission wanted a long-term view on the future of CFSP that could shed light on key issues that the EU will have to face on the international scene until 2015 and on research needs in relation to such issues.

This is the Report that resulted from that study. It is divided into three parts: Part A identifies the 10 most important threats and challenges confronting the EU up to 2015; Part B refines these findings into a more precise analytical framework through the construction of five scenarios relating to the future European security environment; and Part C identifies the major implications of the scenarios for future developments in EU research and innovation policies – in particular its external dimension

Introduction

This Report analyses the future challenges for the European Union's (EU's) Common Foreign and Security Policy (CFSP) and assesses their implications for EU research, technology and innovation policy. In doing so it attempts to look over the horizon, beyond immediate security threats, to give a longer-term perspective (up to 2015) that will help to shape the future direction of EU policy in these areas.

The Report first identifies and examines the most important policy issues relevant to EU security over the next ten years. It then develops and refines that analysis through the use of five carefully defined scenarios. The major implications of those scenarios for the future of EU research, technology and innovation policy in relation to supporting CFSP are then explored. The Report concludes with a number of recommendations for particular research priorities, instruments and policies.

The Report aims to supplement the conclusions of the European Commission Report 'Security Research: the Next Steps', but does not address questions related to priorities for the Community-funded European Security Research Programme (ESRP) that will be launched by 2007 as part of the next Financial Perspective (FP7) 2007-13.

The Report is not tied to any particular research programme: rather, the aim is to inform overall research agendas in support of European security. The Report supports the recommendations contained in the Report of the European Parliament's Foreign Affairs Committee 'Security Research: the Next Steps' – produced in response to the Commission's Report – which call for a

more balanced interaction between research in the natural sciences and technology and other sciences, in particular political, social and human sciences.¹ The main recommendations of this Report address topics in social and human sciences.

This Report does not dispute the importance of research into technology to provide more security for the community's citizens. However, the Report also recognises the importance of understanding complex socio-technical systems requiring a more comprehensive approach to understanding the role of science and technology in both threatening and promoting security. Furthermore, the authors of this Report saw a particular need to take a comprehensive and forward-oriented look at security challenges, strongly endorsing the Commission's desire that any European initiative on security research should respect individual rights, democratic values, ethics and liberties. Security research should also work to promote social justice and cohesion, equality of opportunity, environmental quality, public health and human dignity. In a post-national world, the design of research and innovation policy should also take into account the other - potentially detrimental - effects that a predominantly military or technological orientation may incur.

¹ *Security Research – the Next Steps*, Report of the Foreign Affairs Committee, A6-0103/2005, para.15, p.6.

A. Meeting the key threats and challenges to 2015

The purpose of Part A of the study was to identify the 10 most important threats and challenges confronting the EU – drawing on the in-depth analysis of 15 leading experts (from various disciplines: social sciences, physical sciences; and institutions: universities, research institutes, NGOs, and think tanks), each of whom wrote a paper that was presented to, and discussed with members of the European Commission at a workshop in Brussels in 2004.² These threats and challenges were divided according to regional, horizontal and technological trends. A particular emphasis was given to identifying issues that were relevant to DG Research’s considerations for FP 2007-2013.

Introduction

Global insecurity is now brought about primarily by various impacts of the networked political economy and the ‘clash of civilisations’ in a world of borders that are highly permeable to flows of information, finance, goods and people. It arises from societal changes related to scientific and technological developments as much as from new types of vulnerabilities to human aggression and unanticipated byproducts of various types of human activity.

In the 21st century, the EU has turned its attention to how best to preserve and enhance its long-term security interests. A major step in this direction, in addition to practical activities within the European Security and Defence Policy, was the adoption of the European Security Strategy (ESS) in December 2003, by the European Council.³ The ESS provides, on the basis of a broad perception of security, a list of major threats to European security, political principles on how best to respond to them, and an outline of instruments already available to - or in need of development by - the EU.

Part of the challenge of how to achieve sustainable security in an increasingly interdependent world, is to add security concerns to the community’s research, science and technology agenda. This requires a review of research priorities, instruments and policies, a job partly already done within the framework of the Preparatory Action on ‘Enhancement of the European industrial potential in the field of Security Research 2004-2006’ and the European Security Research Programme foreseen for FP7.

Several key tasks remain to be done, however. One is to improve the dialogue between those conducting ‘peace and security’ research and those researching ‘science and technology’. Although there is an appreciation in both ‘camps’ that the work of the other is important to their own field, to date there has been comparatively little interaction between them. Another task is to mainstream within EU policy a common, but much wider definition of security.

² This Report contains a synopsis of the findings produced by these 15 papers. The full text of each paper from Part A can be found in the Annex attached to this Report.

³ *A secure Europe in a Better World*, Report drafted under the responsibility of EU High Representative Javier Solana, Brussels, 12 December 2003.

As the ESS clearly acknowledges, we need to move beyond relying solely on military means and develop a spectrum of policy instruments. These instruments should range from civilian ones - employed in conflict prevention, peacebuilding and in neutralising terrorism - to those intended to tackle the root causes of insecurity and conflict.

Understanding the socio-economic and cultural dimension of geo-strategic threats is often under-rated, and certainly under-funded, compared to simply seeking technological ‘solutions’ to the various manifestations of threats. By that time, it may be too late to prevent threats from becoming conflicts and materialising into seriously damaging situations. Investing in science, social and natural, and technology to forestall threats *before* they become critical is clearly a more cost-effective application of scarce resources than pouring money into coping with the *consequences* of them once they have become ‘live’.

Social sciences and humanities can offer no foolproof ‘solutions’ about how to bring about peace and security any more than “magic bullets” can be developed to perfectly safeguard European security. Consequently, it will remain important to continue to invest in applications of emerging technology to deal with the manifestations of threats as well as seeking their eradication at source. Moreover, it is important to develop greater understanding of the complex nature of socio-technical systems as related to security, an area that is under-researched at present.

This Report identifies the ten most important security challenges facing the EU until 2015 drawing upon the findings of 15 leading experts (from various disciplines: social, physical and engineering sciences; and institutions: universities, research institutes, NGOs, and think tanks). These are defined under three thematic headings namely, regional security trends, horizontal security trends and technological security trends. For the purpose of clarity and focus, the findings outlined below follow a designed template, which indicate recommendations respectively for FP 2007-2013 and for DG Research until 2015. These recommendations are based on future-orientated analysis structured under three sub-sections, namely: threats, challenges and opportunities. The main conclusions and recommendations are presented at the end of the Report, and set out a conceptual framework for the design of research and innovation policy to promote European security for the long term.

A.1 Regional Security Trends

A.1.1 Russia and Eastern Neighbours

Threats

Any serious deterioration in the relationship between Russia and the EU - very difficult to envisage at present – would raise once again the risk of the possible use of Weapons of Mass Destruction (WMD) in Europe. . The illegal export of nuclear material, as well as expertise, to countries of concern will continue to be a major worry over the next ten years at least. Organized crime and terrorism will also become more of a danger, partly because of the inability of some Eastern European neighbours adequately to enforce the rule of law and control their frontiers. While conventional military capabilities will decrease in the long term, some groups could acquire

advanced systems in the next decade (Global Positioning System jammers; rudimentary Unmanned Aerial Combat Vehicles etc.) that would improve their ability to conduct asymmetric attacks.

Challenges

The possibility of a further deterioration of civilian control over national territories, due to the collapse of legal systems, organized crime or the outbreak of civil wars, could require European intervention – perhaps even military intervention. The need to respond early and timely to secure materials and weapons of mass destruction as well as civilian research institutions would be necessary.

Opportunities

Between now and 2015 it seems preferable and possible to improve and develop those conflict-prevention and crisis management tools that are capable of containing local or regional conflicts.

Research recommendations

- Enhancing research-based knowledge of internal, national and transnational political and security developments in the region, including technological developments and capacities, in the context of the role of European security policy looking to 2015.
- In the long run, the aim of a European research plan for improved security responses should be to understand and influence the information flow in the conflict region. Thus, all the technologies for information gathering and assessment as well as social science-based analysis that is useful for understanding events should be developed.
- European security policy needs to start developing the capabilities necessary to negate the exploitation of networked systems by adversaries (media; C3 systems; dispersed weapon systems).

A. 1.2 Mediterranean Neighbours

Threats

By 2015 there could be a growing feeling of resentment towards the EU in the Mediterranean region, both in Northern Africa and in the Middle East, due to EU-imposed reforms (conditionality) and to a growing perception that the EU is not living up to its side of the bargain. Poor governance may also contribute to a possibly worsening economic situation in the South. The Israel/Palestine conflict could also flare up again, possibly leading to a wider regional military conflict. Although the conflict will not pose a direct security threat to the EU, it could have important negative consequences for EU interests. For instance, it is already an important cause of the stagnation of cooperation in the Euro-Mediterranean Partnership (EMP), and still feeds terrorism.

Challenges

Many existing regimes to the South do not have good records vis-à-vis democratization and the rule of law, nor do they inspire confidence for the future. The incomplete application of human rights clauses in the framework of the EMP has certainly not contributed in a positive way. As a result, the EU is often perceived as favouring stability over democratization. Given the gravity of the security environment, the future challenge for the EU is not only to focus on stability, but also to focus on representative grassroots democratisation processes.

Opportunities

There is a need to develop a new type of policy dialogue that includes security cooperation between the EU and Southern partners. This holds true especially in the field of the European Security and Defence Policy (ESDP), where the appointment of liaison officers to the EU Military Staff and, eventually, participation in ESDP manoeuvres and operations could be pursued.

Research Recommendations

- How to successfully build institutions in weak and/or undemocratic states that contribute to knowledge creation and to political, social and economic development.
- How to achieve accountability and benchmarking - with a sense of ownership - in the framework of 'positive conditionality'.
- Understanding the interaction between state and non-state actors and external partners in the framework of 'positive conditionality'.
- How to reform the security sector in authoritarian states.
- Development of communications policy and improving the perception of the EU.

A.1.3 Transatlantic relations

Threats

Although US unilateralism, especially in respect of a number of security-related issues, risks a strategic rift opening up with the EU, it is hard to imagine this developing to the extent that the US becomes a direct threat to the EU.

Challenges

In the short/medium-term, ideological shifts in the White House may reinvigorate a differentiated bilateralist US approach towards European states rather than a more symmetric US-EU partnership. This could be exacerbated if the differences in security perspectives are amplified by economic differences, possibly resulting in 'trade wars' that would affect the EU as a whole. Despite the solid foundation of common values, the fact that the US and the EU are the two most capable power blocs in the world, could lead to destabilising forms of competition and conflict.

Opportunities

Under Javier Solana's guidance, the EU has chosen to stick very closely to US initiatives, by developing its own strategy on WMD (despite disagreements about threat assessment), by writing together the 'roadmap' for peace in the Middle East (despite skepticism about the US's pro-Israel bias), and by using a very similar style of vocabulary and structure in the ESS to that used in the US National Security Strategy. Because of converging structural interests and because the US Administration will face difficult consequences of its policies (especially in the Middle East) there is room for a transatlantic rapprochement.

Research Recommendations

- Develop EU-US co-operation in major science and technology programmes and investments (ITER, through organisations such as the European Space Agency (ESA) and CERN, and joint research programmes in areas such as energy, environment and climate change, and on social science research related to security).
- Upgrade Science and Technology co-operation with other regional frameworks like the Southern Common Market (MERCOSUR), South African Development Community (SADC) and the Association of South East Asian Nations (ASEAN);
- Reinforce multilateral research cooperation between NATO countries, and involving North and South America and the EU.
- Conduct research on the EU-US *New Transatlantic Agenda* and *Joint Action Plan*, not only at the level of ministerial meetings and senior officials, but also medium and lower levels.
- Maintain investment to enable strategic autonomy from the US when necessary.
- Establish an EU Think Tank in Washington to conduct security analysis and to engage US decision makers and opinion formers in debates on transatlantic relations from a European perspective.

A.1.4 China and South and East Asia

Threats

The coming decade will witness a significant shift in the ‘balances of power’ associated with the growing wealth and power of China, which will raise inevitable security concerns. Risks of inter-state war and conflict will tend to pre-occupy Asian states, and this is a region where war between the major powers, including nuclear powers, may occur. US military power will continue to loom large for virtually every state in the region, either as a potential threat, ally or welcome outside ‘balancer’. Many states in the region will invest heavily in accumulating major conventional arms. A particular risk is the further nuclearization of Asia beyond the Indian subcontinent, including South Korea, Japan and Iran. Some states are at risk, in particular Indonesia, which could have major regional ramifications. Currently, the EU’s engagement with China is generally weak on key political and security issues. This situation needs to be rectified.

Challenges

There are several weak or failing states, raising associated concerns about transnational crime, terrorism, piracy, and complex internal or transnational violence. Numerous conflicts are ongoing, including in Nepal, Sri Lanka, Kashmir and Irian Jaya. India and Pakistan both possess nuclear arsenals, and North Korea poses direct challenges both to the Non-Proliferation Treaty (NPT) and to its North East Asian neighbours. Democratisation processes are powerful across much of these regions - including fragile states like Indonesia - which are welcome but will continue to instil tension and unpredictability.

Opportunities

External actors will have an important contribution to make to conflict prevention and reduction efforts in Asia. Appropriate wider international assistance from international organisations, the EU and ‘donor’ states such as the UK, France, US, Canada and Australia is vital (especially in the wake

of the 2004 Tsunami). A particularly important issue is to engage with actual or possible new nuclear states.

Research Recommendations

- More comprehensive research is required on the nature of inter and intra-state disputes, including economic, religious and cultural factors, and on cross-national institution building that could promote stabilisation and reduction of conflict.
- A greater research focus is required on the nature of failing states and how the phenomenon can be redressed.
- More expertise on Chinese International Political Economy is required.

A.2 Horizontal Security Trends

A.2.1 Trends in internal warfare - particularly in Africa

Threats

Sub-Saharan Africa is in particular danger of remaining within the conflict trap in the next decade. Political institutions and economies will continue to remain weak in most African countries. GDP per head is the lowest of all major regions of the world; economic growth is slack, economic diversification limited, and population growth high. HIV/AIDS will dramatically worsen the situation, because it predominantly disables and kills people in their most productive years and burdens social systems. Low economic growth is a major cause of civil wars.

Challenges

One future challenge is to find and promote technologies that support income generation in situations marked by political instability. Civil wars in Africa have potential spillover, particularly through increased refugee flows, health crises (HIV/AIDS) and inflow of illegal drugs. Media coverage - the 'CNN effect' - also may lead to stronger public calls for Europe to intervene in Africa, although the transience of media attention makes it difficult to sustain support for assistance over time. Other challenges include implementing effective development strategies, persuading African governments to accept institutional reforms, and the preparedness of EU Member States to invest in peace support operations.

Opportunities

There is a need and opportunity to increase our knowledge of particular conflicts and wars – requiring regional expertise on political institutions, social structures and conflict formations. Developing the New Economic Pact for African Development (NEPAD), African Union would be a good start.

Research Recommendations

- Social science research: regional expertise, research into the causes of internal wars and conflict resolution. Regional security analysis, effectiveness of development assistance, including the generation, uptake and application of knowledge to indigenous problems.
- Research on developing cheaper airlift capacity, as this would lower costs of military and humanitarian intervention.

- Peace support operations should become a particular focus of attention in military research.
- An important field of research involves exploring the conditions for re-establishing safe and stable post-conflict environments, for instance, security sector reform, turning war economies into peace economies and restarting devastated economies.
- Developing tagging techniques for small arms, ammunition, and equipment used in illegal exploitation of natural resources, to make it easier to disrupt illegal trade routes.
- Surveillance: sensors on various platforms, including satellites, are needed for better control over the flow of many types of goods (and people) traded illegally.

A.2.2 Trends in International Terrorism

Threats

The primary terrorist threat is likely to come from fundamentalist Islamists and their development of new methods - perhaps deploying chemical, biological, radiological, or even nuclear (CBRN) devices - as part of suicide attacks upon civilian targets. They will also deploy psychology and cyber-warfare techniques and continue to use the media. They will exploit failing states (sometimes in conjunction with organized crime) arising from empires disintegrating, under-development, and regional conflict.

Challenges

Counter-terrorist activities need to be applied in ways that are not counter-productive, resulting in the alienation of extremist communities. There is also a danger that a failure to provide proper and transparent risk assessments to populations will result in confusion and unrealistic expectations, a draining of support, and a backlash against political establishments. We need to be able to track, arrest and prosecute terrorists before they strike. The protection of key strategic assets can best be achieved through an integrated Homeland Security strategy. It is important to address the 'supply side' of CBRN by tightening controls, and the 'demand side' by influencing state behaviour using a variety of instruments (diplomacy, deterrence, protection). Regional diplomatic initiatives e.g. in the Middle East, are required, as well as educational programmes for allies (Saudi Arabia, Pakistan), spreading good governance, supporting social and political reform, dealing with corruption and the abuse of power, establishing the rule of law and protecting human rights.

Opportunities

Terrorism can be tackled by addressing some of its root causes, including political repression, regional conflicts, poverty etc. Improved homeland defence will raise the cost of terrorism. However, we should avoid the temptation of attempting to deploy technological countermeasures to meet every conceivable threat scenario. It is unrealistic to defend every public building and every airport and highway. There will continue to be a need for states to protect key strategic assets, but overall efforts should be concentrated on trying to mitigate the generic threat. Homeland security and foreign policy need to be integrated into a coherent and genuine Common Foreign and Security Policy (CFSP) which includes positive measures to stabilise civil conflict and overcome polarisation, ghettoisation and discrimination. The EU should recognise the strengths and limitations of technology and not to divert scarce resources into wasteful technological 'fixes'.

Research Recommendations

- Application and further refinement of biometric technology to prevent identity theft and identity forgery.

- Investment in financial tracking technologies.
- Development of enhanced verification technologies, especially in relation to biological weapons and radiological materials.
- Cross-cultural research on conflict reduction strategies, including legal, educational and financial instruments, and on institution building.
- There is an urgent need to educate a new generation of arms controllers that understand the scientific and technological application of CBRN weapons and that can help devise effective means to control them through multilateral mechanisms.

A.2.3 Trends in nuclear proliferation

Threats

The ESS identifies WMD proliferation as potentially the greatest threat to the EU's security. It also links the issues of proliferation and terrorism that would allow a small group to inflict damage on a scale previously possible only for states and military organisations. In the near term, the main state-based proliferation concern is and will continue to be the risk that states remain within the Nuclear Non-Proliferation Treaty (NPT) but these states could go on to covertly develop the elements of a nuclear weapon. On a number of occasions non-state groups have shown an interest in using nuclear materials to commit a mass impact terrorist attack. An expanded role for nuclear - as part of a balanced energy strategy - will increase the number of nuclear facilities around the world and the volume of trade in proliferation-sensitive materials and items. To avoid vulnerabilities that could be exploited by terrorist groups it is of great importance to locate and safeguard fissile material and contain the spread of relevant knowledge.

Challenges

We need a deep and wide understanding and shared diagnosis of the problem that would provide the platform for EU policies that can be sustained over an indefinite period.

Opportunities

An analysis of nuclear proliferation trends demonstrates the inter-woven political, strategic, economic and technological dimensions of the issue. Therefore, when tackling the nuclear proliferation question, the EU must keep in mind that approaches to energy strategy, sustainable development, the willingness to strengthen governments in failing states and the preparedness to invest in peace support operations could all impinge on the likelihood of nuclear proliferation in specific states.

Research Recommendations

- Research on how arms control doctrine can respond to a possible 'second nuclear age' in light of the expiration of existing bilateral strategic arms control agreements and including exploration of the potential of regional mechanisms.
- Research future energy policies to explore the relationship between economic competitiveness, secure energy supply, environmental sustainability and regional and global security.
- Research into the future of the international nuclear safeguards system along two axes: legal/political and technical. Examine enhanced nuclear safeguard technology and analytical techniques that could facilitate the IAEA's ability to verify a states' compliance with its safeguards obligations (e.g., by improving nuclear material accountancy at bulk handling

facilities) and be applied by international organizations and bodies other than the IAEA to detect clandestine activities, including trafficking in nuclear weapon-related technologies and expertise..

- Studies of the research establishments in countries of potential proliferation concern, including the identification of facilities (such as specialized research institutes) where nuclear-related knowledge and materials are located, and how the proliferation relevance of R&D at such locations may be evaluated.

A.2.4 Trends in poverty

Threats

Poverty can fuel internal instability, with all that entails for local and regional security. It can also lead to voluntary migration, which not only robs developing countries of dynamic and valuable human resources, but also can cause problems in host societies. It is particularly in the EU's interest that countries on its borders are well governed and that violent or frozen conflicts are resolved. Combating poverty, inequality and marginalization both inside and outside of the EU's immediate neighbourhood will also continue to be relevant for European security. The concern is that development should not become an objective *only* in a security context, but should remain a goal in its own right.

Challenges

Ongoing poor governance often lies at the heart of these problems. Corruption, inefficiency and a lack of commitment to undertake policy and institutional reforms due to lack of internal social cohesion are inimical to reducing poverty. The post-Cold War period has additionally seen state failure characterized by weak (and in some cases collapsed) state institutions, abuse of power, corruption and lack of accountability. This situation compounds regional instability, while providing opportunities for organized crime, which thrives on the opportunities for illicit profits presented by conflict.

Opportunities

Trends in poverty reduction and the key resulting impediments all have important implications for future EU strategy, including in terms of science and technology policy. While progress towards the Millennium Development Goals (MDGs) rests on the combination of a large number of factors, the EU, with the Community and its Member States has a vital role to play – especially given that it provides some 55 per cent of global Overseas Development Assistance (ODA), is the world's largest multilateral grant provider (at 63 per cent), the world's largest single market and the main trading partner of most developing countries.

Research Recommendations

- In order to enable swift, effective and useful EU intervention in pursuit of poverty reduction, EU research funding should aim to ensure a multi-faceted character, with the cooperation of partner countries that are the most seriously affected. DG Research should aim to ensure that the results and recommendations resulting from such research are fed into the appropriate Directorates.
- Research into the effectiveness of the use of resources under various constraints (land, people, capital)

- Technologies for more efficient use of resources (agriculture, industry) and research into reliable distribution mechanisms for food, equipment and information.
- Social science research into the links between poverty and governance.

A.2.5 Trends in organized crime

Threats

Organized crime was one of the five ‘key threats’ identified in the ESS: principally involving drugs, small arms, trafficking (people, money, arms). Ethnic distinctions that define most organized crime groups are now beginning to erode. In the years ahead organized crime is likely to adopt a more ethnologically pragmatic, network-based approach. This makes sound business sense in a globalised world and amongst actors unfettered by political constraints. It will, however, make the roots and dynamics of organized crime more difficult to analyse, comprehend and counter.

Challenges

The virtue and efficacy of biometric passports and associated identification in tackling organized crime is highly controversial. Some view such ‘technical fixes’ with great suspicion, and the majority of developing countries will certainly take many years longer to introduce their biometric equivalents.

Opportunities

There is a growing political will at EU level to tackle organized crime e.g. EU support programmes in third countries now specifically demand its suppression.

Research Recommendations

- Given the link between organized crime, terrorism and failing states, DG Research programmes should aim to coherently research the three dimensions collectively, while acknowledging the demarcation lines between them.
- An audit should be conducted in order to gauge the extent to which Security Sector Reform (SSR) is capable of eroding organized crime, based on research into appropriate indicators.
- Social science research on preventing dangerous technology falling into the hands of criminals (dual-use problematic).
- Technologies for crime prevention and fighting.

A.3 Trends in Technological Security

A.3.1 Trends in nanotechnology

Threats

In the longer term, certain applications of nanotechnology will pose risks that will need regulation. Future military R&D in several countries could lead to nanotechnology proliferation that endangers international peace and security. In general, the nearly complete lack of resources for military-

technology assessment and preventive-arms-control research should be corrected. In the near future, specific studies should be devoted to the prevention of new chemical and biological weapons and appropriate transparency and compliance measures, and the limitation of autonomous fighting systems.

Challenges

The EU should co-ordinate nanotechnology restraint among its Member States active in military high technology. On the international stage, the EU should promote discussions at various levels with a view to agreed nanotechnology limitations, preferably by global treaties, alternatively by export control measures. Politically, one of the most important tasks should be to engage the US - as well as its potential opponents - in talks about preventive limits. Adherence to ethical and specific procedural rules should be demanded from R&D contractors.

Opportunities

Ethical rules for dealing with nanotechnology dual-use should be developed. Such rules can build on the regulations currently in force in the areas of human experimentation. Questions relating to the proliferation of knowledge about nanotechnology should be assessed. Exploratory studies should be conducted on the potential of nanotechnology in the verification of compliance with national and international rules and agreements.

Research Recommendations

- The EU should support R&D in the areas of better protection against terrorist attacks using chemical or biological agents. This type of research concerns mainly sensors as well as neutralisation and decontamination substances and devices.
- Research required regarding the question of dual use, given the ethical, legal and societal implications.
- Research on how co-operative international limitation of dangerous technologies can be implemented in the EU's best interest.
- The development of civil society participation in the international system that would allow the control of nanotechnology and other potentially dangerous new technologies.

A.3.2 Trends in Biotechnology

Threats

The future threat posed by the hostile use of disease will manifest itself on three levels. First, state programmes will continue to remain a serious cause of concern. Second, non-state entities appear to have an ever-growing interest in non-conventional weapons, including biological agents. Third, a significant segment of the biological weapons (BW) threat lies in the future as developments in science and technology may enable states, or even individuals, to develop stable and controllable agents to cause widespread and indiscriminate harm.

Challenges

At the core of the biotechnological revolution is information: data collection and processing, knowledge, techniques and skills. With today's globalization and growing interdependence this knowledge and the capacity to use it inevitably diffuses across national borders. While lateral proliferation processes are undeniably taking place, the greatest challenge to the future Biological

and Toxin Weapons Convention (BTWC) regime may actually come from a sudden massive application of civilian biotechnology for the purpose of acquiring a biological warfare capability by a state party facing a security threat. There is a need to strengthen the BTWC and the Chemical Weapons Convention (CWC). Generic countermeasures are possible, cost-effective, and necessary, however such measures must be undertaken long before an incident.

Opportunities

If a future BTWC verification regime is to remain relevant for many decades, it will require mechanisms to deal with the possibility of instant realization of the dual-use potential of biotechnology. In addition to the traditional verification and monitoring of the destruction and non-production of BW, it will have to incorporate an understanding of biotechnology and technology transfer processes that go beyond mere products (agents, production equipment, etc.). The aim of this new set of tools is to render transparent technology transfers between economic units (e.g. individuals, laboratories, companies, etc.) within a state and between economic units across national boundaries (including states and transnational companies and organizations).

Research Recommendations

- Research is required on how governments and public authorities can take wide-ranging preventive measures against biological terrorism without resorting to mass mobilization of national resources. Such measures must be generic and cost-effective, and benefit society as a whole through, for example, improvements in health and emergency infrastructure.
- Need to develop detection technology, and innovative means for engaging with research communities who may be involved with potentially dangerous developments in biotechnology, including the development of ethical rules within research and professional institutions.

A.3.3 Trends in Info-technology and cognitive sciences

Threats

Some information-technology (IT)-based military applications, in particular autonomous fighting systems and preparations for net/cyber war, could bring dangers for international peace and security, the security of citizens and even for democratic society itself. If preventive/limitation of the most dangerous military IT applications are not successful, serious and previously unrecognised threats to European security are likely to materialise.

Challenges

There is a need to reconcile or balance contradictory goals in IT R&D, to monitor and assess the potential adverse impacts of new developments, and to support technology for crisis-intervention capabilities, monitoring and verification.

Opportunities

IT provides options for monitoring and verification of compliance with rules and agreements. With its dominant political, multilateral approach to the resolution of conflicts the EU may be in a good position to affect the worldwide climate towards co-operative limitation of dangerous technologies including military applications.

Research Recommendations

- Research is required on how cognitive science can be more relevant to security or defence research and policy, including human-computer interaction, and monitoring activities such as computer simulation of weapons testing through community building in the appropriate scientific and technological professions.
- Research on how to contain information warfare.
- An overview study should be devoted to the potential of IT to monitor events and information with a view to verify compliance with rules and agreements. Specifically, automatic tools to find indications of illegal or unethical R&D or other activities – specifically in scientific literature, in the public media and on the Internet.
- Interdisciplinary research should study how to balance the increasing need for transparency with the right to privacy.

A.3.4 Trends in Military technology

Threats

There should be a distinction made between *immediate* threats *directed at the EU*, demanding direct EU science and technology/research and development (S&T/R&D) responses, and *potential* as well as *indirect* threats. What are not risks today may be risks tomorrow if the right actions are not performed. The problem of conventional weapons proliferation needs to regain political saliency as an issue. We need to understand better how the arms trade operates and what the consequences of proliferation of all types of conventional military technology are; how proliferation is likely to occur in the future and what the security consequences could be. There is a danger that EU-US disagreements on civilian aerospace subsidy will spill over into the defence field, and that the perceived need to compete with the US could draw the EU into an economically destructive ‘arms race’. However, ensuring that needs are defined by users rather than industry should help to limit this threat.

Challenges

The security sector needs to better understand how civilian technological advances can be altered in order to meet internal and external security needs, as defined by user groups. There should be funds made available for the evaluation, testing and demonstration of the potential of these technologies for security use. A particular aspect of western societies is the quick spread of IT and related goods and services. This is also reflected in the S&T/R&D military planning for network-centric warfare. This creates a particularly high degree of societal risk given the vulnerability of the structures/networks themselves; while making such structures/networks secure is costly. Sweden currently seems to be managing this successfully in the field of network centric warfare, and their system should be investigated.

Opportunities

- It should be possible for the EU to formulate a long-term ‘baseline’ for an EU Science and Technology-based innovation system: one in which societal/individual security and military security-related threats as well as creative perceptions, aims and ambitions are presented in a strong policy and institutional framework. That baseline should directly relate S&T/R&D disciplines or activities to the ESS. This baseline needs to be discussed and revised at regular intervals, especially in light of changing EU policy aims. In order to avoid

duplication, ways of encouraging national defence research organisations to put in joint bids for funds should be investigated. Could a special scheme, including all the necessary security provisions, similar to that currently operated by the European Science Foundation be put into place? Also, a focus on the specific needs articulated by the European Defence Agency (EDA) should help funding to be targeted in a way that moves ESDP further down the path of being able to fulfill all Petersberg tasks (humanitarian, peacekeeping and crisis management) as quickly as possible. It will be necessary to develop new types of arms control strategies to deal with new types of actors and technologies.

Research Recommendations

- Ensure that the money available for testing, evaluating and demonstrating the potential of civilian technology for internal and external security purposes is both open to small, niche firms or research programmes.
- Develop research links between the EDA and European defence research agencies and the European Commission.
- Science and Technology-based military innovation skills, competences and potential in smaller EU members including new members.
- Developments in and potential (deliberate preparations) for military use of commercially available technologies and equipment.
- The importance of military S&T/R&D skills for the creation and use of asymmetric force. Such a study could be combined with studies of conflict developments in general and in EU neighbouring countries or regions, particularly the Middle East.

A.3.5 Trends in Space Technology

Threats

The informal US policy of refraining from putting weapons in space seems increasingly in question as perceived risks to US space assets from a variety of sources grow. The capacities and intentions of the North Korean regime remain unclear, and the US suspects China of developing lasers designed to destroy satellites in orbit. Moreover, the very dynamic of modern warfare threatens to blur the line between militarization and weaponization of space, increasing the likelihood of conflict in outer space. An attack on Western space assets could be a ‘grand equalizer’, denying the most developed countries the ability to use their most lethal and sophisticated weapons which are dependent upon space-based Command, Control, Communication and Intelligence systems. European militaries are a part of this dynamic as well, as they are increasingly dependent on space assets.

Challenges

The increasing proliferation of ballistic missile technology is another element driving the militarization, and possibly weaponization, of space. Faced with the challenge of shooting down a missile in flight, the US is looking to space both as a platform for detection sensors and a potential launch point for anti-missile munitions to strike enemy missiles upon launch or mid-flight. This would be a destabilising development, as it could be perceived as developing a first-strike capability, or encourage other states to develop and deploy space-based military platforms.

Opportunities

Confidence-building steps between the EU and US hold the promise of reducing the likelihood of space warfare. Both the US and Europe will need to gain mutual assurances that they will continue to enjoy access to and use of their space assets. A more ‘water-tight’ regulatory regime for the Global Monitoring for Environment and Security (GMES) and Galileo satellite systems, for example, could significantly lessen US fears of a potential breach of the systems’ neutrality – thus reducing one incentive for putting arms in orbit.

Research Recommendations

- Research required in ballistic missile development and WMD developments in countries of concern and ability to weaponize missile, i.e. make delivery vehicles with warheads.
- Non-missile strike capabilities: laser, other forms of energy
- Research into the use of space-based remote sensing for verifying compliance with international agreements on arms control and the environment, and for monitoring industrial accidents and natural disasters.
- Vulnerability of current and future EU space assets.

The 10 most important policy issues for EU security until 2015:

1. The EU needs to mainstream a strong conflict prevention mechanism horizontally across all major foreign policy fields, including international cooperation in science and technology. This mechanism requires substantive analytical capacity and the technical backup in order to pursue upstream conflict prevention.
2. The EU Homeland Security agenda needs to be coherent with its foreign policy agenda. The technical capacity of both Homeland Security and foreign policy also needs to be augmented, specifically regarding intelligence sharing and retrieval. EU military capacity also needs to specialise (demarcation of tasks) and streamline (battlegroups concept), while airlift capacity needs to strengthen dramatically.
3. Technology should become a centrepiece of EU foreign policy in the future. However, there is a need for a clear technological code of ethics governing dual-use, which safeguards individual privacy and increases necessary transparency. Also, there is a need to ensure that potentially harmful technology is kept out of the hands of terrorists and organized crime, while stabilising technologies are shared as widely as possible.
4. Arms Control: there is an urgent need to invest in a new generation of arms control, non-proliferation and technology experts able to understand the new scientific challenges posed by existing and emerging technological breakthroughs (across Nanotechnology, Information Technology, and CBRN technologies) and the means for their regulation and constraint through multilateral and regional frameworks.
5. There is a need for a renewed emphasis upon area studies combined with security studies/conflict studies in the social sciences to investigate the regional contextual sources of contemporary security concerns (regional security complexes, terrorism, failed states, “risk society”, poverty, organized crime etc)
6. There is a need to understand further the importance for EU Co-operation with neighbouring countries and key partners such as China and the US as well as the need for strategic autonomy in responding to contemporary and future security threats, as well as opportunities for the future evolution of the ESS. A co-operative and synergistic approach needs to be balanced with the ability to go it alone if needed, in terms of research, technology and action.
7. There is a need to further our understanding, as the basis for developing a European strategic culture on security matters, on what a common European security and threat assessment includes and continually revisit this analysis in the face of a changing security environment and in order to deepen further our understanding of threats, risks, opportunities and common (foreign and security) policy responses. Similarly, greater understanding is needed of the causes of insecurity in Europe and about strategies for security building.
8. State failure and disintegration, internal conflict and organized crime, could trigger major threats to European security. This is most likely to happen in the poorest area of the World, particularly in Africa and on Europe’s eastern and southern borders – but also in pockets of deprivation within Europe. Despite a recent surge in analysis, there remains a great need for further study of the causes and consequences of civil wars on the African continent. Fighting poverty and improving governance throughout the world is a major security challenge for Europe.
9. It is important for the governments and public authorities to realize that counter and preventive measures must be taken long before a terrorist incident, in particular using the technologies surveyed above, occurs.
10. The security sector needs to better understand how civilian technological advances can be altered in order to meet internal and external security needs. The potential contributions of other sectors, both public and private, need to be recognised and supported as well.

B. Responding to specific security scenarios

The analysis in Part A was refined into a more precise analytical framework through the construction of five scenarios relating to the future European security environment. These served to illustrate how the key threats and challenges identified earlier might manifest themselves in particular contexts.

It should be understood that the scenarios are not predictions, nor are they even considered probable developments. They are just useful as instruments for organizing thinking and helping to prepare for future developments in light of uncertainties. The scenarios were able to provide more precise ideas about geo-strategic regional issues, horizontal security trends internationally and on technological security trends.

These scenarios were presented to the European Commission at a workshop attended by the authors, project partners and Commission officials in June 2005.

B.1 Geo-strategic scenario: *Nuclear device detonated in Europe*⁴

B.1.1. Context in 2015

Europe remains a potential target for mass impact terrorist attacks. There are significant geographical areas not far from the borders of the European Union, outside government control, that could provide armed groups with places to train and accumulate materials and weapon-relevant items. Large stockpiles of fissile material stockpiles remain in Russia, the security of which continues to be a cause for concern.

Terrorist groups may further develop their links to organized crime and to individuals working inside nuclear establishments. When combined with weak international nuclear safeguards, there is a risk that the thefts of small quantities of materials will go undetected. These thefts may be undertaken for financial and not political or ideological reasons but the internal network between terrorists and organized crime provide a pathway to extremist groups.

The amount of nuclear material in Russia is not known and no official figures on Russian stocks exist. While estimates involve large uncertainties, varying by several hundreds of tons, the upper limit of the current estimates of HEU held in Russia is 1,400 tons, enough for some 30,000 crude nuclear explosives. These stocks are managed with very little transparency and are not subject to

⁴ This scenario is not a prediction, nor even a probable development. It is a useful instrument for organizing thinking and helping to prepare for future developments in light of uncertainties.

any international safeguards. Confidence that they are safe and secure rests entirely in the level of faith we have in the Russian authorities.

For the purposes of the scenario it is assumed that security upgrades continue to be implemented in Russian facilities, but that these are given a relatively low priority.

B.1.2 The Scenario

In this scenario, the main uncertainties (and uncertainties are inevitable in judgments about the future) relate to the developments in the political sphere. There are fewer uncertainties in the technology sphere because the properties of nuclear explosive devices are reasonably well understood and possible to predict based on information in the public domain.

Having spent ten years accumulating highly enriched uranium (HEU) in small quantities, a terrorist group has sufficient material to construct a simple gun-type nuclear explosive device. The material is used to assemble a device, which is then detonated in a city of a country bordering the EU. Between 40,000 and 100,000 people are killed. Understandably, the capacity of the targeted state to respond to the immediate consequences of the attack is quickly overwhelmed. The scenario is only driven by technology to a limited degree, and preventive approaches and humanitarian responses are equally if not more relevant to consider here.

Trigger: The event that is the trigger for the scenario is clearly hypothetical. Efforts have been made to ensure that the projections that set the initial conditions for the event are credible and plausible. Each of the background conditions is considered likely, given what we currently know. Therefore, while it is not suggested that the event at the centre of this scenario is probable (let alone likely) it is argued here that there is a clear possibility of such an event.

The risk of a nuclear terrorist attack taking place in future is significant given the identified trends amongst mass impact terrorist groups combined with the availability of fissile material, the questionable quality of nuclear security and the relative ease with which a functioning device could be constructed once adequate quantities of suitable material had been acquired. However, such an event is almost certainly not imminent, given that very considerable quantities of fissile material would need to be accumulated to compensate for the lack of sophistication in weapon design that a terrorist group would be likely to use. Therefore, a systematic preventive programme would have a very high probability of succeeding and forms the main part of a credible positive outcome to the scenario described below.

The design for a nuclear explosive device is different from that likely to be used to build a nuclear weapon as traditionally understood in state arsenals. However, there are continued refinements in the technology of nuclear material protection, control and accountancy and in the EU (including in fact inside the European Commission) there is a very great deal of technical expertise that can be applied in understanding and addressing the technology issues raised in this scenario.

The security of Europeans is affected in several ways by such an event. First, a successful terrorist attack on the borders of the EU would have a serious impact on the domestic politics of the targeted country. Second, the demonstration effect of such an attack would have an impact on the wider

effort to fight global mass impact terrorism. Third, the quantity of material available to the group that carried out the attack would be unknown along with its location and their intentions concerning further attacks. Fourth, the nature of the international response, and in particular by the US, would be difficult to predict.

The terrorist group issues a statement that it has in its possession sufficient material for a second device and states that unless its political demands are met this device will be used to attack a second major city. Large numbers of people spontaneously begin to evacuate major cities in the country in question. Many of the evacuees travel to the borders of the EU.

If the negative outcome to the scenario actually came about, there could be a technological component to the response where it could be necessary to manage large numbers of people assembled at the borders of the EU, including the delivery of medical and other humanitarian assistance on the other side of the border. In this case there would be a need to respond at the border of the EU in conditions where a significant number of sick and wounded people are trying to enter the Union. The technological implications of responding to this credible negative outcome of the scenario would include understanding what kinds of medical and humanitarian treatment would be required, where this treatment would be delivered and by whom.

B.1.3 EU preventive measures

An expanded nuclear security programme

There is a strong case for Europe to support increased efforts to secure and, where possible, reduce the stockpiles of fissile material that could be used to make nuclear explosive devices, in particular those stocks of materials that could be used to make a device without the need for additional processing. HEU and plutonium stockpiles should be consolidated in fewer locations, which are easier to protect. The process of consolidation could also take into account the possibilities for decommissioning research reactors that are no longer needed for the purpose of separating isotopes for experimentation.

Expanded capacity to respond at the borders of the EU

The EU has established mechanisms to combat terrorism, organized crime, environmental threats and threats to public health and safety within its border. Many initiatives exist to develop integrated border management at the EU's external borders. However, these efforts do not always connect together in all of the fields that would be required to ensure security within the EU. In particular, existing programmes for cooperation with countries that share borders with the EU lack cross-border dimensions in WMD-related areas.

An enhanced programme on counter-terrorism cooperation with Russia

The common interest in combating terrorism has been a key theme in recent political statements from the EU and Russia. The documents agreed at the recent EU–Russia summit included the desirability of exchanging ideas and models for combating terrorism as one among many suggestions for enhanced cooperation in this area. This could increase the degree of commonality in the approaches taken towards counter-terrorism operations in the EU and in Russia. Moreover, at the declaratory level the question of how to develop an effective counter-terrorism programme that remains proportionate and respects democratic values, protecting individuals while upholding human rights, is one of shared interest.

Relations to EU science and technology policy

There is a strong case for the development of further knowledge and intelligence related to the security situation in Russia, including the questions of the future developments in the security sector (including a better understanding of the scale of financing that is being directed to security-related activities and the wider economic impact of such financing), in civil-military relations, and in relations between the centre and the regions in Russia (in light of the wider political development within the country).

There is a strong case to continue to investigate the approaches to preventive action in the field of nuclear security. These investigations should include a natural and applied science element focused on issues related to nuclear material control and accountancy. These types of investigations should engage the nuclear pole of DGs Transport and Energy as well as the Joint Research Centre.

There is still a need for a systematic and dedicated programme to build a nuclear security culture in Russia and in other countries. This is a programme that should engage the scientific and the industrial communities from the EU and from Russia in multi-disciplinary projects in the nuclear, biological and chemical functional areas.

The development of a mobile capability able to respond to CBRN terrorist events could assist the delivery of post-event humanitarian and emergency assistance either within the EU, at its borders or to populations within the affected country. The feasibility of including this capability as one element in programmes to manage the borders of the enlarged EU could be one area of further investigation. The response in case of a request for assistance would depend partly on the capacities that exist and partly on the effectiveness of a deployment of those capacities. Forward planning and exercises in which participants from both EU countries and countries adjacent to the EU think through how responses could be organized in different scenarios would be potentially useful areas for further attention.

The organisation of an integrated border security management system around the periphery of the enlarged Union could aid border control. The inclusion of a WMD-related component into the integrated border security management system of an enlarged EU should be investigated, taking into account both preventive aspects of border management and crisis responses.

B.1.4 Recommendations

From the brief outline above a number of areas emerge in which scientific- and technological research could make a valuable contribution to gaining a better understanding of future problems and fashioning responses. Our analysis concludes that a systematic preventive programme would have a very high probability of succeeding. This should focus on:

- Research focused on assessing the risk of nuclear terrorism in countries close to the enlarged EU should be given a high priority as part of EU WMD non-proliferation effort. The research should also focus on identifying responses to identified risks.

- In a similar vein, focus should be placed on coordination and cooperation with the countries around the periphery of the enlarged EU to take preventive actions and to prepare responses to a nuclear terrorist event or other act of catastrophic terrorism.
- It is crucial to identify and support the nuclear security measures that can safeguard and control all relevant materials that a terrorist could use (over and above current efforts in Russia and Ukraine). Equally, the EU should help to develop a programme for building a ‘nuclear security culture’ to be introduced as part of the curriculum in scientific and technical training programmes within the nuclear establishment of Russia and other countries.
- In designing such a research programme, representatives of the relevant internal actors (such as the Joint Research Centre, other nuclear safeguards specialists, border management and security specialists as well as relevant country and regional desk officers) should be engaged. Experts from Member States, the Council and other competent partners could also form part of an advisory body.
- Any EU sponsored and managed research programme in this area should draw on the knowledge of, and be conducted in, cooperation with international organisations with relevant expertise. Special reference is made here to the International Atomic Energy Agency, the International Science and Technology Centre (ISTC) in Moscow and the Science and Technology Centre of the Ukraine (STCU) in Kiev.
- Another research focus should be on the linkages between the domestic economic, political, social, ethnic and demographic development of countries around the periphery of the enlarged EU and tendencies in the development of international, mass impact terrorism.

B.2 Homeland security scenario: ***Biological incident in Europe***⁵

B.2.1 Context in 2015

The reality of the threat posed by bio-terrorism can no longer be denied. Today the nature of this threat lacks specificity. Terrorist organizations may be more likely candidates for large-scale bio-terrorist attacks than criminal organizations, although the latter might be involved in extortion schemes involving the threat of poisoning with toxins (poisonous substances derived from living organisms). Criminal acts involving biological agents (mostly toxins) are in the overwhelming number of cases committed by individuals as an act of revenge or out of a grudge against another individual or company.

There are many types of agents. Biological agents differ in infectivity and pathogenicity, and therefore pose different levels of threat. However, while certain agents primarily affect human

⁵ This scenario is not a prediction, nor even a probable development. It is a useful instrument for organizing thinking and helping to prepare for future developments in light of uncertainties.

health, other ones target animals or plants, and may consequently be used for economic terrorism while they would pose less of a danger to the perpetrator. These types of threats might escape from common EU policies as a consequence of the human health approach to bioterrorism. Targets can be humans, animals or plants and the purpose of bioterrorism may be societal or economic disruption rather than mass casualties.

The present scenario assumes that by 2015 the EU has adopted a counter-bioterrorism policy focusing on particular threat agents. These agents are being researched for the development of effective prophylaxis, medication and vaccines. In addition many research programmes funded by the EU and individual member states address the growing concern about emerging and re-emerging diseases, which are responsible for a large number of outbreaks inside Europe and in the continent's periphery.

In several EU member states high-containment laboratories have been set up in which researchers are looking into genetically modified pathogens in order to determine to what extent existing medication and vaccines might be overwhelmed. As part of the efforts to reduce the risk of disaffected scientists and laboratory workers in neighbouring countries (Russia, Ukraine, as well as Middle Eastern and North African countries) being involved in illegal weapon programmes, the EU has set up several collaborative programmes promoting peaceful uses of biology and biotechnology.

In addition, individual EU member states are promoting extensive scientific and technology exchanges with some of the neighbouring countries to counter the threat of newly emerging diseases plaguing different parts of the world. They invite foreign scientists to participate in research programmes inside the EU. In comparison to ten years earlier, the overall fear of biological warfare has receded as a result of more peaceful security interactions in Europe's periphery. Nonetheless, some societies remain unstable as a consequence of unequal distribution of wealth and religious rivalry.

B.2.2 The Scenario

On 31 June 2015 some vague reports appear in the national press of an EU Member State about several people having come down with a mysterious illness. It emerges that whatever is causing the disease, the symptoms progress fast and it has a high fatality rate. Although initial symptoms are flu-like, specialists in infectious diseases are baffled because of the lack of response to available medicines. By mid-July the first cases emerge in two other Member States, and the disease spreads further thereafter. There is the suggestion that truckers driving across Europe may have carried the disease, as the initial local cases in the other countries appear to have their presence in petrol stations along motorways or motels in common. It is soon clear that the picture about the epidemic health officials have is hours, if not days behind the actual situation.

Governments close borders, and attempts are being made to quarantine infected people. However, at the same time, economic activity grinds to a halt as supplies no longer come through and people refuse to go to work. Soon this turns into social unrest as a consequence of the lack of food supplies and other essentials, on the one hand, and the rapidly dropping confidence in the ability of the authorities to handle the crisis.

Preoccupied with the unfolding crisis, nobody links the disease outbreak to a news story that had appeared on 4 June about the murder of the wife and three children of a microbiologist working in the EU and his disappearance. These events were then widely viewed as a family drama. In fact, a criminal syndicate had held them hostage while he was forced to smuggle genetically modified pathogens out of the high-containment laboratory.

Trigger: *The trigger for this event was a criminal syndicate using extortion to gain access to genetically modified pathogens out of a high-contamination laboratory. The lessons learned, however, are applicable to whether the disease results from deliberate, accidental or natural causes. While the revolution in biotechnology will bring numerous new nefarious applications of disease, it will also - if applied appropriately - create many new opportunities to deal with health threats from benign/natural or accidental causes as well as from hostile sources. In other words, some of the policy development should be geared towards harnessing biology and biotechnology for peaceful purposes.*

B.2.3 EU Preventive Measures

The goals of biological terrorism may be diverse. Not only is it possible for terrorists or criminals to select biological agents with effects ranging from incapacitation to a high risk of lethality, they can also target agriculture or infrastructure to cause economic damage. No government can prepare to deal with all contingencies. The measures to be taken in order to prevent acts of terrorism, protect the population and infrastructure, and deal with the consequences of a terrorist event must be designed and executed in such a way that they cause the least disruption to economic and social activities and do not diminish the fundamental organizing principles of a society. While it is necessary for policy makers to sufficiently prioritize the threats posed by biological terrorism, it is equally important not to excessively dramatize the threat and especially the consequences of hypothetical events.

Development of health infrastructure

The basic options with regard to countering the dangers of deliberate disease or poisoning with biological agents (toxins) are the development of (1) a nation's general health infrastructure with some supplementary measures that target some specific risks, or (2) countermeasures against specific threat agents. The first option is the preferred one. A range of generic measures that bolster the existing health and emergency infrastructure and procedures may go a long way in dealing with such threats. Rather than disrupting a society, they may actually be beneficial to the population in ordinary as well as extraordinary circumstances. As governments and public health officials are increasingly confronted with threats posed by emerging and re-emerging diseases (e.g. Severe Acute Respiratory Syndrome (SARS), polio, Marburg virus, influenza, etc.), the generic measures would also help to build the necessary capacity to deal with naturally occurring emergencies. Some of the generic measures are set out below.

Of particular importance is that there is a good regional distribution of emergency wards (including staff) and a spare capacity of beds. In the case of an emergency following the release of a biological agent against humans, there is an immediate need for a surge capacity to deal with the emergency.

Many other measures will lose much of their effectiveness if the ability to deal with a sudden massive influx of patients is non-existent or inadequate.

Rapid detection and identification of an outbreak is of critical importance to take the correct emergency measures. This is crucial, as with certain diseases (e.g. anthrax) it is still possible to administer vaccines or medication immediately after the infection has occurred. Highly contagious diseases may have spread much farther than the latest intelligence would indicate to decision makers. The longer the delays in identification, the greater the emergency they would have to confront. Early and up-to-date intelligence on the progress of the epidemic is critical for early decisions on containment and quarantine strategies. It will be important to mobilize distribution channels and production capacity of vaccines or medication, as well as to mobilize international assistance.

Many of today's physicians will not be familiar with some of the diseases that are of the greatest concern for use in warfare or by terrorists. Such refresher courses would improve their ability for rapid and accurate diagnoses (a doctor who had taken an emergency course quickly suspected anthrax in the first victim of the letters with anthrax spores in the US in October 2001). Furthermore, regular training would be a very cost-effective contribution to the need for early and reliable intelligence about an outbreak. Often civil emergency services are well equipped to deal with industrial disasters. Their equipment should be complemented to deal with cases of deliberate outbreaks, and the staff should be trained in how to deal with suspicious outbreaks.

The size and nature of stockpiles of vaccines, antibiotics and antidotes are a function of the emergency plans the public health authorities develop. In the case of the anthrax letters in the US in 2001, there was a rapid shortage of adequate antibiotics and the dependence on a single (foreign) supplier exacerbated the situation. Also, the recent failure of influenza vaccines in the US because of the forced halt in production in the UK demonstrates the need for adequate stockpiles until such time that the distribution channels become operational or the production can be increased.

Communication equipment should be adapted or developed to common standards. These standards must be applied not only to emergency services on the territory of a single EU member state, but also among member states, neighbouring states and more widely as disease will not stop at borders. In addition, common protocols must be designed and adopted in order to address the issue of the many languages within the EU.

Development and adoption of crisis communication strategies

Crisis communication strategies are designed to be able to inform the public in a responsible way. Among the measures to be considered are the identification of authoritative sources of information for the public at both national and EU level and the establishment of procedures to maintain communication even under the gravest of circumstances. Both the national and EU authorities should conclude agreements with different sectors of the press in order to prevent – as far as possible - sensationalist reporting that might contribute to panic with attendant pressures on stockpiles of antibiotics and social disturbances. In addition, political authorities and key personnel should receive training in crisis communication. The communication strategies at high-risk industrial facilities and industrial evacuation procedures probably offer a good starting point.

Training and simulation

Simulation exercises and training of crisis response and management are required at all levels of decision-making and across the multiple agencies that would be involved in a large-scale emergency. They must involve local, regional and national politicians, the people responsible for managing and overseeing emergency responses, and the press. Tabletop exercises for the highest levels of decision makers would focus on overall coordination and communication strategies with the different services and commanders on the scene of the incident. While single-day exercises are sufficient to test certain components of the emergency procedures, it is also necessary to plan occasional simulations that may last several days, in order to examine the overall integration of these components. The tabletop exercises are complemented by realistic field exercises simulating the exercise on the ground. It is imperative that the simulations are concluded, even if situations emerge that are unpalatable to democracies (e.g. quarantine measures for humans for highly contagious diseases, and their enforcement by means of lethal force if necessary).

EU members are already conducting such simulations with regard to incidents at nuclear or industrial facilities or major accidents, and the exercises for biological and chemical terrorism can build on these experiences. However, industrial disasters like the ones in Seweso (1976) or Bhopal (1984) or the recent outbreak of SARS suggest the need to develop and test the emergency procedures at all levels. Many lessons in this respect can also be learned from the terrorist strikes against the Twin Towers in New York and the Pentagon in Washington, DC on 11 September 2001.

In Europe, with its many small countries, a need exists to run cross-border training exercises whereby the organization of emergency response procedures among EU members is tested and improved (e.g. by discovering and resolving legal and bureaucratic obstacles preventing emergency and law enforcement or specialized military units to operate on the territory of another EU member). Similarly, EU-wide technical assistance programmes must be tested in practice. The important point to bear in mind is that the preparation and fine-tuning of procedures takes many years, and these activities should be undertaken soon.

Specific measures for countering CBW threat

The generic measures described above (which probably make up 80–85 per cent of the preparedness against a biological attack) should be supplemented by some specific measures. They include the stockpiling of vaccines and medication against low-probability, but high-consequence biological agents for both military and civilian use. Before there is a serious incident - especially with a highly contagious pathogen -government authorities should identify the priority services and personnel who should have access to pre-treatments and medication. These groups of people extend beyond the obvious categories of first responders, medical staff, and police forces. In the economies of advanced industrialized states, personnel responsible for the energy supply, food distribution, and so on, are equally vital to prevent the collapse of a functioning society. Such an assessment should be based on the careful analysis of the functioning of critical infrastructure and integration of services in the EU member states.

For the civilian authorities it is equally important to realize that the military standards for chemical and biological decontamination differ fundamentally from those required in a civilian setting. Military standards for decontamination are governed by operational necessity on the battlefield and under certain circumstances military commanders have to accept chemical or biological casualties. There is no such tolerance for casualties in civil society. However, if the civilian standards are set at unnecessarily low levels or, worse, no commonly accepted levels have been adopted, then the

normalization of activities will be considerably delayed and this could cause considerably more social disruption and economic losses than the actual terrorist attack.

B.2.4 Recommendations

To conclude, since it is impossible for any policy maker or health official to predict what a biological attack might involve, it is important not to become fixated on certain types of biological threats that *might* be used, as this would only drain resources from the public health infrastructure and divert much of the research, vaccine and medicinal development away from *naturally* occurring disease outbreaks. The response, therefore, should be driven by generic considerations, such as:

- Investments in health infrastructure should ensure that there is a good regional distribution of emergency wards and a spare capacity of beds, with some supplementary measures that target certain specific risks. Establishment of specialized, well-equipped laboratories for rapid identification of pathogens; enhanced production capacity of vaccines or medication; familiarizing all health ‘first responders’ with unusual diseases; investments in communication technologies for emergency services etc.
- The EU should continue to engage in international programmes to employ scientists, technicians and other professionals who were formerly involved in offensive BW programmes, both within Europe and in partner countries as appropriate.
- It is imperative that the EU develops its independent intelligence capabilities and interprets the data in accordance with European security needs. Moreover, it needs to adopt common standards and criteria for interpreting risk and threat data so that the analyses are acceptable to all member states.
- The EU should develop a new generation of vaccines and medication. This would not only deal with emerging and re-emerging diseases, but also be prudent vis-à-vis ‘traditional’ diseases.
- The EU should develop early warning and detection technologies. At present detectors exist for specific agents. However, considering that many different types of pathogens could be used in a biological attack there is a need to develop early warning and detection systems that are more generic. Investment in leading edge technologies is needed, which may require public funds to stimulate industry interest.
- There needs to be improved mental adaptation to risk. Proper information provision from the authorities, along with familiarization with the emergency procedures, help to alleviate people’s fears.
- It is important to strengthen the disease surveillance infrastructure and procedures in the 2005 accession states and in current EU candidate states – especially in the transitory period just after they accede – as these are currently seen as an Achilles’ heel to current EU bio-security policies.
- The EU needs to monitor and develop a response capability with regard to non-human pathogens too. Although the EU can deal with the terrorist BW threat as a consequence of its competences in the field of human health, attacks against plants and animals (agriculture) or against the economy in general are outside its remit.

B.3 Regional security: *Turmoil and Crisis in North East Asia*⁶

B.3.1 Context in 2015

The selected geographical focus here is North East Asia: a region of major geo-strategic importance to the EU and to the wider international community. It is also important for many other reasons as well (technology, economy, regional security, transnational issues). There are secondary but important transnational dimensions to the scenario, including issues of poverty and development, financial risk, migration and refugees, ideology, internal turmoil and transition from entrenched authoritarian government.

From the perspective of 2015, a number of factors have accumulated in recent years that undermine North East Asian States' continued capacity to manage and avoid key domestic and regional conflicts. China, after several decades of rapid economic growth (of 8 – 10 per cent per year), has entered a period of relatively slow growth (4 – 5 per cent) and uncertainty.

Meanwhile, the regime in North Korea (DPRK) has successfully retained power, but on the basis of strict authoritarian control rather than reform. The international community has long become accustomed to this, though security anxieties associated with the development of a modest DPRK nuclear arsenal had gradually legitimised the development of a more 'normal', i.e. robust, Japanese defence policy, and reinforced US military alliances with South Korea (RoK) and Japan.

B.3.2 The Scenario

***The Trigger:** In late 2014, centralized state control within North Korea collapses, and fractures within the ruling elite in DPRK open up. South Korean troops (but not those of the US or Japan) are invited in to assist with restoring order. The outcome of the increasingly violent struggle for power in North Korea is not clear.*

The location of the DPRK's nuclear weapons remains unclear, but fears of a launch against South Korea and Japan are high. China, the US and Japan are on high military alert, amid intensified mistrust. In the Taiwan Straits, Taiwanese authorities also go onto high military alert. The risks of further escalation, and widening military conflict appear high. The EU and the rest of the international community struggle to prevent and defuse the conflicts.

The scenario is designed to clarify and illustrate the challenges and priorities for the EU and its partners in addressing factors and trends relating to possible major geo-strategic security issues. It also contributes to appreciating issues relating to regional security and the interaction between domestic, international and transnational processes.

⁶ This scenario is not a prediction, nor even a probable development. It is a useful instrument for organizing thinking and helping to prepare for future developments in light of uncertainties.

North East Asia continues to be a region of immense strategic importance, with relationships between China, Japan, US, Russia, Taiwan and the Koreas – all strong or medium military powers – continuing to exhibit a complex mixture of tension, suspicion and co-operation. Difficult disputes between these states/entities remain unresolved, as policy-elites from these states hope and assume that economic and other self-interested considerations will continue to prevent crisis or war. Even in relation to North Korea, the status quo appears to many to be better than the collapse of the regime, with resultant upheaval, migration and uncertainty. However, there is a real risk that the region will enter a period of turmoil and crisis by 2015, threatening devastating war. In this context, this scenario is well adapted to highlight the significance and need for effective measures to prevent, reduce and manage conflicts in this region by the EU and its partners.

B.3.3 EU Preventive Measures

The EU needs to consider various confidence-building and conflict prevention, management and reduction policies and programmes relating to North East Asia, including a broad range of security co-operation mechanisms. It should advance policies and programmes that promote domestic reform (good governance, rule of law, democratic institution building, tolerance, restraint, etc) in China, DPRK and other relevant countries. Capacity building in relation to the UN and other international regimes is important to develop the capability to respond to crises and aid stability and security. Partnerships and common approaches need to be forged between the US, Russia, Japan, China and others to engage constructively with conflict prevention and management in East Asia, along with the promotion of civil trade and economic development.

There is a range of credible variants relating to the outline scenario described above. A relatively benign and a relatively malign scenario are possible, both of which have the same essential factors: slowing economic growth rates, crisis in North Korea, and unresolved issues over the Taiwan Straits leading to a regional crisis.

Within this framework, the relatively benign scenario is one in which policies, programmes, reform processes and regional/international security-building processes help to limit and contain the intensity of the crisis and facilitate relatively successful responses to it. The EU and other OECD countries become increasingly engaged with the challenges of promoting security and co-operation in North East Asia. Having long stood on the sidelines of US military and political engagement with China and DPRK, and North-East Asia more generally, the EU decides to add an important politico-military dimension to its economic, trade and cultural relations with the countries in the region. This comes at some cost, since it raises difficult issues that some EU member states would prefer to defer. But, perhaps stimulated by the need to address DPRK nuclear weapons programmes, EU Member States join Japan and the US in mounting concerted pressure on China to take stronger action to pressure DPRK in relation to its nuclear weapons programme.

As the scenario proceeds, the EU and its allies review overall policy towards the region, strengthen political and security relations with Japan, South Korea and ASEAN countries. The EU's military presence in the region remains low, certainly compared to that of the US. However, conflict management and prevention is given a higher priority in EU policy and programme engagement. A decision is taken to ensure that EU and other, non-European states play an active, multilateral role in promoting co-operative security and defending non-proliferation regimes, rather than leaving the US to act largely independently. This is manifest in several areas. One is to engage more forcefully

in supporting efforts by ASEAN states and by Japan to establish military confidence-building measures and other co-operative security frameworks in East Asia, to facilitate conflict prevention and conflict management capacity. Although EU influence is limited, this has the impact of clarifying global multilateral interest in these issues.

The relatively malign scenario is more in line with ‘business as usual’ trends, in which pressures to tackle the factors underlying the crisis have been modest, and the crisis catches the international community relatively unprepared, without the capacities, shared confidence and understandings to respond in a co-ordinated and co-operative manner.

B.3.4 Recommendations

This scenario highlights a wide range of issues specifically relating to EU and its partners’ engagement with North East Asia and also other key geo-strategic regions far from Europe. Following the specific scenario, there are many issues for scientific and technological research raised. However, there are also generic issues that would be raised also in relation to possible crises in other regions. A key point to notice in relation to this scenario is that understandings and enhanced EU policies, programmes and technology transfer regulations over a period of time can contribute to relatively modest incremental steps toward stabilisation over the next decade in geo-strategic areas that can nevertheless make all of the difference when/if a crisis occurs.

The outcome depends on a combination of prior development of frameworks for security co-operation and availability of instruments for crisis management. Considerations here include the degree to which political/security networks are created, developed and sustained in North East Asia over the coming period. Within that broad framework, will be the extent to which transfers of military (including actual weaponry) and dual-use technologies (including civil nuclear technologies) can be controlled. It will be important to build confidence-building mechanisms, including the development and applications of verification and intelligence technologies.

In many key respects the North East Asia scenario demonstrates the need for a number of enhancements to current research that have generic applications. For instance, in order to help us to prevent such a scenario requires:

- Social science research into: the key political and security developments and trends in the region, and of the countries that comprise it; the relationships between economic, societal and political processes (including democratization) and security issues; lessons learned from crisis response and conflict prevention missions, and humanitarian/peace-support interventions;
- Enhanced research into conflict prevention, management, reduction and resolution, and development of the institutional and technical instruments available to the EU and its partners to pursue these;
- More research of strategic/security linkages between science and technology, especially dual-use technology transfers from the EU and its partners to East Asian states - particularly China - and the political/security implications;
- Relevance of transnational science and technology communities to regional conflict prevention, management and reduction;

- Enhanced understanding about the use, and limits of use, of EU instruments (aid, trade, preventive diplomacy etc.) to exert pressure on states for internal reform and regional confidence and security building processes.

In other words, social science research is needed to help European and regional policy makers to improve the conditions for regional stability, confidence and security building, crisis management and reduction, good governance, and the legitimacy and stability of governments. The scenario also highlights a number of natural and engineering science and technology priorities, including:

- Enhanced technology assessments relating to dual-use and military transfers;
- Improved capacities to detect, monitor and verify the presence or movements of sensitive WMD technologies and materials;
- Enhanced EU capacity to monitor and assess developments (including population and military movements) in areas such as North East Asia.

B.4 Regional security scenario: *Turmoil in Gulf of Guinea*⁷

B.4.1 Context in 2015

In addition to the colonial history and political, economic and personal ties that grew out of it, the Gulf of Guinea has become one of the major oil-producing regions in the world. While most of the oil produced in the sub-region will likely go to the US in the future, it is also likely to become an increasingly important supplier to some countries in Europe. The countries in the sub-region as well as the US will look to Europe to contribute to securing the flow of oil.

Most of the states in the sub-region are very poor. The legitimacy of governments is low. Parts of the territory in the region are currently out of reach of government control. In the Niger Delta violent clashes between various armed groups and government forces take place from time to time while in the Angolan enclave of Cabinda the militant Front of Liberation of the State of Cabinda (FLEC) continues to operate.

All of the states in the region maintain strong ties to Europe, all having been European colonies (of the UK, France, Spain). Elites in these countries continue to be oriented towards Europe. Children are primarily sent to France and the UK for education. Migration to Europe is a common and desirable ambition. Family ties between migrants and relatives at home are strong. However, economic relations between the sub-region and Europe are unbalanced. Europe is important as a trading partner and source of investment for the countries, while the countries are economically of minor importance for Europe. Some countries, such as Cameroon and Republic of Congo in the region continue to be major recipients of economic assistance from Europe.

⁷ This scenario is not a prediction, nor even a probable development. It is a useful instrument for organizing thinking and helping to prepare for future developments in light of uncertainties.

The Gulf of Guinea region hosts a number of major oil producing states, particularly Nigeria and Angola (Cabinda). Oil from the region already constitutes a major share of oil imports of some European states, and, even more so, the US. Oil, and also gas, production in the region will grow as new production comes on stream (because its oil needs to be transported through the Gulf of Guinea, Chad, a coming major producer, often is seen as being part of the region). The US is not only the leading importer of oil from the region; US companies are also dominating the oil business. In the US, the Gulf of Guinea is often seen as strategically important. Estimates from various sources, including the US National Intelligence Council put the share of oil coming from Sub-Saharan Africa, with more than half of it coming from the Gulf of Guinea, at up to 25 per cent of US imports by the year 2015. As the share of the region in US imports is likely to grow, the strategic importance of the region for the US will also increase.

People in the region are overwhelmingly poor, and are likely to remain so by 2015. Income per head is very low in Nigeria, with more than half of the population living on incomes below the internationally defined poverty line of US \$1 per day. Incomes in other oil producing countries are higher, but only Gabon can be considered a (lower) middle-income country. Income distribution is highly skewed in all countries. Even in the relatively better off countries, some areas are very poor. This includes some of the oil-producing regions, such as the Niger Delta region in Nigeria. Migration is high, with Europe and the US as preferred destinations. Levels and quality of education are low. Qualified students strive to attend quality tertiary education institutions in Europe and the US, contributing to major 'brain drain'. Increasing oil production may raise income per head in some countries, including Equatorial Guinea, Sao Tome and Principe, and Chad. However, theory indicates and history demonstrates that this may not necessarily be the case.

While it is difficult to make any prediction about the political systems prevailing in 2015 in the relevant countries, it is fairly easy to predict that the level of legitimacy of the state, whoever rules, will be low unless there are major improvements in economic well-being and internal conflict between social groups. Research-rich countries are surprisingly often afflicted by bad governments – in the sense of not delivering public services to citizens, including security and welfare. Corruption is often rampant and governments rule autocratically in the majority of states in the Gulf of Guinea region. In a number of these states, the combination of poverty and incapable government has weakened already weak state institutions, reduced people's confidence in politicians and officials and led to civil unrest. As a result, all states in the Gulf of Guinea region are widely regarded as being 'fragile states'.

B.4.2 The Scenario

***Trigger:** Massive parallel demonstrations, acts of sabotage and shutdowns of oil and gas installations in oil producing regions of Western Africa are escalating into widespread violence. The objectives of the uprising are unclear (unfriendly regional governments? independence? ethnic tensions?). Some groups with possible connection to international terrorism may be behind the acts of sabotage. One African government reacts by sending troops into the region, which further intensifies the conflict and it spreads to other countries in the region. Massive population movements result, including increased refugee flows within Africa and to Europe. The US government, which draws 25 per cent of its oil from the wider sub-region, is extremely worried about the situation and calls for European intervention.*

With violence growing and oil production stopped, one African government decides to act with military force. Some groups with possible connections to international terrorism are conducting acts of sabotage on offshore oil installations and attacking pipelines and tankers. Other governments in the region remain silent, even though violence has spread to their territories. It is not clear whether they support the violence, which now spreads further and government forces cannot quell the unrest. Instead, large parts of the region become unstable and the situation degenerates into civil war. Fighting is increasingly brutal with atrocities committed on all sides. Massive population movements result, including increased refugee flows to Europe but primarily to other parts of the region.

The US government is very worried about the situation. US warships are engaged in patrolling offshore operations. While this results in fewer attacks of offshore installations, warships themselves become targets of sea-mines and crude missiles. Pressure on the US government to also protect installations on shore grows. In turn, the US government calls on Europeans, with their historical ties and their own oil interests in the region to joint action to stabilize the situation.

The lives and livelihoods of Europeans are not directly threatened by the events described in this scenario. However, with major disruption in oil imports, oil prices are rising. European oil companies are losing income and assets. With continued fighting, immigration levels may become so high that they present a burden to economies and societies in Europe. If acts of sabotage are really committed by terrorists, than these groups may also extend their activities to Europe, presenting a threat to the lives of European citizens. Clashes among militant groups and between these and government forces lead to significant battlefield deaths. However, much worse is the situation of civilians, particularly the refugees, in affected African countries. Humanitarian organizations cannot work properly because of the ongoing fighting and the general chaos on the ground.

While not a security threat in itself, the strong stand of the US government is a major security concern for European political decision-makers. An unwillingness to help the US would contribute to a deterioration of the relationship between the US and Europe. Whilst no direct threat to the security of European, the unfolding humanitarian catastrophe, the level of oil imports, migration flows and US interests will put pressure on European policy makers to take steps to contain, possibly help to solve, the crisis.

If things go well

The members of the EU increase humanitarian aid, promise additional development aid to the countries, focusing on particularly poor regions. At the same time, the EU offers its good services to help facilitate the settlement of the conflict. Mediation by the EU Foreign Minister and EU Special Representatives is successful. Officials benefit from the advice of social scientists with regional expertise and a good grasp of the situation in the region. Part of the success lies in their ability to offer packages of development assistance and trade measures to improve the economic situation in the respective countries, utilising the expertise and connections of the expatriate communities based in Europe.

In the affected African countries, the EU uses a number of instruments for short-term stabilization of the situation. After further assessment of the situation, which again benefits from the input of academic country and regional expertise, teams of policemen and administrators are dispatched. This provides the foundation for a more long-term engagement in economic and political

reconstruction. Refugee flows to the Southern borders of the EU are at a manageable level. Refugees are properly screened at entry points and brought to pre-established refugee camps for later temporary settlement in communities all over Europe. The US is content with the European stand, and is also following a policy of constraint. After some further bloodshed, and death from starvation and diseases, parties to the conflict establish a truce. The uprising ends, and production and export of oil and gas resume.

If they don't

Fighting and humanitarian crises in those African countries affected reach levels that neither the US government nor European governments and public are willing to tolerate. Open war between these African countries seems imminent. Refugees increasingly move to other countries in the region, in the wake also spreading turmoil and chaos to other states in the region. The sinking of a patrolling US warship by a missile triggers a US decision to send troops to the region. The UN Security Council sanctions military action on humanitarian grounds. European decision-makers decide to participate with forces in a US led military action to occupy the Niger Delta. Refugee flows to the Southern periphery of Europe are growing. Screening of refugees becomes a problem. It cannot be excluded that militants from the region now see Europe as an enemy and plan to conduct acts of terrorism in Europe.

B.4.3 EU preventive measures

European science and technology policies with effects on situation factors

The appropriateness of European reactions to the unfolding crisis is contingent on understanding it properly. Two factors seem of particular importance for such understanding: a) a solid knowledge base about the conflict formations in the relevant region (see above, structural factors) and b) intelligence on leadership, actions and plans of militant groups, as well as governments and political opposition groups in the region. While government authorities will likely have to primarily rely on intelligence service with appropriate means (signal intelligence, informants, photo-intelligence), knowledge resources are best built in academic institutions. (These will also be an important recruiting ground for intelligence services.)

The probability of a reasonably good outcome is increased with the availability of, and experience with, a wide range of instrument for conflict resolution. Research is needed to support the development and use of appropriate instruments for conflict prevention, resolution and management, including topics such as how to deal with states in various forms of decay or decline, how to mix instruments of development, diplomacy and coercion (sanctions), and on priorities for external aid in crisis situations.

If the situation deteriorates, the members of the EU will need to decide about sending troops. If troops are sent, they should obviously be sent with the best possible technology for logistics, intelligence, reconnaissance and, ultimately, fighting. As this is a vast field of technologies, this will not be deepened here.

Refugees from West Africa will reach Europe primarily by boat over the Mediterranean. In addition, some entries via commercial airliners (with false passports and visas) can be expected. Prevention of refugee flows to Europe has many facets. From the point of view of science and technology policies, border patrol technologies are particularly pertinent. Screening of refugees will

require, in addition to physical searches, interviews and other techniques for checking of identities. Again, this is not the place to expand on an area that recently has received much attention in Europe.

How well the countries in and around the Gulf of Guinea could be doing by 2015 will largely depend on whether they have democratic, open governments, reduced poverty and economies that are growing even outside the oil and gas sector. Economic dependence on oil and gas production may well still be high, but efforts can be made to reduce it through investment in other economic sectors. One of the forms of investment is into education, where Europe has a major role by accepting students to European schools and universities and providing support to educational and training institutions in the sub-region, with the aim of building indigenous capacity rather than succumbing to the temptation to recruit “drained brains” into European employment. One approach could involve support for European/African partnerships, whereby franchising, distance learning and other arrangements would benefit educational establishments both in Europe and in the region.

European science and technology policies

It is assumed that the level of attention given to the sub-region remains fairly constant between 2005 and 2015. The discussion on how European S&T influences the trajectories of the major factors identified above focuses on scientific exchange and other forms of training, reductions of dependence on oil and gas, research on the improvement of livelihoods outside the oil and gas sector, and the promotion of social science for good governance.

S&T for improvements outside the oil and gas sector

Improvements in agricultural production, as well as in a broad range of manufacturing activities are crucial to improve living conditions in the countries concerned. Oil and gas income provide the opportunities to invest in the diversification of production and exports, in agriculture, industry and services. S&T can help leverage such investments. Without further detailed analysis of bottlenecks and opportunities for economic improvement, it is not possible to prioritize S&T fields. However, in view of the continuing importance of agriculture in the countries concerned, improvement in agricultural production would be an obvious candidate. Other research priorities would be in public health and the delivery of online education to rural communities. A related issue is that of conflict-effects of economic growth and development. A number of strategies and instruments have been developed under the heading of conflict-sensitive development; however more research is needed to improve their practical application in various circumstances.

Reductions of dependence on oil and gas

This has been and continues to be a major field for S&T in Europe. Obviously it is important quite apart from the topic discussed here, but the security dimension adds to its weight. Achieving a reduction in the dependency on oil and gas will depend on the success of diversification. Investment in immediate down-stream activities can assist here, supported by research on which sectors are of particularly good development potential for each of the countries in the region.

Scientific exchange, training

The application of modern technology in the oil and gas sector, including in down-stream activities as well as improvements in other income earning activities, will yield increasingly better results with growing numbers of high class researchers, engineers, technicians, and educators from the relevant countries. The basis for scientific work in these countries is very weak. Until 2015 it will,

at best, be possible to lay some of the foundations by increased training of students from these countries in Europe and support for educational institutions in the sub-regions.

Social science for good governance

Another area with potential to have some influence on the trajectory of major variables until 2015 is social science research that helps policy makers in Europe and the sub-region to improve the conditions for good governance, focusing on the legitimacy and stability of governments, and better mechanisms for the delivery of public services. Relevant areas of social science research include research into the functioning of the control of small arms and light weapons, conflict formations and resolutions, constitutions and other institutional arrangements.

B.4.4 Recommendations

This scenario predominantly covers issues of regional security in a region of some political and economic interest for Europe, arising from poverty and government failure made worse by resource scarcity. Recommendations for S&T policies illustrated in this scenario are primarily in the fields of social science, particularly area research, development research and research on good governance and technologies relevant for conflict prevention and crisis management, particularly intelligence and military capabilities. Other S&T policies with relevance for the scenario include energy conservation and border control. Prevention strategies that Europe could consider include:

- Improvements in agricultural production are crucial to improving living conditions in the countries concerned. Oil and gas income provide the opportunities to invest in the diversification of production and exports, and S&T can help leverage such investments.
- Although a number of conflict sensitive development strategies and instruments have been developed, more research is needed to improve their practical application and effective integration into the productive economy.
- The application of modern technology in the oil and gas sector, including in down-stream activities as well as improvements in other income earning activities, will yield increasingly better results with growing numbers of high class researchers, engineers, technicians, and educators from the relevant countries. Institutions are needed that are capable of educating, training and sustaining their work in the region.
- Effective, humanitarian immigration control needs to be able to distinguish between legitimate and illegitimate refugees. Technology for identification of documents and persons, as well as for information collection and storage can be useful in this respect.
- Research to support the development and use of appropriate instruments for conflict prevention, resolution and management includes topics such as how to deal with states in various forms of decay or decline, how to mix instruments of development, diplomacy and coercion (sanctions), and on priorities for mobilising external aid in crisis situations.
- Social science research is needed to help policy makers in Europe and the sub-region to improve the conditions for good governance, the legitimacy and stability of governments.

Area studies to enable European reactions to the unfolding crises being based on solid knowledge about the region and the causes of potential conflict (as in previous scenario).

B.5 Technology driven scenario: ***Cyber Warfare and New Weapons***⁸

B.5.1 Context in 2015

The use of new weapons - based on information technology, nanotechnology and biotechnology - provide a potential for much more clandestine and unexpected types of attack, and the ability to destabilise the military situation. Counter-technologies, such as software agents, are deployed to help to find the violators of limitation treaties or sensors to detect explosives or chemical/biological warfare agents.

Since most of the dangerous new weapon technologies are still under research and development, there is an opportunity for preventive limitation: prevention being much more effective than “therapy”. New technologies can be used to monitor for dangers (at borders, important traffic centres, government buildings), contain the consequences of incidents (protection) and help in overcoming them (decontamination).

Clouded in secrecy, most countries with strong armed forces have prepared for information warfare. Cyber attacks would use secret `backdoors` in widespread operating systems. Co-ordinated action by thousands of network computers, in part using sleeper agents, both of the electronic and the human variety, would be augmented by physical destruction of central communication trunk lines and nodes, and possibly satellite communications infrastructure, both earth-based and in space.

Following the US introduction of unmanned combat aircraft, other leading producers develop them too and some export them with few restrictions. Lightweight carbon-nanotube (CNT) composites, very powerful computers and small sensors and actuators are used widely in civilian industry so that imports of hardware components are easy to arrange without arousing suspicion. Flight-control, target-recognition and other algorithms for (semi-) autonomous movement and action can be developed based on publicly available information; there is suspicion that specific algorithms and programmes have been sold illegally or stolen.

Technology for weaving/spinning carbon-nanotube-based fibres into arbitrary forms and forming strong, lightweight composites is used in many countries. One large country that produces small arms develops all-plastic small arms with CNT-composite barrels and (maybe recoilless) metal-free ammunition and exports them in large numbers. Via civil wars in Africa they spread to criminals all over the world. Security equipment for their detection is being developed, but has not yet been deployed at many locations.

⁸ This scenario is not a prediction, nor even a probable development. It is a useful instrument for organizing thinking and helping to prepare for future developments in light of uncertainties.

Based on the same principle, and using more powerful nano-particle-based propellant, smaller missiles are developed. Using small sensors, actuators and guidance computers `child-portable` air defence systems are developed (30cm long and 2kg mass) that are capable of reliably shooting down civilian aircraft. Rockets just 2m long are routinely used to launch miniature satellites of below 1kg mass. Even though docking on, or hitting, another satellite is extremely difficult, suspicion about the intention to do so are high. There is also an increasing fear that very small ballistic missiles (of 2-5m length) may be used to hit strategic nuclear targets with high-precision, small, non-nuclear warheads (maybe using target-seeking sub-munitions).

Suspicion grows that new biological or chemical weapons against organisms - based on advances in biotechnology, pharmacology, nanotechnology, genomics and proteomics - are being researched and developed in many countries. In Europe, in order to deter a threat, calls grow for the pursuit of an offensive research and development programme for biological weapons.

The consecutive steps set out below address different technologies in isolation, whereas, in reality, a number of events would take place in rapid succession or simultaneously involving a mix of technologies. The intent is to emphasise systemic thinking (in terms of the international security systems) and to stress the high leverage that prevention provides. If prevention is unsuccessful, once certain thresholds are crossed, action-reaction cycles are likely to occur that will be very difficult to stop until the system arrives at a new - perhaps uncertain - stability. One present example of such a threshold would be the introduction of space weapons. A near-future threshold would be the introduction of autonomous combat systems (aircraft at first).

B.5.2 The Scenario

It is difficult to devise a realistic purely technology-driven scenario. In reality, aspects of technology would enter other conflict scenarios in various forms and to various degrees. In order to demonstrate the technological aspects, this scenario is an artificial, condensed combination of events tied to information technology, nanotechnology and biotechnology. It is intended to highlight the importance of preventive limitation of cyber warfare and new weapons based on information technology, nanotechnology and biotechnology. Recommendations for science and technology policy follow from that.

***Trigger:** civil war breaks out in a state adjoining the EU - in a situation similar to former Yugoslavia in the early 1990s. Among immigrants from A and B, there is strong support for the respective causes with money being collected and volunteer fighters being recruited. Apart from the warring factions other non-state actors get involved (terrorists, supporters, unknown); this spills over into EU territory and leads to attacks on the communication infrastructure (with resultant breakdown) leading to severe economic consequences; terrorist attacks on decision-makers; escalation to large-scale armed conflict involving the EU.*

Bad Case Scenario

In response to the EU intervention, terrorists linked to side A attack buildings of the European Commission and of national governments with small missiles programmed to deliver an explosive payload through the windows of particular rooms. Because new, expensive detection equipment has not yet been set up at many airports, hijackers from side B are successfully smuggle all-plastic firearms onto several aircraft, take them over, and crash them into government buildings. Unknown

actors launch a large-scale, software-virus attack on European computer/communication networks. Communication is severely hampered, damaging mostly the civilian economy. The computers used in the attack are based in a country outside Europe – country C - and make it appear that it was this government that conducted the attack.

While the EU and member states ponder retaliation, after a few days side A exploits the opportunity and launches a cyber attack against country C, making it appear to come from the EU. Except for independent military lines, communication in country C collapses for several weeks. Fearing that country C – in the belief that the cyber attack has come from the EU and no longer able to react in kind – would attack Europe, EU member states have autonomous mechanised combat aerial vehicles (UACV) patrol along its eastern borders. They repeatedly pass country C's combat aircraft at short distance. At one encounter, the control computer of one EU UACV mistakenly thinks a country C aircraft is attacking it. Due to the programmed short reaction time, it shoots the aircraft down. As a consequence of communication to the other UACV and programmed fast reaction, aircraft of both sides go into firing mode and armed conflict starts.

The bad-case outcome is extremely negative. There is no doubt however that it is possible. The very knowledge about this possibility will instil considerable caution in rational decision-makers; they would only escalate to the point of attacking an opponent if under extreme pressure. However, there is a risk that such perceived pressure could be the result of false information. Another possibility could be that one party gambles with a show of force that does not go as expected. And one should not discount the possibility of less rational decision-making, mistakes in the interpretation of information and accidents. Finally, there are many possibilities for systemic human and technical errors, or for human insubordination.

Good Case Scenario

Terrorists linked to A, while trying to smuggle mortars for attacks against government buildings, are interdicted at a European border. Intensified police checks find a van transporting artillery rockets. One car bomb explodes in front of a government building, but roadblocks with portable explosive-detection equipment prevent three others from coming close enough to injure a high-ranking decision-maker.

Sympathisers of B are caught when they attempt to smuggle pistols into the airports of Country C. No aircraft are hijacked. Unknown actors launch a large-scale, software-virus attack on the European computer/communication network. Communication is severely hampered, damaging mostly the civilian economy. They use computers in Country C and make it appear that the its Government conducted the attack.

EU and member states have doubts if the attack was indeed carried out by Country C. Side A has not prepared a large-scale cyber attack and does not act against Country C. As a precaution, EU member states have piloted combat aircraft patrol along the EU's eastern borders. They repeatedly pass Country C's combat aircraft at short distance. At one encounter, one EU pilot has the impression that a Country C aircraft prepares an attack, but waits to be certain. Recognising that he was wrong, he does not shoot at this aircraft. In another instance, a missile is actually fired and an aircraft downed, but because there is no automated fast transmission and reaction of the full squadron, the incident remains isolated and does not trigger general shooting.

A terrorist group spreads anthrax spores in several metro stations, but due to small, relatively cheap BW-agent sensors mounted in most stations, the consequences remain limited. Using new nanoporous decontamination agents, the stations are cleaned in a few weeks.

Preventive arms control is not a new concept. It is not about outlawing whole areas of technology. Instead it focuses on specific applications or, in a few cases, on military/hostile uses of generic technologies. The arguments and criteria derive from considerations of ethics, security, health, democracy etc. – similar to the usual technology assessment in the civilian sphere, but here applied to the tools of large-scale security activities of states. Examples of preventive arms control are the Protocol banning blinding laser weapons of 1995 and the BTWC of 1972 (that already prohibits development of biological weapons).

Except for cyber warfare and some aspects of precision weapons, all other new technologies mentioned below will probably only start to arrive by 2015. Thus, they may be more relevant at a later period of time; nevertheless they should be included because they would be based on tendencies starting much earlier.

Under more benevolent scenarios, international negotiations have led to agreements limiting armaments and to new humanitarian-law protocols, and this approach could be applied to this scenario. For example, there should be a new rule in humanitarian law forbidding cyber attacks against computer networks, and a treaty that bans unmanned combat aircraft (and similar vehicles for land combat). Further agreements rule out small arms and ammunition that contain no metal, and small missiles altogether. The BTWC remains in force and has been augmented by a compliance and verification protocol. Pharmaceutical and biochemical companies are inspected randomly. Software agents scan the scientific - including `grey` - literature, the Internet and public media for indications of illegal behaviour in all areas. Challenge inspections investigate the suspicious cases.

B.5.3 Recommendations

International preventive arms control is the central means of dealing with cyber, nanotechnology and biotechnological threats. Counter-technologies, such as software agents, are deployed to help find indications of non-compliance and sensors to detect explosives or chemical/biological warfare agents.

The main findings from the scenario suggest that in order to counter threats from nefarious applications of emerging technologies, EU research policy should be oriented towards:

- Interdisciplinary research on the design of preventive limits of dangerous new technologies or new military options, including consideration of the verification of compliance.
- Interdisciplinary (at least natural and social science) research on the risks of misuse of new technologies and consequences for international security, explicitly including military applications and civil-military interactions/exchanges, considering also the capabilities of small groups and second-level arms-producing countries.

- Social- and cultural-science research on the conditions necessary for agreeing to preventive limitation. Among the specific priority topics should be cyber warfare, autonomous combat vehicles, small robots, small missiles, new chemical agents, new biological agents, space weapons. Generic areas to be studied should include information technology, molecular biology and nanotechnology.
- RTD: of sensors for chemical and biological agents, radioactive, explosive and other dangerous material (smaller, cheaper, more sensitive – to be carried by security personnel), and of filtering, neutralising and decontaminating material; of co-operative technical means of verification (close-range sensors, remote sensing, tags/seals, inspection equipment, methods to find preparations for cyber attacks); of software agents that evaluate the scientific literature, public media, the Internet for indications of illegal or unethical R&D or other activities: complemented with broadened science ethics and community-building within scientific and technological communities across borders, particularly where active research with dangerous potential is known to be undertaken.
- Research on: how to set up an international high-level scientific committee on developments in science and technology that are relevant for security, to conduct observation, analysis and advice; systematic inclusion of the potential for misuse into the research and development process, incorporating consequences of military applications of technology and possibilities for internationally agreed limitations; the possible roles of professional societies and codes of conduct in such a process.
- Improved monitoring of compliance and early warning of potential problems.

C. Implications for EU Research and Innovation Policy

Part C of the project sought to identify the major implications of the scenarios for future developments in EU research and innovation policies – in particular its external dimension.

Introduction

Reflecting a wider shift in the EU's development,⁹ European research and innovation policy is in transition. In future, rather than being tied to industrial competitiveness - the *raison d'être* of the Framework Programme in the past - policy will increasingly have to include a stronger focus on other public policy objectives, including security. This is because, to date, European foreign and security policy has outpaced the modification of research and innovation policy. Consequently, there is not a Europe-wide basis for establishing a good understanding of issues that underpin security policy choices. Europe as a whole lacks expertise in some functional and geographical areas, whilst in other areas expertise is highly concentrated in certain countries. Those who might wish to make use of research findings do not have a wider European research community at their disposal.

Promoting a European Research and Innovation Area that includes a security component is crucial, therefore - regardless of CFSP-related developments in the EU Treaty provisions. National programmes, especially in smaller countries with insufficient resources, are unable to address the problem across a spectrum of different research areas. If the EU wants to continue to expand its role in the world it will require a research community of sufficient capacity, quality and breadth to sustain it.

An effective security research programme needs to be based on the best possible understanding of anticipated trends and developments across a wide spectrum of different functional areas and in different parts of the world. It also needs to encompass areas of research, particularly in the social sciences, that may not previously have been considered relevant to security building. In the next budget cycle, therefore, it would be unwise to allow concerns over the limits of Commission competence artificially to restrict areas where research is sponsored. In respect of innovation, insofar as this refers to the development of specific technologies through applied science and engineering, the situation is different. The use of Community resources would probably not be appropriate where there was a risk of duplicating the efforts of Member States.

The scenarios examined earlier suggest that developments in 'hard science' are more predictable than those in social science. Overall, the EU needs a better understanding of social, political and demographic developments in different parts of the world. Specifically, it needs to incorporate that information into better security assessments, to understand both the origins of threats, whether hostile or as by-products of other natural or human causes, and the efficacy of measures designed to

⁹ As noted earlier, with the publication of *The international dimension of the European Research Area* (EC, 2001), EU research and technology policy became linked with foreign policy objectives for the first time. This development is described and elaborated in the Commission Report entitled *Security Research: The Next Steps*, published in September 2004, found at: http://europa.eu.int/eur-lex/en/com/cnc/2004/com2004_0590en01.pdf.

mitigate or to prevent conflict. This requires research programmes and projects to be structured in ways that facilitate both international and cross-disciplinary studies and analyses.

So what are the wider implications for the EU's overall research and innovation policy? Drawing on the findings above, the aim should be to develop a vision for research and technology that enhances European security over the next ten years. Accepting the reality of globalisation and increased interdependency, the premise is that European security now depends upon extending to others the power sharing and cooperative regime it has itself so effectively applied internally. And that this include forms of cooperation in research and innovation, science and technology similar to those that helped to pave the way for the accession of ten new Member States in 2004.

Through the Framework Programme and the European Research Area in particular, the EU has already developed a wide range of instruments for international cooperation, and refined associated concepts and approaches. For example, it has successfully designed pragmatic and effective policies for intellectual property rights and for balancing cooperation in research and technology development with fostering industrial competitiveness.

C.1 Implications for conflict prevention and crisis management

The above clearly points towards a greater emphasis being placed on conflict prevention and crisis management capacities. Research is needed to generate knowledge that can guide various investments in security building measures. A renewed emphasis in bolstering the social sciences - including Area Studies – would help us to better understand the causes of conflict and hence help us to prevent future ones. The causes and consequences of state weakness and failure, the changing nature of weapons proliferation, and the consequences of mass impact terrorism all require deeper analysis and comprehension. This could be followed by an investigation into the effectiveness of the application of existing policy instruments relating to development, diplomacy and coercion (sanctions). This is needed because although the ESS recognises the need to apply a broad spectrum of instruments it has yet to fully understand the implications of doing in particular combinations and in specific locations and contexts. There is also a need for the exploration of alternative mechanisms for security building associated with the re-conceptualisation of economic and social development in these terms. This could apply to consumer movements and corporate ethics development, for example, or research initiatives in agriculture, information infrastructure and animal health, by international charities, and their inter-linkages with more conventional “security research”.

Another recurring theme has been the importance of providing ‘enabling’ skills - practical and technological assistance - to potential accession states and neighbours, and in regions affected by possible or actual conflict. The EU has an obvious vested interest in ensuring that these countries can properly enforce their border and export controls. It should also expand those programmes that employ scientists, technicians and other professionals who were formerly involved in WMD programmes or where there is a risk that scientific knowledge will be misapplied. New cooperative threat reduction programmes should be developed in countries wherever appropriate, and should involve biological, as well as nuclear and chemical weapons. Developing joint science and technology projects that engage the relevant scientific community in peaceful research and development activities would have multiple and tangible security benefits to the EU, in addition to economic, environmental and other benefits in an interdependent world.

Successful conflict prevention and crisis management also still requires enhancements to existing - and the development of new – technologies (for example, transport capacity, communications capability and quality of intelligence). In respect of controlling the illegal trade in weapons, tagging technologies need to be developed, along with sensors to improve monitoring and tracking the flow of goods.

When considering how to expand and improve information/intelligence requirements, again it is the quantity, quality and analysis of such information that will make Europe more secure, rather than technology *per se*. In confronting terrorists who rely on minimal technological support and who are linked through familial bonds, technology serves to generate, intercept, and translate actionable intelligence - as the use of closed circuit television images and mobile telephone intercepts has recently demonstrated in respect of identifying and arresting suspects in the London terrorist bombings. However, technology is not sufficient; trained interpreters and analysts also need to engage with increasingly sophisticated technologies and networks of agents, which requires research into knowledge management to improve recognition, evaluation and rapid, appropriate response to threats.

Promoting cross-cultural understanding and dialogue among and within different ethnic and religious groups - especially in relation to young people and in areas of high unemployment - is vital in combating terrorism. The engagement of research and educational institutions in Islamic countries, in partnership with their counterparts in the EU, should be made a priority here. Developing innovative ways of conducting research using new media and information technologies – such as the Internet and satellite television - should be supported.

C.2 Structural versus thematic elements in EU policy

A mixture of thematic, horizontal and structural elements, and approaches which combine these elements, is needed in any successful EU research, technology and innovation policy. Themes that emerge include crisis prevention and management, and understanding the sources of conflict and terrorism. New structural elements would include incorporating security assessments into technology development policies. The need to strengthen particular research fields, such as increasing the funding of area studies, could constitute a key horizontal element across all thematic areas.

In a rapidly changing security environment it is important to anticipate the types of research that are orientated towards societal - rather than traditional military - security. A redefinition of security to encompass economic, social cohesion, environmental and other issues, requires new research into how best to build and sustain that security. For instance, research is needed into how to stabilise international financial markets, develop industrial ecology, control greenhouse gas emissions, construct social capital, enable endogenous innovation and economic development, and so on.

As internal borders in Europe have dissolved, so too will the dissolving boundaries of the European Union make territorial defence of the EU as a whole increasingly less relevant. The armaments industry is not irrelevant to defence against contemporary threats, but much of it will need to be re-oriented to deal with the very different nature of those threats, some of which have become more internalised. So, military technology will continue to make a contribution to future security, and will find limited derivative application, for instance via the control of smuggling of illegal goods, drugs and immigrants.

But the growth area for technological applications to security challenges is likely to be in the implementation of internal surveillance systems such as the introduction of biometric identification cards, and data mining activities, ostensibly as measures against terrorism, but also in relation to combating crime and preventing social security fraud. Nevertheless, serious questions remain as to whether such increased surveillance methods will in effect improve security. The deleterious impact on privacy and civil liberties that would result from this state-sponsored surveillance could - by undermining the trust of those sections of society whose cooperation is essential in combating terrorism - actually *decrease* security. It is essential therefore that 'security impact assessments' are applied before any decisions are made to apply new technologies in this way.

Although technological trajectories can be extremely complex to identify - and the link between military and civilian technologies difficult to decouple - certain patterns have emerged. Aerospace technologies, for instance, are generally highly transferable between military and civil applications in either direction. Electronics are more complicated. In the US, for instance, electronic-based inventions developed by civilian industry were 'captured' early on by military sponsorship. But subsequently, civilian markets overtook military contracts in commercial value, and innovation in non-military electronics made more rapid progress, with the ironic consequence that a significant number of US weapons systems became dependent upon imported Japanese electronics.

The situation in Europe is different again, in part because many countries' armaments industries never developed into a separate and economically significant industrial sector. Nevertheless, there is considerable evidence that the US experience in microelectronics applies across the board in Europe as well. As long as the 'pull' from the civilian market is sufficiently ambitious and demanding, most of the demands of the military market could be met by using civilian-driven technological developments.

The EU's Framework Programme is well equipped to support RTD related to security in areas that traditionally have not been associated with the military. Each Framework Programme's six-year duration provides the necessary continuity and flexibility to cope with changing requirements. It is also important to stress that parts of the Framework Programme that are *not* associated with the European Security Research Priority within FP7, may nevertheless have significant security implications.

For those industries in decline for which economic conversion or dual-use technology policies are appropriate, the Structural Funds may be more appropriate vehicles for innovation support than the Framework Programme. Moreover, the Structural Funds can leverage innovation support mechanisms with other types of support for economic development, such as training and regional infrastructure.

C.3 Consequences for Science and Technology

Europe has an industrial policy focused on making military industry more competitive. But it must ensure that this policy serves – and does not drive – its foreign and security policy. For instance, in the initial phase of constructing a ‘Security and Space’ theme within FP7, the consultative process was conducted largely within those industries and communities associated with the development of armaments and military systems. It is hardly surprising, therefore, that the four priorities identified as part of the proposed FP7 were oriented towards protection against terrorism and crime; infrastructure security; border security; and emergency management. Within the sub-category of ‘Space’, there is also a call for the development of Global Monitoring for Environment and Security (GMES).

Three of these four priorities are already orientated towards security *within* Europe as opposed to more traditional territorial defence, and GMES incorporates environmental security. Hence, the means of reorienting science and technology priorities for European security towards non-military applications already exist. The crosscutting themes within the security sub-category are: security systems integration and interoperability; security and society; and security research co-ordination and structuring. Of which, ‘Security and society’ has the potential for identifying ‘mission-orientated research’ based on citizens’ perception of security-related needs such as technologies for crime prevention, detection and prosecution, for reducing other types of risk (e.g. financial, health, employment, accidents) for safeguarding privacy and civil liberties, and research on ethics. It will be important to involve social science disciplines to investigate and analyse risk perceptions among European citizenry.

Other priority areas of science and technology relevant to European security enhancement can be identified within other parts of the Framework Programme as well. For instance, biotechnology poses a range of new threats and opportunities that need careful assessment and application. HIV/AIDS is one example of how a global pandemic threatening to Europe can be addressed through international research cooperation. The GMES activity has already provided a platform for space technology focusing on satellite systems for global navigation and remote sensing, relevant for both military and non-military use.

C.4 Implications for the external dimension of EU policy

Cooperation in military technology development has occurred through intergovernmental agreements, and through small-scale programmes such as EUCLID. But mainstream science and technology cooperation in the EC/EU and in other organisations such as European Cooperation in the field of Science and Technology Research (COST) and Eureka, has been deliberately restricted

to non-military R&D. This civilian, cooperative approach should now be exported to the wider world.

European international cooperation (INCO) policy for research and technological development is also in transition. With the publication of *The International Dimension of the European Research Area* in 2001 (EC, 2001), EU research and technology policy became linked with foreign policy objectives for the first time. Rather than being tied to industrial competitiveness (the *raison d'être* of the Framework Programme), policy for INCO focuses on largely *non-economic* objectives more typically associated with public sector responsibilities and services.

C.5 Implications for transatlantic relations

NATO scientific cooperation has been relatively small-scale in comparison with intra-European science and technology cooperation programmes, although it also has mainly concentrated on civilian research areas. Unlike the industrial focus of European programmes, however, NATO prioritised areas of basic science and mathematics. From the early 1990s, Partner countries from Eastern Europe and the former Soviet Union became eligible for support, which broadened to address security concerns such as economic conversion.

In 2003 NATO renamed its Science Programme the NATO Programme for Security Through Science. There are currently two main priority areas. The first is scientific collaboration for defence against terrorism, which concentrates on rapid detection of WMD agents or weapons, rapid diagnosis of their effects, physical protection, decontamination, destruction of agents and weapons, medical countermeasures etc. The second is scientific collaboration to counter other threats to security, including environmental security (e.g. desertification, pollution, etc.), management of water and non-renewable resources, modeling sustainable consumption (e.g. food, energy etc.), disaster forecasting and prevention, information security, and so on.

To the extent that European objectives align with those of NATO's Security Through Science programme, therefore, EU Member States already have a vehicle for transatlantic cooperation. This could be further developed, although there would not appear to be a case for participation at EU level unless a specific demand were to emerge.

C.6 Technology relations with neighbours

The *International Dimension of the European Research Area* document (EC, 2001) specifies various technologies that are priorities for cooperation with Mediterranean and Western Balkan countries as part of the FP6. These include specific reference to the promotion of co-development for greater 'stability, prosperity and security', with an implied need for technology transfer. Priority areas include 'integrated management of water, agriculture and the agro-food industry, health and environmental protection...' - consistent with the types of security-building activities identified earlier in this report. Perhaps most interestingly, there are measures specifically aimed at meeting social challenges, for example, the preservation of cultural heritage: particularly important when building trust and good relations between nations of different faiths.

EU cooperation with certain neighbouring countries is further developed and formalised through Association Agreements. Specified research priorities for cooperation with Russia and the Newly Independent States have also been identified. The latter are intended to stabilise the research capacities of these countries, with particular attention to conversion of military research to civil applications, and cooperation on problems such as non-proliferation, health and environmental safety related to industrial change.

C.7 Importance of arms control

The inadequate level of knowledge about states' weapon programmes has been highlighted as a general problem in arms control in recent years. The risk of states acquiring nuclear, biological or chemical (NBC) weapons has been exaggerated in some cases and either underestimated or simply not recognized in others. Arms control is particularly relevant vis-à-vis scientific cooperation and technology transfer: for instance, in the fields of treaty verification; the provision of alternative research for those engaged in military R&D; and in arms export controls.

The verification of arms control treaties requires technological expertise in the weapons systems under control, a system for monitoring technology development and testing, and the deployment of weapons (through remote sensing, seismology, radiation detection, through intercepting communications, and other techniques) and a method for evaluating the implications of information gathered. There are serious deficiencies in all three respects in Europe. It would seem sensible to build upon the types of research expertise and accumulated knowledge through EU initiatives, in the first instance through consulting experts and then by consolidating existing arms control, verification and peace research in Europe.

The EU has played a useful role in helping scientists who participated in the massive Soviet military industrial complex to find peaceful employment. This research effort needs to continue to focus on a finite set of individuals in known locations in countries that previously have invested in military research. However, this needs to be supplemented by proliferation prevention measures that can be applied more widely, including in the scientific communities of countries not known to have developed NBC weapons.

Building on an assessment of the extent to which the work already carried out in the science centres established in Moscow and Kiev contributes to non-proliferation, alternative ways to expand and modify this approach should be the subject of cooperative research. The development of new technologies, for example in the fields of biotechnology, cyber warfare and nanotechnology, against the background of the threat of mass impact terrorism requires the expansion of non-proliferation efforts into new functional areas and new parts of the scientific community.

Another example of cooperation between Europe and the states of the former Soviet Union in the area science and technology is INTAS: the International Association for the Promotion of Cooperation with Scientists from the New Independent States (NIS). Interestingly, INTAS supports research in social and human sciences, as well as in the natural sciences. Apart from its aerospace-related research, the INTAS research programme is more closely related to that of COST than the Framework Programme. Developing space-related security in relation to the proposed FP7 research in the 'Security and Space' thematic area may be one way to build upon INTAS's achievements to date.

For other areas, linkages to COST may be the most fruitful way to realise synergies with existing INTAS partnerships. Research organisations in eleven non-COST countries currently participate in COST actions and the extent of this international cooperation, as well as a good match of COST with INTAS thematic coverage, makes closer cooperation between the two a realistic prospect.

Export controls are a preventive measure that already engages industry and the research community in non-proliferation efforts. However, the traditional approach to export controls has been challenged by a variety of changes - in technology, in the ways that industry operates, and in the increasing sophistication of proliferators. A control system that accounts for the movement of intangible technology and prevents unauthorised access to dangerous items is needed: a system that still allows the legitimate growth in international trade and commerce.

C.8 Implications for a European Research and Innovation Area

Europe provides a tried and tested model for S&T partnership that manages scientific, legal, commercial, intellectual property, and financial aspects of collaboration - for the most part successfully. Evaluating proposals with reference to existing foreign policy objectives already occurs. So, adjusting this to address security policy objectives would be a natural extension.

Europe has shown that collective decision-making and the distribution of research responsibilities are not only workable but also help to build capacity and stability within dispersed research communities. This experience is translatable to the wider world. While most European researchers are likely to appreciate the need for genuine partnership with collaborative partners, many in the rest of the world – accustomed to more hierarchical, nationally-based and non-collaborative models – may find it harder to adjust. And certain Europeans themselves may need to overcome traditional patterns of ‘partnership’ that have not always adequately recognised the skills of non-European partners.

The EU is already highly active in external relations and the Commission currently has a diplomatic presence in over 120 Delegations and Offices abroad, with a network of science councillors posted around the world. It maintains liaisons with various S&T-related international organisations or their agencies or subsidiary bodies.

There is significant participation by non-EU countries in the mainstream consortia of the Framework Programme. Typically this participation is self-financed, but any non-EU research or international organisation may participate (as long as this conforms with Community objectives) and receive EC funding in order to fulfill European objectives. COST currently involves more than 80 organisations in 11 non-COST countries and international organisations.

It is not only the research community that is gaining international collaborative experience; a growing body of S&T policy-makers and civil servants have experience of negotiating priorities for European research, monitoring and evaluating programmes, and participating in policy fora. A scientific advisory system is emerging in Europe to support the full range of research objectives: priorities for knowledge generation and diffusion; policies to promote industrial competitiveness; regulatory development for consumer, public health and environmental protection, and so on.

One of Europe's under-utilised resources is its own immigrant population. As Europe has been a training ground for scientists and engineers from around the world, many have remained in Europe and are employed in all types of innovation-related activities. Along with foreign students, these expatriates have helped to establish diasporic networks connecting communities within Europe to colleagues around the world. These international links can be used to develop collaboration in security-related sectors and to enlist expatriate researchers in the design and implementation of policies for international S&T cooperation.

C.9 Implications for scientific advisory systems

There are three principal implications of European security for the organisation of science advice, related to both internal and foreign policy. As understanding of security-related research and technology development inevitably moves beyond traditional military concerns, it is important that scientific advice is set up in a way that anticipates new aspects of security-related innovation and can react to incremental technological developments emerging from the armaments industries.

Scientific advisory committees will be important to ensure that international extensions to existing RTD instruments (Framework Programme, EUREKA, COST) and S&T cooperation agreements negotiated between the EU and other countries are consistent with European security objectives. Advisors should: be drawn from as many of the EU25 as possible (those with a significant armaments industry as well as those without); have expertise in defence, aerospace and electronics industries, and in related areas such as border control and domestic surveillance; some should be drawn from academia (including medical, environmental, and social science); and at least 40 per cent should be of the opposite gender to the majority.

In areas such as trade, where the EU represents the interests of all its Member States and is responsible for negotiating international agreements, technical experts in areas such as biotechnology, disaster response, Internet regulation, and refugee health should be mainstreamed into the 'diplomatic' process. Finally, Europe needs to participate actively in international scientific advisory systems related to European and global security concerns.

Conclusion and Recommendations

It is incumbent upon Europe to share the solutions it has developed over the past half century with its global partners, and to find collaborative means of applying lessons learned in a way that is applicable to science and technology partnerships globally.

The research that underpins this study has identified a number of key areas of science, technology and innovation where EU investment as part of FP7 would significantly enhance Europe's long-term security and that of the wider world. The following recommendations explicate the priorities identified as part of the proposed FP7 (2007 – 2013) namely: protection against terrorism and crime; security of infrastructures and utilities; border security; and restoring security in case of crisis – with a strong emphasis on social science and humanities as well as the interaction between security and technology.

- Developing the basis for a European 'strategic culture' on security matters, including the identification of a common European security and threat assessment. The objective would be to deepen the EU's understanding of threats, risks, opportunities and common (foreign and security) policy responses. These assessments should be continually revisited in the face of a changing security environment.
- Renewed emphasis in the social sciences to combine area studies with security studies, in order to investigate the regional context of contemporary security concerns, such as civil wars, terrorism, failed states, weapons proliferation, poverty, organized crime etc., but also threats arising from natural causes, and as byproducts of socioeconomic and technological activities. The aim here is to explore how best to combat the root causes of emergent threats by enhancing conflict prevention, improving the targeting of aid, investing in poverty reduction, sustaining engagement in post-conflict peacebuilding, promoting good governance, and so on. This must include a recognition that threats occur *within* the EU as well as from outside, or from systems in which the EU is dynamically linked to other parts of the world (former colonies, for example), and a recognition that such linkages can be exploited for building systems and institutions to strengthen European, and global, security.
- Invest in a new generation of arms control experts with the necessary scientific skills to be able to understand the new challenges posed by existing and emerging technological breakthroughs (across traditional WMD fields - chemical, biological, radiological and nuclear - but also those in IT, nanotechnology, and new conventional weaponry) and the means for their regulation and constraint through multilateral and regional frameworks, including verification technologies and methods.
- Expanded co-operative threat reduction programmes – providing technical assistance in disarmament, conversion of military industries and alternative employment for weapons scientists. Targeted research into sensors, communications and other technologies relevant for the detection and monitoring of programmes for the production of WMD. Expand ISTC/STCU-type of activities to other countries that have given up the option of producing WMD, or are prepared to do so.

- Provide greater near-term and sustained practical and technological assistance to the EU's potential accession states and neighbours to enable them properly to enforce export controls (especially in relation to dual-use technologies and materials) and the control of their frontiers (primarily as a means of tackling organized crime and terrorism). This will involve fairly rudimentary technological assistance as well as building partnership with these countries, which both assimilate ongoing technological innovation and have the capacity to contribute to mutual learning and cooperation.
- Promote a transatlantic rapprochement, while simultaneously reinforcing the EU's strategic autonomy to be able to act without the US when necessary, through carefully designed S&T policy. The EU should seek to engage the US in ways that promote research into sustainable development, solutions to problems in health, agriculture and the environment, and into improving mutual understanding and cooperation around the world. It should orient its technological innovation along its own political/security requirements, keeping in mind that international peace and security will in many cases be better served by international preventive limitation and cooperation in non-military S&T than by military expansion e.g. into space.
- Creation or strengthening of expert bodies - reporting to the Commission - capable of advising on the security effects of research and new technology. Priority thematic areas include biotechnology, nanotechnology, electronics and communications systems, nuclear technology and aerospace. Compulsory consideration of security implications in applications to the research programmes of the EU, both by applicants and reviewers. Support for dialogue fora of security and technology experts on relevant themes, particularly in the biotechnology and nanotechnology areas.
- Increased investment in research on alternative energy sources and the promotion of improvements in agricultural production with the aim of reducing threats stemming from energy dependence and poverty.

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Annex to Study:

**EU research and innovation
policy and the future of the
Common Foreign Security Policy**

**The full texts of the papers that contributed to Part A
on 'Threats and challenges'**

1. Major policy issues in the Eastern neighbouring countries, including Russia

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1. Major Issues

This short paper covers those countries that will border the EU after the next round of enlargement. Thus, we have included Belarus, Ukraine, Moldova / Transnistria, Croatia, Serbia & Montenegro, Macedonia, Albania, Bosnia, Georgia and its secessionist regions of Abkhazia and South Ossetia, Azerbaijan and Armenia. Also, special attention has been given to Russia and its exclave of Kaliningrad.

In all these countries we can easily detect some long-term trends that are going to constrain the political modernization in the next decades. Natural demography is one of these constraints, because the shrinking population, with its related aging factor, will further reduce the availability of young workers and fresh minds, while worsening the dependence index, or the share between un-productive population and the productive one. The availability of natural resources will remain low for the vast majority of the examined countries, but the few with a natural abundance of resources, like Russia and, to lesser extent, Azerbaijan, will likely play a greater role in the region and globally. Most of these countries suffer a geographical isolation from the richest part of Europe and its commercial axis. Such isolation is often a combination of geographic remoteness and poor infrastructures. Due to the long time required for the construction of main axis of communications or for the redirection in the priorities for the development of new trade corridors, also these factors could be included in the long-term constraints to political changes.

Summarizing the main characters of these countries, we find low income levels, with large part of the population below the poverty line and accentuated differences between the richest citizens and the rest of the population; high rates of migration, that further exacerbate the negative trends in natural demography; high levels of economic dependence from external resources, foreign direct investments, international or bilateral aids; little diversification in internal economy and wide presence of oligopolies; environmental deterioration; weakness in political and legal institutions; wide presence of organized crime; operational terrorist networks in some of them.

If we look at the leading elites, we can find again some distinctive characters in most of these countries. Some of the present political leaders have been the outcome of internal or border conflicts; they emerged as leaders of their respective states or territorial entities due to their ability to manage ethnic or local wars, but remained in power after the end of the conflicts. Some others seem to be the political expression of the change against a previous regime, a sort of dramatic reaction to the inability of the former regimes to deal with social or economic needs. Also, there are some leaders that could be described as the

remnants of the Cold War era, due to their direct participation in the political establishment of the Soviet Union and their re-proposition of a political agenda based on a centralized control of the economy and social dynamics. Some common guidelines could be traced for the description of these political systems.

There is not a virtuous swing between different leaderships or ruling groups; usually, the political change occurs as a dramatic shift from the existent, in favor of a substantially different leadership and political agenda. Thus, each political change is suffered as a sort of revolution, rather than a physiological modernization. There aren't any more strong ideologies, able to simplify the political framework. It seems impossible to identify common beliefs useful to unify large sectors of the public opinion around a non-partisan political agenda. Usually, political leaders or parties tend to promote the interests of a specific component of the civil society, on the basis of ethnic, cultural, economic or familiar criteria. Also, there is a proliferation of the so-called single-issue groups, paying attention to the acquisition of specific benefits, without any real interest in broader political programs.

These elements, combined with the embryonic constitutional systems, cause a fragmentation of the political landscape, worsening the poor results of the inexperienced political elites. As a consequence, leaders are not committed to reach consensus through the mediation among diverging priorities or interests, or through the general improvement of socio-economic conditions.

In terms of governance problems, local authorities usually have poor available resources for addressing huge macroeconomic imbalances. Their base of political consensus is usually narrow and volatile, while the government apparatus, including civil servants, are of doubtful trustworthiness. This unfavorable set of circumstances has often prompted vicious behaviors in the ruling elites, like kleptocracy, close association with economic power centers or the exploitation of nationalistic attitudes of some part of civil society, both against internal minorities or external enemies.

In this general scenario, Russia presents several peculiarities that can deeply differentiate its position vis-à-vis European and world affairs. First of all, in Russia the political leadership seems to be more stable and can rely on a far greater self-estimate of its role. As a consequence, this elite can adopt long-term policies, even paying a price in terms of popularity, but pursuing far-reaching objectives, able to modify the established trends. Also, in Russia there is a real alternative between the adoption of a values-driven strategy for the relation with the outer world and a realistic approach to the international affairs. Russia maintains a global relevance in several strategic context, being a major civilian and military nuclear power, holding huge oil and gas reserves, possessing a technologically advanced industrial - military complex. It can effectively influence strategic balances in most of the world, being clearly a major political player in the Euro – Asian space. Hence, its leadership can opt for the pursue of an hegemonic position over its former sister republics of the Soviet Union, while negotiating pragmatic compromises with the European Union, China or the United States on reciprocal interests. For these reasons, any European policy toward Russia cannot avoid to consider that (a) Russia is

both a main regional player and a global actor, with its own multifaceted political strategy; (b) there is a sort of competition between Brussels and Moscow over the political developments in the respective and overlapping “near abroad”; (c) Russia can shape functional bilateral relations with China, India or the United States, either in accordance with or against European interests.

The political developments in the countries surrounding the EU after the next enlargement will be deeply influenced by the combined effect of the European attitude toward the future status of these countries and the Russian ability to exercise an attractive influence. Without any explicit, although remote opportunity to become a full member of the Union, many Eastern European elites will consider to join Russia in a sort of “alternative consortium”, for addressing their needs of energy, technology, social stability and, moreover, political identity. Very likely, the Russian political and economic system could provide only a partial answer to these requirements, but it seems pretty improbable that any country would face the challenges of the globalization without a close association with either the European or the Russian centre of gravity. But a rigid posture of the EU on the membership issue – like the denial of the access for any CIS country – could provoke further instability inside those countries. In Moldova, in example, the hypothesis of re-unification of (at least) the western regions with Romania could find new support, as the only way to circumvent the European rejection.

On the other hand, if European Union and Russia will succeed in defining common European policy spaces, harmonizing their respective technical and legal systems in fields like trade, infrastructures, people circulation, then the countries in the middle should be necessarily involved in a similar fashion. This could provide even the smaller of new neighbours with a sort of veto power, or at least the ability to obtain relevant fee for the implementation of such common policies.

2. Suggestions for a European science & technology policy

To improve the EU’s security and the stability over the whole Continent, it seems useful to actively operate for the strengthening of those positive trends that do exist, inside civil societies, economic circles and some political elites, while not providing any ground to the hegemonic and illiberal factions.

For the positive development of civil societies, it seems useful to improve the level of information and political consciousness among the public opinion. The diffusion of satellite televisions, internet, wireless communications, while improving the general awareness of the public opinion, could act as destabilizing factor when the flux of information become unidirectional, from the West toward the less advanced realities of the eastern Europe. Thus, it could be more effective to promote and support the local exploitation of new technologies, providing affordable means for the active participation of local societies in the world of global media.

For the reduction of dependency from external sources of energy, it seems useful to promote the exploitation of local resources (hydro electric; solar plants etc.), and to invest in the construction of efficient power plants, while improving also the efficiency of the whole electric grids and electrical supplies.

For improving the local government ability to fight organised crime, the whole spectrum of technologies for police investigation, personal identification, remote control of borders and traffic choke – points seem extremely useful.

Clearly, all these technologies are very useful for EU countries as well; the improvement efforts should be devoted to the reduction in the costs of both acquisition and maintenance. Without such improved affordability, hi-tech means of communication would remain under the control of few peoples. If the new power plants would be too expensive to maintain, the dependence from external support would simply shift from the providers of energy resources to those of logistic support. As for the technologically advanced systems for law-enforcement, there is a long record of supplies of advanced weapons to second-world countries that proved to be too costly to maintain, with the subsequent unavailability of very complex and expensive systems due to the lack of relatively minor spare parts.

3. Recommendations for decisions taken today for FP 2007 – 2013

3.1 Threats

In the examined area, the direct and conventional military threats are relatively low. The majority of neighbouring countries have obsolescent military structures, unable to mount large offensive action, or to sustain prolonged military confrontations. Most of the equipment has been produced before the collapse of the Soviet Union, thus the present panoply of weapon systems is old and difficult to maintain. Most of the ammunition stock has now exceeded its service life and is becoming unreliable or dangerous. In this general pattern, Russia still possess a conventional military capability able to mount local operation and medium scale military offensive, although very likely the lack of proper training would prevent any operation above the Brigade – level. Both the Russian Air Force and Navy, while preserving some advanced systems, have an average training level too low for any major theatre operation. In conclusion, the use of WMD by Russian Federation is the only feasible direct military threat in the short term. Organised crime and terrorism, on the contrary, is a present danger, also because of the failing ability of European neighbours to enforce the law and control their frontiers. As a consequence, quasi-military threats, like the hijacking of civilian planes, suicide bombers or potentially large-scale terrorist attacks against civilian infrastructures, will remain a major concern for Europe.

3.2 Challenges

While not being a military threat under the conventional definition, the examined region presents several challenges for European armed forces. The possibility a further deterioration of civilian control over national territories, due to the collapse of legal systems or the outbreak of civil wars, would require a European intervention with

military assets. In such a case, very likely the first requirement for a successful intervention would be to suppress or incapacitate the anti-access capabilities still present in most of the examined countries. This preliminary phase would encompass complex military operations, like SEAD/DEAD, precision strikes against key targets and personalities, mine clearing and river crossing under hostile reaction etc. Note that all these actions had been performed in 1995 in Bosnia and in 1999 in Yugoslavia, exactly for the actual enforcement of a stabilisation plan. Obviously, after the initiation of a military projection inside the eastern regions, although finalised at the enforcement of peace and stability, the hostile reaction of local entities – legal or non-state actors – would imply a direct threat to the European intervention forces. Hence, while being now mainly a challenging context for European militaries, the residual military capabilities of eastern neighbours would become a threat in case of a European-led military intervention. As for the presence of well-armed organised criminal and terrorist networks, after the forcible entry into the conflict area, these entities would pose a far greater danger to any European stabilisation force than the residual conventional military opposition-force. As a consequence, the examined area is a challenging environment for any military projection, both in terms of anti-access capabilities and prolonged low-intensity, mostly asymmetric insurgency.

3.3 Opportunities (research priorities)

At the present stage, it seems preferable to improve and develop those conflict-prevention and crisis management tools able to contain local or regional conflicts. In case of further deterioration of the security environment, with the outbreak of war, those same tools could also be useful for the battlefield and strategic intelligence, providing the ability to control the escalation of the confrontation, or retaliate in a proportionate manner. Signal Intelligence is paramount for the planning and the execution of any comprehensive conflict-prevention and crisis management action, especially when coupled with adequate resources in Imagery Intelligence. These two branches of Intelligence, when provided to military Commanders in quasi-real time are also the precondition for the suppression of time-critical targets that offer the best opportunities for the termination of the conflict with the lowest level of attrition. Obviously, the Intelligence action encompass both technical tools and the cultural understanding of the reality, thus the research in the social field (anthropology, sociology, linguistic skills) should be developed. Such knowledge could also offer further opportunities for the execution of non-violent operations (i.e. Psy Ops), both during the conflict-prevention, crisis management or post-conflict reconstruction phases.

3.4 Risks

In the region, the risk of proliferation of WMD is relatively low, although the actual control or Russian stockpile is a matter of concern. On the contrary, there is a growing risk of diffusion of political violence, associated with organised crime. In this framework, the over-stretching of local law-enforcement resources could facilitate the proselytism of terrorist groups. Also, in the region there is a growing risk of contagious diseases, due to the failing health systems.

3.5 Scenarios

The recent developments in Ukraine offer a perfect example of the threats, challenges and opportunities for any European security policy aimed at the improvement of the security in the eastern neighbouring regions. That scenario could be replicated in several other sub regions, like Belarus, Moldova, the whole Caucasus.

4. Recommendations for DG Research based on trends to 2010

4.1 Threats

In case of ethnic or civil wars inside some eastern neighbours, there is the potential of further increase of organised crime or terrorism. This, in turn, would increase the non-conventional threats to Europe.

4.2 Challenges

While the conventional military capabilities will decrease in the long term, some local entities could acquire advanced systems (GPS jammers; rudimentary UCAVs etc.) that would improve their ability to prevent a foreign military intervention. Criminals and terrorists could also improve their performances in asymmetric attacks, due to the availability of advanced weapons.

4.3 Opportunities (research priorities)

In the long run, the aim of a European research plan for improved security responses should be to dominate the information flow in the conflict area. Thus, all the technologies (Intelligence gathering systems) and cultural capabilities (Analysis) useful for understanding the events should be developed. At the same time, Europe should be able to negate the opponents the exploitation of networked systems (media; C3 systems; dispersed weapon systems). In brief, while these resources will be enabling capabilities in the short term, in the longer term they will represent the centrepiece of European security.

4.4 Risks

The risks will be the same also in the longer term, but the danger of some of them, like contagious diseases, would obviously increase at exponential pace, if not addressed in the short term.

4.5 Scenarios

Potentially, the crisis area could expand to the whole Russian federation, due to the inability of local authorities to address economic, health and political problems. Also, Russia could become the main arena of confrontation between radical Islam, nationalistic and xenophobic extremists, warlords and ethnic factions. Thus, in a worst-case scenario, threats, challenges and risks for Europe could increase both in number and intensity.

2. Major Policy Issues in the Southern Neighbouring Countries until 2015

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For the purpose of this paper, the Southern neighbourhood of the EU is defined as comprising the members of the Euro-Mediterranean Partnership (EMP) – Morocco, Algeria, Tunisia, Egypt, the Palestinian Authority, Israel, Jordan, Lebanon, Syria and Turkey – and Libya, which has been invited to join on the condition of accepting the EMP *acquis*.

1. The Israeli-Palestinian Conflict

The Southern Mediterranean region is still troubled by a number of ‘hard’ security or politico-military concerns. In the first place, the ongoing armed conflict between Israelis and Palestinians has been clouding the region for decades. Although it does not pose a direct security threat to the EU, the conflict has important negative consequences for EU interests: it is an important cause of the stagnation of cooperation in the EMP, in all fields, it serves to radicalize public opinion and thus creates a breeding ground for extremism. At the current level of violence, and with the parties maintaining the rhetoric of the peace process, the conflict can rage on for many years, as long as the parties (including third parties such as Syria and the Hezbollah) do not cross certain red lines, e.g. expulsion from Jerusalem, civilian casualties on a massive scale, or the use of weapons of mass destruction. This would provoke radical retaliation and/or widening of the conflict to other States in the region and would thus lead to the intensification of the conflict and the destabilization of the region.

In the current political constellation, the parties are unable to reach a settlement by themselves. On the Palestinian side, a change in leadership is required, which can be expected in the short term, but the succession by an effective and legitimate government is far from certain; factional strife, possibly evolving into armed conflict, is a real risk. On the Israeli side, the political will to accept a reasonable compromise must be found, which is greatly hindered by a volatile and splintered political landscape, a situation which can be expected to persist over the next years.

Outside mediation therefore is a necessity. A joint effort by the EU and the US is the only feasible option, as each enjoys legitimacy with just one of the parties. Political will on the part of the US is thus also required, on which the influence of Iraq can work both ways: either it will be judged that involvement in Iraq precludes an additional initiative, or an initiative in the peace process can be seen as a way of addressing the causes of extremism in *inter alia* Iraq.

2. Militarization and Proliferation

A history of conflict has led to excessive militarization of States in the region, which is likely to continue along with the Israeli-Palestinian conflict. States have built large military apparatus, absorbing large shares of national revenue and often playing a determining role in politics and society. This militarization has seen proliferation of weapons of mass destruction and their means of delivery, with several States not being party to the basic arms control agreements; this specific characteristic of militarization too is closely related to the Israeli-Palestinian conflict and the ambition on the part of certain Arab States to balance Israeli conventional and reputed nuclear forces.

Again, no direct threat to the EU emerges. Likewise, apart from the worst-case scenario of nothing short of an all-out escalation of the Israeli-Palestinian conflict (for in spite of rhetoric, nothing less would lead to Arab intervention), the risk of inter-State conflict is limited: existing differences between States, e.g. on water, or on the issue of the Western Sahara, though possibly leading to disputes, do not seem to have the potential to lead to armed conflict. The limited efficacy of armed forces (for lack of training, under-equipment or lack of familiarity with equipment) is a prohibitive factor in this regard. Rather the armed forces are primarily an instrument of domestic politics, serving to safeguard existing regimes from internal opposition, complemented by nationalist rhetoric to turn attention away from domestic issues.

Arms control and disarmament in the fields of weapons of mass destruction and major conventional platforms would be possible though in the framework of a settlement of the Israeli-Palestinian conflict, if it were not for the interference of factors from outside the region. As States' security concerns are also determined by developments outside the EMP, notably in Iraq and Iran, initiatives that remain limited to EMP members can never be successful.

3. Authoritarianism, the Wealth Gap, Extremism and Terrorism

As the armed forces are an instrument of domestic politics, basically militarization is not likely to diminish. Authoritarian regimes lacking legitimacy have to rely on the armed forces/security forces and on nationalist rhetoric to control the opposition and muster popular support. This lack of legitimacy is a consequence of the inability to provide for the basic public goods to which every human being is entitled: physical security, an enforceable legal order, an inclusive economy, wellbeing in all of its aspects (access to education, health services, a clean environment etc.). This is exacerbated by the repression of political opposition, which from the perspective of the regimes and associated elite is inevitable, for because of their poor performance democratisation would undoubtedly lead to their removal from power and thus the loss of the wealth which they acquire by running the state.

The result has been a radicalization of the opposition, leading mostly to the growth of Islamist movements, including extreme factions that support the use of violence. The strength of Islamism is closely linked to a dense network of mosques and associated organizations, which often provide certain social services that the State is unable or unwilling to organize. Several regimes have thus created their own extremists, which primarily have a domestic agenda: overthrowing the current regime.

In order to divert attention away from domestic problems, regimes often revert to fierce nationalist rhetoric, often of an anti-Israeli nature, a theme which strikes a chord with public opinion. At the same time however regimes thus confirm the views of Islamist factions, to whom this theme comes natural, which also makes it easier for the latter to spread the more general anti-American or anti-Western views that often complement their opposition to the domestic regimes. A number of regimes have thus engaged in a game they cannot win: going along with anti-Israeli and anti-American/anti-Western views might temporarily soothe public opinion, but in the end serves only to reinforce the legitimacy of the Islamists, as these regimes can never live up to their rhetoric, being as they are dependent on American and European economic – and often military – support. The invasion of Iraq has certainly reinforced the legitimacy of the extremist Islamist view.

A side effect of nationalist foreign policies and competition for scarce resources is the very low level of regional integration among the Southern Mediterranean States. Existing regional organizations, such as the League of Arab States, have very limited impact or have been paralyzed by internal differences, such as the Arab Maghreb Union. In the framework of the EMP, the Southern partners therefore do not act as a group and have shown very little enthusiasm for multilateral programmes and activities. This lack of political integration reflects the limited nature of economic relations between the Southern States: intra-Southern trade accounts for just 10% of their trade, while more than half of their trade is with the EU.

4. A Diffuse but Growing Security Threat

In the medium to long term, the huge – and widening – gap between haves and have-nots in terms of access to basic public goods between the Northern and Southern shores of the Mediterranean constitutes the primary security threat for the EU. It is an indirect and diffuse threat, which is however of a systemic nature, i.e. it results from, and impacts on, the functioning of the global and regional order itself. For unless mechanisms of governance are created or rendered more effective that can alleviate this situation, at a certain level of inequality, the resulting political instability, extremism and violence, economic unpredictability and massive migration flows will become uncontrollable. Destabilization of the region might be the ultimate consequence.

Symptoms of this can already be discerned, e.g. increasing migration across the Mediterranean, which is ever more difficult to control. Occasional terrorist violence is another symptom, including in Algeria, where unrest continues to fester ever since the

first wave of violence in the mid 1990s. Terrorism is usually aimed against domestic regimes, because of the internal agenda of extremists, but Western targets have been attacked and will probably continue to be, as in the wake of '9/11' and the invasion of Iraq popular support and media coverage for such acts are easily forthcoming and thus strengthen the extremist cause. With the al-Qaeda network having been decapitated following the intervention in Afghanistan, there does not seem to be any organized network left (terrorist movements have a history of factionalism rather than cooperation), nor is terrorism 'exported' to the EU from the Mediterranean (or elsewhere). Rather independent groups based in the South or in the EU pursue their own course while referring to the same agenda or al-Qaeda 'trademark' that is certain to attract massive media attention. Attacks against Western targets often seem to be linked to involvement in Iraq, so the more balanced policies of the EU, regarding notably the Israeli-Palestinian conflict and the fight against terrorism, might be expected to have a positive impact on the likelihood of further terrorist attacks. On the other hand the involvement of irrational actors without a clear structure or agenda has certainly increased rather than decreased the threat, and has rendered it more difficult to combat and predict.

In the next years, developments with regard to the public goods-related root causes of this systemic security threat do not look promising. In spite of long-standing cooperation with the EU, which has been intensified with the creation of the EMP in 1995, the economic situation in the South has not substantially improved; economic developments have certainly not been able to keep pace with the steady growth of the population. It has even been argued by a number of observers that EU policies in the framework of the second, economic basket of the EMP, have actually led to a worsening of socio-economic conditions in the partner States, who have had to suffer the hardships entailed by economic reform without receiving truly substantial benefits in return from the part of the EU, notably in the sectors of agriculture and textiles. The predominant feeling in the South therefore seems to be one of resentment, against an EU that imposes difficult reforms but is perceived as not living up to its side of the bargain. It should not be forgotten though that bad management by local authorities, including excessive defence expenditure, and obstacles posed by traditional structures equally contribute to the worsening of the economic situation, as was forcibly demonstrated by the Arab Human Development Report. As to democratization and the rule of law, existing regimes are not very forthcoming; the quasi non-application of human rights clauses in the framework of the EMP has certainly not contributed in a positive way. As a result, the EU is often perceived as favouring stability over democratization.

Non-extremist reforming forces are weak, but do exist – the authors of the Arab Human Development Report are the obvious example. Perhaps the radicalization, especially since Iraq, and the almost complete association in the eyes of Western public opinion of terrorism with Muslims, could lead to a reaction by reformists, including moderate Islamists, which could set in motion a gradual process of change, which the EU could support.

5. Limited Security Cooperation with the EU

One result of the combination of the trends related *supra* is a very limited degree of security cooperation between the EU and the Southern partners. This holds true especially in the field of the European Security and Defence Policy (ESDP), in spite of the fact that the EU has offered extensive involvement, including regular dialogue, appointment of liaison officers to the EU Military Staff and, eventually, participation in ESDP manoeuvres and operations:

- Partners are unwilling to engage in far-reaching security cooperation when they are divided by the Israeli-Palestinian conflict that dominates the entire region and when, moreover, several of them reproach the EU for maintaining too passive an attitude towards the conflict;
- The EU is often felt to overemphasize the security dimension of the EMP, to the detriment of the economic basket;
- There exists a general lack of knowledge about the objectives of ESDP, which can easily lead to unrealistic expectations, e.g. with regard to a potential EU role in the Israeli-Palestinian conflict, or to distrust, mirroring fears of Western 'interventionism' that were voiced in the 1990s;
- Partners are less familiar with notions such as cooperative security, confidence and security-building measures etc.;
- For a number of regimes, open cooperation with 'the West', particularly in the military field, would further alienate public opinion;
- Partners have limited interest in the Mediterranean as an organizing concept of foreign policy; the EMP is mostly seen as a framework to organize bilateral relations with the EU rather than as a platform for multilateral cooperation;
- In the field of terrorism, cooperation has been handicapped by the classic differences regarding the distinction between terrorists and legitimate freedom fighters.

The security basket of the EMP has thus remained limited to a political dialogue and a number of largely declaratory and/or 'soft security' initiatives. This is likely to remain the case until significant steps have been taken towards a settlement of the Israeli-Palestinian conflict.

6. Policy Options

In response to the trends outlined *supra*, a number of policy options for the EU could be suggested.

The settlement of the Israeli-Palestinian conflict is the major imperative if anything substantial is to be achieved in the region. Even significant steps towards a settlement would probably already have a decisive impact on dynamics in the region (the creation of the EMP itself was only possible because of the good climate in the early years of the

Oslo Process) and would deprive actors of a pretext that is all too often abused to justify their policies. The EU has a major role to play:

- The EU can contribute to building a strong Palestinian authority as a necessary condition for the peace process to be reactivated, making use of its financial leverage if required;
- EU involvement is a prerequisite for the commitment of the Palestinians to any peace initiative, which to succeed demands a joint EU-US effort, and the will on the part of both to equally pressurize both parties;
- In the framework of a settlement, the first steps towards arms control and disarmament could be made, which can then be pursued by enlarging the debate to include the members of the Gulf Cooperation Council, Yemen, Iran and Iraq, i.e. the States addressed by the EU Strategic Partnership with the Mediterranean and the Middle East adopted by the European Council in June 2004.

The European Neighbourhood Policy (ENP) offers an opportunity to revitalize the EMP and deal with the root causes of insecurity in the region in a comprehensive way:

- The notion of 'positive conditionality' requires the agreement of detailed benchmarks for reform in the bilateral actions plans, and the will on the part of the EU to allocate effective benefits;
- In that framework, the promotion of democratization requires the identification of reliable local actors that can initiate an internally driven, gradual process of reform;
- In order to be fully comprehensive, cooperation on CFSP/ESDP could be included in the action plans, so as to promote an effective security partnership, i.e. joint mechanisms for early warning, conflict prevention and crisis management, based on a common strategic assessment; this will firstly demand a comprehensive communications policy on the scope and objectives of CFSP/ESDP;
- In the context of the promotion of democracy and the rule of law and cooperation on ESDP, security sector reform is likely to become an important topic;
- The promotion of multilateral cooperation and intra-Southern regional integration could also be included in the action plans;
- Finally, as on the Israeli-Palestinian conflict, close coordination of efforts with the US, on an equal basis, can only enhance the effectiveness of both European and American policies.

7. Implications for Research Policy

On the basis of the above recommendations, a number of fields of interest for research policy can be identified:

- the conditions for success of a process of institution-building in a weak and/or undemocratic State;

- the combination of accountability and benchmarking with a sense of ownership in the framework of 'positive conditionality';
- the interaction between local State and non-State actors and external partners in the framework of 'positive conditionality';
- security sector reform in authoritarian States;
- communications policy and the perception of the EU.

3. Major policy issues in transatlantic relations

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1. America's new approach to Europe and the world

The long-lasting emphasis of the United States on the transatlantic alliance as a cornerstone of U.S. foreign and security policy has been given up by the Bush Jr. Administration while, after the end of the Cold War, the Bush Sr. and Clinton approaches were still characterized by such an emphasis (support to German unification and partnership in leadership offered to Germany, signing of the Transatlantic Declaration and New Transatlantic Agenda, joint action for crisis management in the Balkans, partnership with President Yeltsin, NATO reforms and preparation of EU/NATO enlargements, establishment of the PfP, CJTF and ESDI as ways to associate as many European states as possible to the Alliance).

Before September 11, unilateralism about some diplomatic questions (Kyoto protocol, ABM treaty, International Criminal Court) was raising some concerns among Europeans and other allies, but the bi-partisan dimension of most of these decisions and their political content allowed to consider that this could be a conjunctural "unilateralist moment" like others in the long-term history of US foreign policy. This unilateralism was addressed mainly as a divergence about values and world order rather than as a strategic rift. Nevertheless, at that time, some signals were showing more than that, especially the rise of military expenditures, the attitude towards talks with North Korea and the very unbalanced position regarding the Israeli-Palestinian conflict.

After September 11, the US has spurned NATO's Council offer to implement the reference to article 5 in order to retaliate against the Taliban and Al Qaida and the security discourse in Washington became distrustful towards European allies. Defence Secretary Rumsfeld's joke about old and new Europes revealed the willingness to play openly with divisions among Europeans and weaken the European Union's emerging global actorness. A neo-darwinian discourse opposing American self-assertive power and European post-modernist dreams was spread all over the world by active neo-conservative essayists (Kagan, Kristol).

The new threat assessment has been transformed into a very aggressive "permanent total war" discourse based on nationalism rather than multilateralism. This attitude was reinforced by the publication of the US National Security Strategy in September 2002, which has replaced deterrence by threat of pre-emptive war, not only against non-state terrorist groups but also against some states. At that time, the Iraqi target had been already mentioned and the State of the Union speech referring to the "axis of evil" has been written according to a "Schmittian" vision of friends and enemies ("those who are not with me are against me"). This readiness for a military offensive posture, confirmed by the war on Iraq, has involved plans for the selective use of mini-nukes against both

non-nuclear (deep strikes) and nuclear (counter-proliferation) targets. Furthermore, the war on Iraq has been prepared in secret with Britain, without any involvement of NATO (the 1991 Gulf War had been prepared in a very co-operative way), the United Nations and NATO have been considered only according to instrumentalist views and alternative options than war were ignored and rejected, including by the use of massive deception of the public.

Even after the official end of the war and despite some diplomatic attempts to improve transatlantic relations, the attitude towards anti-war European states (France, Belgium, Germany, Russia) remained arrogant and humiliating, reconstruction contracts in Iraq were reserved to companies from those states who had supported the military intervention. The comments by US leaders about the results of the Spanish election after the Madrid attacks and their critics of the Spanish withdrawal from Iraq as an act of cowardice illustrate typically this long-term absence of understanding of any critical opinion.

2. Europe's new approach to America and the world

Even if Europeans are much divided in case of crisis like the war on Iraq, there has been a tremendous effort to build a joint global actorness both by establishing a whole range of institutions (HighRep, PSC, MilCom, EUMS, EDA, Joint Diplomatic Service) and by identifying fields and areas for joint actions (conflict prevention and crisis management policies, both civilian and military, neighbourhood policy, definition of Petersberg missions and their scope, strategy about WMD, and all other elements referred to in the European Security Strategy).

Within this context, Europeans have shown a lot of interest for a reinforced partnership with the USA, especially in the field of crisis management. There existed a readiness from the three European largest states, and the other EU member-states, to rely on the military operations performed jointly with the US in the Balkans through NATO in order to establish a mutually beneficial pattern of co-operation between NATO and EU (on the basis of the Berlin plus agreement). The Saint-Malo compromise had confirmed this option that boosted a NATO-compatible ESDP, first EU-led military operations and the designing of a European security strategy. The EU enlargement perspective and elections of pro-US cabinets in the majority of member-states of this enlarged EU gave many guarantees to the US that its "hyperpower" would not be threatened by a "global peer competitor" called Europe (China remains likely the main candidate for such a role). By contrast, a division of labor between Americans and Europeans on the world stage was possible, by allocating regional responsibilities to the EU and keeping strategic responsibilities for the US, and by limiting Europe's role to peacekeeping and "nation-building" under the more powerful aegis of the US and NATO.

Of course, Europeans were also trying within this process to get more strategic autonomy (through Galileo or the A-400M project) but this was not preventing an overall division of labor with the United States and the building of an "Europe-puissance" strongly allied

with North America and Japan (see e.g. the role of the G-8 during the Kosovo crisis). Common interests within the Millennium and Doha rounds of the WTO, feeling to share common democratic values (despite disputes about death penalty, cultural diversity, or biodiversity), were dominating in the European discourse.

Solidarity towards the attacked United States after 9.11 was clearly illustrating this atmosphere but Europeans did not understand the US refusal to use NATO for the reaction to the attacks and had many difficulties to accept a discourse about “total war” even after the assassination of 3,000 people.

Despite this misunderstanding, Europeans have supported the US actions in Afghanistan (though retaliation is not legitimate defence and is forbidden by international law), and did take part themselves into post-intervention efforts to build ISAF and stabilize Hamid Karzai’s government. The use of NATO for this purpose and intensive participation of countries like Germany, France, Belgium, Turkey into stabilization efforts have proved that transatlantic co-operation does work concretely in anti-terrorist policies.

Under Javier Solana’s impulse, the EU has chosen to stick very close to the US initiatives, by developing its own strategy on WMD (despite disagreements about threat assessment in the case of Iraq and difference in methods regarding Iran and North Korea), by writing together the roadmap for peace in the Middle East (despite skepticism about George W. Bush’s pro-Sharon bias), by promoting the increase of European military expenditures (the cornerstone for ESDP credibility in the Pentagon) and by using a very similar style of vocabulary and structure in the ESS than was used by Conleeza Rice in the USNSS.

Though differentiating itself from the US in its discourse (civilian power, multilateralism, promotion of open regionalism, etc.), the EU remains very close to the US in its concrete policies and pleas for complementarity and co-operation.

3. It takes two to tango....

Structurally, Europe and North America keep many reasons to strengthen their co-operation for reasons of domestic politics, international politics, trade politics, security perceptions. Therefore existing framework like the Transatlantic Agenda and NATO still play their role. Key area’s of joint interest and action have been identified in crisis management, attitude towards Balkans, Russia and the Former Soviet republics, fight against terrorism and WMD.

But, on the short/medium-term, the ideological shift in the White House will likely reinvigorate a differentiated bilateralist approach of the United States towards European states rather than a more symmetric US-EU partnership. It will also keep a level of budgetary and commercial deficit that Europeans will pay (like the rest of the world) through interest rates’ policy of the Federal Reserve and the high level of the euro. Therefore, on short/medium-term, the transatlantic ‘*malaise*’ will remain.

Nevertheless, on long-term, because of converging structural interests and because the US Administration will face difficult consequences of its policy (step-by-step withdrawal of allies from Iraq starting in March 2005, likely failure of its Middle Eastern policy), there is room of manoeuvre for a transatlantic *rapprochement*.

This will be needed by Europeans because they will face key challenges in their neighbourhood in 2005 and the following years: interlinkage between all Western Balkan issues (future of the Union Serbia & Montenegro, final status of Kosovo, FYRoM political uncertainty, maintenance of nationalist parties' predominance in BiH); likelihood of political problems in Belarus and Ukraine; potential explosive debates about Turkish accession and the Cyprus issue; plus the question marks about the ratification of the Constitution.

European initiatives for bringing the US back into these dossiers, like into a new roadmap for the Middle East, can be rewarded by US positive answers on other issues (support to the installation of ITER experimental nuclear fusion reactor in France, support to the German claim for a seat in the UNSC).

More widely, the question of NATO's next enlargement, distribution of commands within NATO and ESDP, relaunching of a new bilateral EU-US framework succeeding to the New Transatlantic Agenda, will be likely put on the transatlantic agenda. The balance between competition and co-operation will remain a complex policy mix rather than a permanent drifting apart.

4. Links to European science and technology policy

In order to prevent its own science and technology policy from transatlantic disputes, Europe could

- a) Maintain the efforts to reinforce strategic autonomy in key civilian technological fields and large scientific investments (like ITER, ESA, space programs). It has to be ready both to work with the US and without the US in such programs (*double track strategy*).
- b) Diversify co-operation in science & technology with other strategic partners (at least those quoted as strategic in the ESS: Canada, Japan and Russia, but likely also emerging powers like Brazil, India, China, South Africa).
- c) Promote regional frameworks in the field of scientific and technological co-operation in other parts of the world (for example among Mercosur or ASEAN countries).
- d) Encourage research in social sciences about political and strategic cultures in order to contribute to mutual understanding between peoples and discourage logics of clashes between nations and civilizations. This should be part of a wider agenda for conflict prevention worldwide.
- e) Promote science and research priorities corresponding to European interests in transatlantic frameworks like NATO and the NTA/JAP, and identify the sectors of

- transatlantic scientific co-operation which might be undermined by transatlantic tensions, and long-term strategies for protecting these sectors from tensions.
- f) Promote and institutionalize multilateralism in the field of scientific and technological co-operation.

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4. 'Other' Strategic Major Geo-strategic issues (China, East Asia, South Asia)

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1. Introduction

In accordance with our brief, this paper aims to identify and discuss the major security, and geo-strategic, issues and trends relating to East and South Asia over the next decade, and to highlight a number of key policy issues for the EU.

The next section briefly reviews the overall major security issues and trends relating to these regions to 2015, and discusses the relevance of geo-strategy and conflict prevention for the EU and others outside the region. Section 3 then highlights and discussed a number of specific security issues and trends of importance in East and South Asia. Section four discusses some major security policy issues that arise for the EU. In doing this, I have not particularly focussed on implications for EU research and technology development priorities, but remain open to doing so in the next draft.

2. Security issues and trends: geo-strategy and conflict prevention in East and South Asia

East and South Asia are manifestly important for the EU in virtually all policy spheres, including security. They account for a large and increasing proportion of global wealth, production and trade. Some two-thirds of the people experiencing extreme poverty in the world live in these two regions, so that the achievement of Millennium Development Goals depends critically on economic growth and poverty reduction in them.

These regions include several major powers, including China, India, and Japan, and other major powers including the USA and Russia are directly engaged. There are major and on-going shifts in 'balances of power', for example associated with the growing wealth and power of China, which raise inevitable security concerns. There are manifest and intense inter-state disputes and tensions: risks of inter-state war and conflict tend to pre-occupy Asian states more than in most other regions. Moreover, these are regions where war between major powers, including nuclear powers is all-too possible. US military power also looms large for virtually every state in the region, either as a potential threat, ally or welcome outside 'balancer'. Many states in the region have been able to invest heavily in accumulating major conventional arms.

There are several weak or failing states, raising associated concerns about transnational crime, terrorism, piracy, and complex internal or transnational violence. Numerous conflicts are ongoing, including in Nepal, Sri Lanka, Kashmir, Irian Jaya, and Aceh.

India and Pakistan are both developing significant nuclear arsenals, and North Korea poses direct challenges both to the NPT and to its North East Asian neighbours. Major human rights concerns in several countries of South and East Asia. Democratisation processes are powerful across much of these regions, including enormous but fragile states like Indonesia, which is welcome but with attendant tension and unpredictability.

Regional co-operative and security organisations and mechanisms are relatively weak in East and South Asia, for complex reasons that are hard to overcome, resulting in weak capacity for multilateral conflict management or resolution. In East Asia, some key countries did not even establish bilateral diplomatic relations until after 1990. Since the late 1980s, there has been a determined attempt by some concerned countries to establish and develop regional organisations, and with some success. For example, the ASEAN Regional Forum (ARF) has been established as a significant process to enable inter-state multilateral security dialogues and limited confidence building. But it remains fragile, and limited particularly by China's reluctance to allow it to address particular sources of dispute.

In South Asia, SAARC exists but it is largely paralysed by India-Pakistan disputes over Kashmir. ASEAN emerged as a relatively important sub-regional organisation in South East Asia for some decades, building on principles of non-interference, but it has struggled to cope with the combined effects of expansion of membership, democratic transition in some member states, and the aftermath of the financial crises of 1997/8. The relative importance of the region and weakness of regional organisations has meant that global institutions and regimes have enhanced significance for conflict and security in East and South Asia.

In this context, a concern with geo-strategic patterns and trends is appropriate. There are wide literatures and policy debates about the implications of the rise of China, and possible clashes with the USA, Japan, or its neighbours. The complex rivalries and alliances of India, Pakistan and China; the possible implications of Korean unification; the future of Japan and its relationship with the USA; and the dynamics of internal change in Indonesia, are just a few examples of major issues that intrigue geo-strategists.

However, to identify key issues and trends in terms of sweeping geo-strategic uncertainties and trends can also be superficial and over-narrow. All stakeholders, including the emergent powers themselves, are already concerned about risks of tension and war. Fortunately, all of the major powers, and almost all medium and small countries, in the region have powerful interests in avoiding war and maintaining stability through the inevitably complex transitions up to 2015 and beyond. Thus, for example, many of the major geo-strategic issues associated with the rise of China and insecurity of Japan identified in the early 1990s continue to exist today. But it is important to take full account of the relatively successful history of managing transition and risk over the last 10 – 15 years. In practice, the major security risks in East and South Asia relate to risks of unintended or unmanageable escalation of disputes or un-intended crises. *This briefing thus also focuses particularly on challenges of conflict prevention.*

3. Major security issues in South and East Asia

This section aims to highlight a number of key geo-strategic or conflict prevention challenges and trends in South and East Asia.

The rise of China. China continues to achieve high rates of economic growth, managing some 10% annual GDP growth in recent years, and apparently set to continue at 7% or more for some time. The state continues to focus on economic and development concerns, leading to a strong desire for regional stability and predictable relations with the USA and others. At the same time China's leaderships consistently tends to consider that all reverses from its maximum imperial territorial control and influence in history to be the result of unfair treaties stemming from discreditable weakness, possibly to be reversed as China's power grows. Nationalism is strong. Since 1989, China has focussed on military reform and modernisation, concerned particularly with increasing its military capacity to fight wars in its neighbourhood, particularly across the Taiwan Straits and the South China Seas.

Over the last 15 years, China has increasingly exerted itself internationally. However, this has been largely conducted through existing international regimes, towards which China appears to have become increasingly positive and committed. Thus there is a credible benign scenario for the next decade in relation to the rise of China's power: gradual but manageable strengthening of its role and influence, while avoiding major clashes with the USA and other regional and local powers. In this scenario, human rights abuses and dictatorial excesses will remain a concern. The main risks to this benign scenario arise from the possibility of escalation of disputes over Taiwan and the South China Seas, badly managed international responses to a crisis in the Korean Peninsula; or the undesirable consequences of major internal political crisis within China.

The risk of internal political crisis in China. Chinese economic growth and transformation has been associated with dramatic internal social and economic tensions and change. There are widely noted tensions between regional and national authorities on tax and financial issues; and major and growing disparities of wealth between different sectors of society and between coastal and interior regions. As an authoritarian dictatorship, China can suppress many social disputes, but it lacks the more sophisticated mechanisms of democracies in resolving and managing internal disputes and conferring legitimacy on the leadership. There appears to be a major risk of unexpected internal political crisis within China by 2015, unless the leadership systematically begins to engage in political as well as economic reform.

The Taiwan Straits. Tensions and the risks of violent conflict between mainland China and Taiwan are long-standing. Moreover, they will continue unless the political authorities of China and Taiwan come to a more stable provisional understanding. Without such an understanding, the risks of war across the Taiwan Straits remain high, and now pose perhaps the greatest risk of leading to major power confrontation between China, USA and Japan. The main elements of a possible stable understanding are

obvious: postpone the resolution of Taiwan's status; China agrees to accept that Taiwan has de-facto provisional political autonomy and may be represented at regional and international meetings and institutions with a status that does not imply sovereignty; and Taiwan agree to suspend attempts to achieve sovereign recognition as a State. This implies concessions on both sides. As by far the stronger party to the dispute, China has the main responsibility to accept such an arrangement, but will not do so without sustained international pressure. It is quite unrealistic to expect a well-educated, wealthy, democratic Taiwan to accept the present situation of continuing marginalisation in regional and international issues. Until an understanding is achieved, Taiwan is bound to continue to irritate and implicitly or explicitly provoke China, leading to a context in which crises could escalate uncontrollably.

South China Seas. The territorial disputes over the Spratly and Paracel Islands continue, and remain a source of tension. ASEAN States have made gradual progress in resolving these issues, but disputes with China remain a source of friction. It seems unlikely that these disputes will lead to war by 2015, but unless mechanisms of dispute resolution and co-operative economic management are developed, there is a real risk that the issue could lead to polarisation and balancing alliances.

DPRK. North Korea is perhaps the most obvious and urgent major strategic concern in East Asia. The development of nuclear weapons and missile capabilities is a direct challenge to global non-proliferation regimes, and a major source of insecurity, above all for Japan and South Korea. One positive achievement over the last decade has been the development of better understanding and co-operation amongst all of the other North East Asian states and USA on DPRK issues. This means that the collapse of the North Korean regime or DPRK provocations, are now relatively unlikely to result in wider conflict. Nevertheless, DPRK nuclear weapons programmes remain deeply destabilising, and of urgent concern. The prospects of an early agreement involving the verified abandonment of these programmes seem remote under the present DPRK regime. But if the issue is not addressed, it could have major implications, particularly for Japanese security policies (including the development of BMD programmes and enhanced nuclear 'guarantees')

Korean Unification. South Korea's 'sunshine policy' can be seen as a confidence building measure to secure détente with DPRK rather than unification. The policies of the DPRK are all intimately related to concerns about the survival of its current regime. The fact that the regime has remained stable during the last difficult decade has led to a situation where many policy-makers appear to assume (and even hope for) its continued survival for the indefinite future. In fact, it is probably wise to assume that the regime will undergo crisis and probably collapse before 2015. This implies that preparations to manage and respond to such a collapse are a priority for the neighbouring states, USA and the whole of the international community.

Myanmar. Myanmar/Burma is a weak state whose government is an affront to the international community rather than a military threat. However, ASEAN countries' attempts to exert influence and forestall growing Chinese presence in Burma have failed. China is now a key ally of Burma, leading to a military and political presence that raises

concerns for other states in the region, particularly India. Unless and until the political transformation is achieved in Burma, this situation is set to continue.

Indonesia. The future of Indonesia is one of the greatest uncertainties in East Asia. It is a vast country, and by far the biggest and most strategically important in South East Asia. Multiple secessionist (Aceh and Papua) and sectarian (Maluku, Poso and Kalamantan) conflicts threaten to undermine the country's fragile political stability. State security institutions are themselves often involved in fomenting conflict. Wide support for radical Islamic populism remains possible, fuelled by poverty and corruption as well as in response to international developments. The democratisation process remains very fragile, and armed conflict over control of the Indonesian state itself cannot be ruled out.

However, there are reasons for optimism. The democratisation process has been strikingly successful so far, in view of the many risks and obstacles that have not so far lead to disaster. The recent elections were peaceful, and demonstrated little popular support for radical Islamic populism. The newly elected President has declared support for negotiations to provide special autonomy arrangement for Aceh and Irian Jaya, which may provide a framework for peaceful management of the disputes. Some civilian control is gradually being exerted over the military. However, the process will probably remain extremely fragile for the next decade.

ASEAN and ARF. As noted above regional organisations are weak in East Asia, particularly in relation to co-operative security. The prospects for developing ASEAN co-operation depend particularly on the resumption of a benign leadership role for Indonesia, and a change of ASEAN norms and practices to enable institution building and co-operation on complex internal and transnational conflicts. This will at best emerge slowly over the next decade. Similarly, the ARF remains a useful body capable of substantial further development. But without substantial changes of policy from China and certain ASEAN states, this potential will only be slowly realised. This implies a continuing strong role for bilateralism, and particularly for USA influence.

India and Pakistan. Recent improvements in relations between India and Pakistan are welcome signs that the long-standing tensions between these countries may gradually be overcome. However, the process remains extremely fragile, and the issue of Kashmir remains relatively intractable. The most likely 'good' scenario for the next decade is gradual achievement of confidence building and détente between India and Pakistan, and a reduction of violence and improvement of human rights in Kashmir. However, if this is achieved, it will probably be in the context of continued rivalry and suspicion, and continued development of nuclear and missile forces and doctrines. The alarming scenario of renewed crises and conflicts remain fully credible, with a real risk of major, even nuclear, war.

Moreover, there are likely to be continuing internal security challenges within India and Pakistan. Pakistan in particular is in continuing crisis. Although it is very unlikely to disintegrate, the situation remains extremely uncertain. A single assassination could have profound repercussions. The possibility of a radical Islamic coup exists. Even if this is

avoided, international engagement to promote reform and better government, gradual democratisation, as well as security sector reform will remain very important. In India, secularism remains at some risk, and insecurity in parts North East India as well as Kashmir will probably remain endemic.

Weak Asian States

Many of the security problems of South and East Asia arise from weak states and bad governance. The conflicts in Nepal and Sri Lanka, for example, are not of traditional strategic significance, but nevertheless are important. While there are reasonable prospects for improvement over the next decade, such countries will remain conflict prone for at least another decade.

Transnational Terrorism *The Bali bombing and subsequent outrages are a clear indicator that transnational terrorist networks are a cause for concern in East and South Asia, as well as localised terrorist campaigns associated with local grievances. Recent developments, particularly the results of recent elections in several S.E. Asian state imply that the risks of militant Islamist movements gaining wide support in South East Asia are lower than many feared. However, this remains dependent on continued progress in democratisation and improved governance and policing. In South Asia, the picture is worse. Militant Islamic groups command substantial popular support in South West Asia, and Hindu extremism is powerful in India. .*

4. Some Key issues for EU Policy

External actors have an important contribution to make to conflict prevention and reduction efforts in Asia. Indeed, in view of the limits on the roles that regional organisations and bilateral co-operation amongst neighbours are likely to play in most cases, appropriate wider international assistance from international organisations, the EU and 'donor' states such as the UK, France, USA, Canada and Australia is vital.

In many ways, the EU has an active policy in East and South Asia. It has major economic and trade relations, and has established important social, cultural and scientific co-operation and exchanges (including for example the ASEM process).

Nevertheless, overall the EU is not influential in political or security issues in South and East Asia, certainly compared with the USA or even Japan. It is widely perceived in the region to be primarily concerned with investment and trade, and have little real engagement on political and military issues. This perception has real substance. The EU generally lacks well-developed policies and engagements on political and security affairs.

One key dimension of this is the EU's generally weak engagement with China on key political and security issues. China sees little reason to take EU concerns seriously into account, because they are rarely followed up with real or sustained pressure. Other states in East Asia, all of which have real security concerns about China, believe that the EU is

unlikely to be a major actor on security issues of concern to them. This undesirable situation should change, with the EU playing a more substantial role.

Some issues that would need to be addressed in this context include:

- Intensified EU engagement and co-operation with USA, Japan and South Korea on East Asian security issues.
- Maintenance of the EU arms embargo on China, not least to signify a concern about the risks of conflict in the Taiwan Straits.
- Sustained diplomatic pressure on China to come to a stable provisional understanding with Taiwan along the lines discussed above
- Raising of EU engagement with challenges posed by the DPRK, particularly active development of co-operation on such issues with Japan and South Korea.
- Development of more co-ordinated and coherent conflict prevention strategies towards weak and unstable states in South and East Asia, and active engagement with India-Pakistan issues.

5. Trends in internal warfare, particularly in Africa

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1. Diagnosis

Military analysts, such as the Israeli military historian Martin van Crefeld (1990), and social scientists, such as British political scientist Mary Kaldor (1999), identified patterns of warfare in the 1990s, particularly in the Balkans and in Africa, that purportedly made them distinct from earlier patterns of fighting. They represent a particularly nasty form of civil war.

The following are often identified characteristics of such “new wars”:

- a) Mode of warfare. New wars are marked by what has been called „asymmetric warfare“. Similar to guerrilla fighters of earlier days, forces are small and often operate autonomously. Different from guerrilla forces, operations predominantly target civilian populations. Fighting against opposing military formations is avoided.
- b) Technology. Fighting is mostly done with small arms and light weapons, in some cases machetes and the like are used against civilian populations.
- c) Funding. Fighting is often self-funding, through sales of natural resources, hijacking, quasi-taxing of humanitarian organisations etc. Another important source of funding are, in many cases, diaspora communities.
- d) Identity. Fighters are predominantly young males, often under-age 18 (“child soldiers”). In most cases, their allegiance is with local commanders who provide them with weapons, food and pay („warlords“). Fighters generally are recruited along ethnic lines, however, several, even bitterly fighting, forces can come from one ethnic group. Political causes of groups beyond gaining control over a territory are often imprecise, if identifiable at all.
- e) International networks. Forces typically are well connected internationally, through funding, supply with arms and ammunition and with diasporas. They often also have regional networks of allied forces, sometimes sending arms or fighters to support similar groups in other countries. Many fighting groups are also using modern means of communication to manipulate international response to particular conflicts.
- f) Regional dimension. New wars seldom cover the territory of a nation state. Typically they are confined to only parts of the territory of a nation-state, but have regional extensions, either because of ethnic alliances, trade relations or common political interests.

New wars are messy, protracted and costly in terms of loss of – predominantly civilian – life and economics. They are therefore a problem both from a humanitarian and development point of view. In a human security perspective, which is promoted by a number of member countries of the European Union, and has also been recommended as

a policy for the European Union itself (Kaldor et al, 2004), the massive threat to life of individuals in war situations is a trigger of actions.

Civil wars, and particularly new wars, are often seen as threats to other countries, including the European Union, even in a more traditional security perspective. One important issue are refugee flows. In addition, the phenomenon of new wars is closely linked to that of “failing states”, which is identified, both in the US National Security Strategy of 2002 and the European Security Strategy of 2003 as one of the major security threats. „Failed states“ are seen as „black holes“ of international policing, providing safe havens, as well as breeding grounds for international terrorism.

Several links between new wars and failing states have been identified, the most important being:

- a) A crucial dimension of state failure is the loss of, first, legitimacy and, second, control of parts of a country’s population, either through bad policies or a lack of state capacity for good government. Low or zero government capacity invites alternative local power arrangements and allows warlords to dominate local economies.
- b) Fighting of the type characteristic for new wars is particularly disruptive for economic development. Governments are generally increasing their military spending, often without much effect and at the same time are deprived of income.
- c) New wars fighters and their commanders can develop an interest in the continuation of insecurity as a source of income and power. Fighting may be sparse, but territorial control dispersed among many local warlords.

2. Prognosis

Protagonists of the new war thesis claim that the number and intensity of new wars has increased dramatically since the end of the Cold War (Münkler, 2002). Critics point out, that this claim is not consistent with available data (Mack, 2004; Kalyvas, 2001). The statistics of civil wars is marked by a significant decline both in the number and the intensity since the mid-1990s (Uppsala/PRIO, 2004; AKUF, 2004). No separate information is available for those wars among civil wars which bear the mentioned characteristics of new wars.

There is no unanimous view on the causes of the high incidence of new wars in the late 20th century, and thus no single basis for predicting their future incidence. Two lines of explanation are particularly important:

- One emphasises low income and income growth. The recent boom in economic analysis of civil wars has again demonstrated the importance of poverty as cause of weak government institutions and low thresholds for recruitment of fighters. Since civil wars are also a cause of poverty, a group of researchers connected to the World Bank has identified a “conflict trap” (Collier et al, 2003): Prior civil wars are, in empirical analysis, identified as a major cause of civil wars. In addition, in at least the majority of the literature, dependence on the export of natural resources is also seen as a major cause of civil wars.

While major international efforts are underway to achieve the Millennium Goals of halving the share of absolute poor among mankind by 2015, predictions are dire for countries marked by protracted conflict. Development policy has focused, since the 1990s, on the “good performers”, countries where investment in the form of development aid has a high chance of bearing fruit. Such a focus, however, carries the danger of perpetuating poverty and internal conflict in countries already marked by weak economies and political instability.

- The second explanation emphasizes various facets of globalization (Duffield, 2001). Globalization has put strong pressure on governments to reform and rationalize, to privatize economic activity and reduce elite privileges. This has led to façade states, propped up by cold war politics and international development aid to lose power, funding and legitimacy. At the same time, more open borders and financial systems have made it easier to trade in natural resources, including in illegal goods, and arms and ammunition. In addition, globalization is marked by improved communication facilities, which make it easier for fighting forces to organise international support, including by diasporas.

Both explanations lead to similar predictions with respect to future incidence of civil war, particularly of the type characterised as new wars. States with growing economies and strong political institutions are likely to gain from globalization and grow further. Territories lacking legitimate and powerful institutions and marked by low economic growth are likely to lose through further globalization.

Geographically, it is possible that civil war largely becomes a phenomenon found in Africa south of the Sahara. Africa south of the Sahara is in particular danger of not escaping the conflict trap. Political institutions are weak in most countries in Africa and economies weak. GDP per head is the lowest among major world regions, economic growth is slack, economic diversification limited, population growth high, despite the HIV/AIDS crisis. In fact, HIV/AIDS dramatically worsens the situation dramatically, because it predominantly disables and kills people in their most productive years and burdens social systems.

One important aspect of civil wars since the 1990s has been the growing unwillingness of neighbouring states and the international community of states to tolerate it. The number of international interventions has grown considerably (Mack, 2004). Military interventions are increasingly expanded in scope and mission. Most international interventions of late are peace support missions, where the objective is to keep a territory under control until the political situation is stabilized and security can be safely transferred to local forces. However, it has proven very difficult to establish a safe, secure and stable post-conflict order, particularly to rebuilt devastated economies. It is therefore difficult to predict whether the international community will have the patience to continue the current path of increasing the number and depth of international interventions, or revert to earlier reluctance to commit resources and soldiers.

3. Links to European science and technology policy

The very brief analysis of new wars emphasises the political dimensions of the issue. Major choices include approaches to development, the willingness to strengthen governments in failing states and the preparedness to invest in peace support operations. Still, a number of priority areas for science and research can be identified:

- a) Social sciences. Despite a recent surge in analysis, there remains a great need for further study of the causes and consequences of civil wars. As mentioned, explanation of civil wars, including new wars, remains contentious. Knowledge of particular cases is often limited. A particularly difficult, but important, field of research are the conditions for re-establishing safe, secure and stable post-conflict environments, including topics such as security sector reform, turning war economies into peace economies and restarting devastated economies.
- b) Technologies for economic development. As mentioned, low economic activity and growth is generally seen as major cause of civil wars. The challenge is to find and promote technologies that support income generation in situations marked by political instability.
- c) Technologies for controlling illegal trade. Two types of technology seem particularly relevant:
 - Tagging. Small arms, ammunition, but also equipment used in illegal exploitation of natural resources, is currently often imported with impunity for the supplier. Tagging such equipment, with electronic, chemical or other types of tags would make it easier to disrupt illegal trade routes.
 - Surveillance. Sensors on various platforms, including satellites, are needed for better control over the flow of many types of goods traded illegally.
- d) Technologies for peace support operations. This includes classical military technology, as well as technology:
 - Transport capacity. Cheaper airlift capacity would lower costs of military intervention.
 - Command, communication, computing and intelligence. Peace support operations have not been a particular focus of attention in military research. The equipment used is non-specific. However, there are particular demands on information, information processing and instruments for dealing with challenges. It seems likely that at least some specific equipment would result from a dedicated research effort.

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6. Identify international terrorism trends until 2015

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1. The changing nature of terrorism

Europe's experience of terrorist activity over the past decades has invariably involved groups with clear and limited political objectives. Today, these groups have largely been supplanted by a more radical, fundamentalist terrorism, exemplified by Al Q'aida. If we are to combat this new terrorism effectively we first need to understand our adversary.

(i) Who exactly are they and how do they work: Today, terrorism is increasingly characterised by a move towards *ad hoc* constellations and networks, away from hierarchical structures, national contexts and traditional modes of state-sponsorship. They legitimise their struggles through ethnic and religious extremist ideology, flourishing in zones of chaos and anarchy in near or already failed states. Al Q'aida is the prime example of this new terrorist group. It is a loosely knit network of extremist Islamic groups.¹ Its general objectives are far-reaching and extreme.

(ii) What motivates them, what are their objectives: Seeking to comprehend the causes of terrorism does not mean condoning their actions. But we need to understand the historic changes underway in the Muslim world and tailor our policies accordingly. It is unwise to talk of a 'clash of civilisations' and to seek to polarise between the West and the Islamic world. This does not describe an empirically observed reality; but describes and exaggerates something feared and imagined.² This language shapes the Islamic perception of what the West is doing. It affects the course of Islamic reform, tending to discredit forces of moderate, secular and progressive theological change as ineffectual.

Muslims have felt under attack for centuries, but what is new is the immediacy of the challenge posed to traditional values and structures by the dominance of America and of 'Western' culture in general, whose media broadcasts directly into homes throughout the Islamic world. This has raised aspirations throughout the Islamic world. People question the right of autocratic regimes to rule. Some feel marginalized, scared and angry in the new world and turn to force to hold on to what is passing. Many Muslims now fear that what is going on in Gaza and in Iraq is what, ultimately, may be in store for them. This already has had a damaging effect on the movement of ideas and political reform between Western and Islamic societies.

¹ Alexander, Y., and Swetnam, S., *Usama bin Laden's al Qaida: Profile of a Terrorist Network*, New York, Transnational Publishers, 2001, p. vii

² William Pfaff, 'This futile fundamentalism, Champions of Islamic revolution are fooling themselves; they have nothing to offer contemporary Muslims', 17 October 2004, *Observer*.

But as Gilles Kepel, the French authority on Islamic society, has already said, the Islamist movement is moribund in moral terms, although its military and political energy is not yet exhausted. There is no way in which it seriously threatens the Western industrial nations, other than through sporadic acts of terrorism. Islamic fundamentalism has nothing to offer contemporary Islam. You cannot function in the 21st Century on the basis of a primitive interpretation of Islamic law. That already is evident in Iran.

(iii) *How they want us to respond in the near-term:* The terrorists need to radicalise their own potential support base. The primary objective is “to bring down upon the community in general a reprisal for his wrongs, in the hope that fury and resentment roused by punishment meted out to the innocent will gradually swell the ranks of those from whom he will draw further recruits.”³ This also appears to be true of Al Q’aida, although with an important rider that this does not preclude the taking of the lives of ‘complicit’ Muslims in the course of perpetrating terrorist acts.

(iv) *How are they likely to pursue those objectives:* Al Q’aida is focusing on a patient strategy, carrying out coordinated attacks that are intended to foment turmoil and instil popular uprising against so-called ‘godless’ regimes. It also focuses on perpetrating numerous and intense atrocities against the West. Any future use of WMD is likely to seek to invoke psychological and societal mass disruption rather than destruction. The use of suicide attacks is an integral part of this strategy because it shows that the bombers possess the weapon that will, ensure their eventual victory i.e. faith.⁴ The example of the young ‘martyrs’ supposedly shames those who do not have the courage to act.

(v) *What weapons will they use:* For groups seeking to inflict mass casualties, to maximise terror amongst the target population and polity, and to heighten still further media interest in their actions, Chemical, Biological, Radiological and Nuclear (CBRN) weapons appear attractive. Exposing themselves to the dangers associated with handling the deadly materials required is unlikely to worry those prepared to launch suicide missions. We already know that some terrorist groups, including Al Q’aida, are seeking to acquire such materials and expertise on the international black market.

There is a concerted move towards greater lethality in suicide missions using conventional explosives; for example, the fuel truck explosion at the Tel Aviv fuel depot or the gas tanker mission against the synagogue on Djerba. These mobile human guidance systems are very difficult to defend against. There are numerous other possibilities, ranging from, for example, the use of portable SAM-missile systems at major airports to the deployment of a liquefied natural gas tanker in any Western port.

³ Lawrence Durrell, *Bitter Lemons*, (New York, 1957) – a classic account of the 1950s Eoka insurgency in Cyprus.

⁴ As outlined by Dr Ayman Zawahiri in his book, *Knights Under the Prophet’s Banner*, (London, 2001), the method of suicide attack has been adopted as the ultimate strategic weapon.

2. Response strategies and techniques

(i) *Build domestic support:* A strategic response rather than a series of knee-jerk reactions is required. We should not play up this ‘clash of civilisations’ as it polarises in just the way the terrorists want and elevates their importance. It is most important to prevent them from draining our political will and opening up and then exploiting divisions between governments and people. Hence, it is crucial to build the widest possible domestic consensus for our responses to terrorism. We must win over our electorates by being more transparent, clearly setting out the costs and benefits of our counter strategy, placing the problem into proper perspective (warning of the nature and magnitude of the threat without exaggerating it).

(ii) *Direct confrontation:* We will need to allow for immediate and direct confrontation when the threat manifests itself e.g. Afghanistan. But more often it will be through the pursuit of disrupting their key ‘enablers’ i.e. international reach, resources and communications. If these elements can be disrupted then the ‘new’ element of terrorism becomes no more than a traditional group that must be understood in its local capacity. When the main concentrations of Al Q’aida and the Taliban were routed, only small cells remained. Subsequently, we have entered a different phase, one where military power usually will *not* be the most important factor in our success. It is paramount that we focus vengeance solely upon the guilty. Israel and Russia, for example, have adopted repressive policies that are counter-productive.

(iii) *Catching the culprits:* The difficulty for all governments in addressing terrorism is that this is best done by undramatic, even invisible means: intelligence, politics, diplomacy, special forces operations. Disrupting operations and preventing attacks requires policing, intelligence gathering, closing accounts, tracking people, lots of legwork, the use of new technologies to identify and track suspects, better security, reduced vulnerability of key strategic targets. But precisely because these efforts are unglamorous and too often unnoticed, support for them can slip. Furthermore, there is a natural tendency for things to gravitate back toward business as usual. Too often in the past, after the shock of a major terrorist attack wore off, attention and political will has wavered.

(iv) *The importance of differentiation:* We should avoid viewing a complex, variegated phenomenon as a monolith – and, therefore, fail to tailor policies to fit individual cases. Each terrorist group is unique in its way. And these groups are dynamic and evolving. The danger is that we respond to those with legitimate grievances – but who are using illegitimate means – by brutalising the innocent and exacerbating the grievance. The only questions that should matter are whether the grievances represented by a given movement receive a political as well as a military response, or whether governments persist with exclusively military policies.

(v) *Political/diplomatic strategy:* EU Member States in Council working groups such as COTER (Counter Terrorism) have already drawn up lists of terrorists, terror financiers,

etc. who are to be excluded from entry into the Schengen zone. Other measures include collaboration on terrorist financing, harmonisation of information on NGO activities, Muslim preachers etc. More could be achieved through collaboration between intelligence agencies and, in particular, the office of the European Counter-Terrorism Adviser.

We continue our efforts to name, shame, and sanction state sponsors of terror, and have seen progress on this front in recent positive steps by Sudan and Libya. Likewise, the benefits of improved training and cooperation helped Greek authorities break open '17 November' in the past year. We need to continue to strengthen and tighten export control measures and to ensure the effective implementation of arms control treaties. In order particularly to avoid the nexus of WMD, terrorists and rogue states we must address illegal and threatening state WMD programmes. Before verification technologies can be applied, however, treaties have to enter into force (such as the CTBT) or have to have verification requirements developed (as in the BTWC).

(vi) Media strategy: Public diplomacy is not propaganda; we have a good story that stands on its merits. Getting our message out to the world played a critical role in our long-term success in the Cold War. We must develop innovative ways of using new media – such as the Internet and satellite television – to reach new audiences. The media will play a critical role in allaying the broader psychological effects for the public. Western media also must recognise their responsibility in responsible reporting, as they become too easily convenient outlets for sowing the psychology of fear, amplifying the violence and extremist messages by Al Q'aida. The role of al-Jazeera is a case in hand where it has become an uncensored vehicle for distributing ideological and even indirect operational directives.

(vii) Education and cultural: The value of cross-cultural understanding and communication should be harnessed, promoting dialogues among and within civilisations that are politically, culturally and socially relevant especially relevant to young people. The educational systems in Saudi Arabia and parts of Pakistan are largely in the hands of extremists who preach a message of religious hatred and jihad against the West. This has created a generation without any transferable skills. Encouraging a reorganisation of Islamic education towards moderation and tolerance and away from extremism is a necessity. As observed by RAND's Bruce Hoffman, it is critical to address the issue of suicide bombings, not merely on the individual or psychological level but rather on the organisational and societal level.⁵ It is critical to address through education and institute a reversal of what has become 'normal.'

(viii) Protecting ourselves: We will continue to enhance the means of protecting our critical infrastructure and ourselves. But, as Secretary of State Powell said: "We can not, we will not, let the need to fight this war make us that different a society. We have to protect ourselves. But... we must not become gated America or they will have won".⁶

⁵ Bruce Hoffman, *The Implications of a Post-9/11 World*, Foresight, Vol. 9, No. 3, 2002.

⁶ Testimony before the House Select Committee on Homeland Security, July 2002.

3. Future Trends

Terrorists will continue to confront us through various methods of asymmetric warfare. We can expect them to become more sophisticated at manipulating the world's media; the aim being to influence western electorates who then demand changes to their governments' foreign policies in directions welcome to the terrorists. They will wage a psychological as well as physical conflict. Seeking to create a climate of fear that will engender a repressive response against the terrorists' potential recruiting pool. They will seek to polarise the clash between the west and Muslims in order to radicalise their 'side'. They will continue to use suicide tactics to demonstrate the moral superiority of their faith. They will attempt to portray themselves as being a larger, internationalised and more significant force than they actually are, representing the entire Muslim world.

They will perpetrate 'spectacular' acts that will strike symbolic, strategic and critical targets to instil a sense that nobody and no place is safe and to strike economically crippling blows against western capitalism. They will also continue to carry on with pinprick, yet highly visible, attacks (such as hostage taking) particularly against westerners in Muslim countries in an effort to deter western investment and involvement in those countries. They want to raise the price of western military, cultural and economic intervention in Muslim countries. They will exploit regions of instability where government authority is diminished.

4. Role of Science and Technology in Counter-Terrorism

(i) *Limits of Technology in Counter-terrorism:* By its very nature, defence against terrorism means we must be prepared for anything. Consequently, it is virtually impossible to deploy technological countermeasures to meet every conceivable threat scenario. Of course, for example, we should continue to screen for bombs at airports and to position devices that detect chemical and biological agents on the underground. But it is unrealistic to deploy these and similar defensive technologies in every public building and on every highway.

It is far more effective to concentrate our efforts on trying to mitigate the generic threat. Technologies that improve intelligence gathering and analysis are a crucial example: ones that could help the authorities more rapidly to uncover terrorist plots, whatever the target. Similarly, technologies that, by facilitating better communication, coordination and emergency response, could reduce the effects of a terrorist attack. It is important to recognise the strengths and limitations of technology and not to divert scarce resources into wasteful and ineffectual technological 'fixes' that could render us more vulnerable to other threats.

It is the quantity, quality and analysis of information that will make us more secure rather than technology per se. Technology serves to generate, intercept, and translate intelligence. For example, when confronting terrorists who rely on minimal technological support and who are linked through familial or tribal bonds, technology is useless - as we have seen with aspects of the War on Terror.

(ii) *Countering Identity Theft*: Because terrorists rely heavily on identity theft, credit card and bank fraud, there is an urgent need to provide more effective mechanisms to monitor and establish the authenticity of identity documents. Achieving technological improvements in our ability to make these documents more difficult to forge and easier to verify, should be a priority. Only if we can identify those planning attacks do we have a chance of stopping them. Developments in biometrics technology - the statistical analysis of biological observations and phenomena – offer us a very new way to identify potential terrorists by their fingerprints, face, and iris. This will greatly assist us in successfully preventing identity theft and identity forgery.

(iii) *Countering Terrorist Finance*: Terrorist finances currently flow far quicker in the international financial system than any law enforcement agency can react to. Operationally linking funds in one country with a terrorist crime in another is extremely difficult to prove, let alone tracking the money in today's international financial system. We need to invest in financial tracking technologies.

(iv) *Appropriate intelligence gathering*: There is further scope for states to improve intelligence gathering, sharing and analysis, specifically enhancing their individual human intelligence capabilities, including, for example, better cultural understanding. Here, technology has a role to play in enhancing the 'real-time' picture of the movements of known suspects. The use of Unmanned Aerial Vehicles (UAVs) is relevant here. Developing computer capacities to assimilate vast quantities of pieces of intelligence into a robust analysis of what may be a rapidly evolving threat is critical.

(v) *Disseminating existing technology*: It is also important to ensure that basic technologies with counter-terrorist applications are provided to our allies around the world. For example, equipping border guards with binoculars and better communications equipment, and training teams of bomb-disposal specialists.

(vi) *Countering WMD*: The application of enhanced technologies to verify non-proliferation of WMD is important in relation to terrorists as well as to states. The lack of any verification provision makes it all the more important that states parties to the BTWC undertake to facilitate the fullest possible exchange of scientific and technological information for the use of biological agents and toxins. It is especially important that states keep abreast of developments in biotechnology and their possible applications for nefarious purposes.

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7. Nuclear proliferation and non-proliferation trends to 2015

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1. Diagnosis

Proliferation challenges in the period out to 2015 can be summarized as follows:

Challenges presented by states

- States developing NBC weapons
- States holding open the option to develop NBC weapons by developing the relevant technological base.

Challenges presented by non-state actors

- Terrorist access to NBC weapons
- Terrorist use of nuclear explosive device
- Use of dangerous materials and new techniques that are not weapons

Governmental and international officials as well as non-governmental analysts have recently identified an increased risk that weapons of mass destruction, and in particular nuclear weapons, will proliferate. A changing understanding and usage of the terms ‘proliferation’ and ‘weapons of mass destruction’ accompany this perception of increased risk of proliferation. During the 1990s the primary focus of both policy and analysis was placed on state weapon programmes, where the tendencies appeared relatively benign. At that time the number of state weapon programmes was relatively small, the growth in the number of programmes that had been widely predicted in earlier periods had not occurred and a number of programmes were either terminated or ‘rolled back’ through peaceful means.

Since the late 1990s the following proliferation characteristics have appeared:

- g) State programmes. Two previously known but “recessed” nuclear weapon programmes have been declared in India and Pakistan, where weapon tests have been carried out. Two suspected but unconfirmed weapon programmes have been uncovered in the Democratic People’s Republic of Korea (DPRK or North Korea).
- h) Non-state programmes. Evidence uncovered in Afghanistan and through the activities of national agencies has indicated that sophisticated terrorist groups and their associates seek to acquire a nuclear explosive device as well as radiological weapons.
- i) Non-weapon programmes. Evidence also suggests that nuclear terrorism might take forms other than weapon use, either by means of attacks carried out with dangerous materials that are not in themselves weapons or by attacks on nuclear facilities.
- j) Technology acquisition and development. The fissile materials that are used to make nuclear weapons can be acquired from industrial processes that also have legitimate peaceful uses. A number of countries, including some of current or recent

proliferation concern, are investing in the development of nuclear industrial capacities that are particularly sensitive from a proliferation perspective. There has been a particular interest in uranium enrichment processes and, to a lesser extent, in processes to reprocess spent nuclear fuel.

- k) International networks. Information provided to governments by Libya and the investigations carried out by the International Atomic Energy Agency have confirmed that an international network of suppliers has worked actively to provide countries and programmes of proliferation concern with items relevant to nuclear weapon development.
- l) Legal dimension. In a number of cases the activities associated with nuclear proliferation have been in violation of the international agreements and national laws of states. The international agreements have not provided any “traction” on the proliferation problem. The effective implementation of national laws in this area has been difficult and the quality of national efforts has been uneven.
- m) Information dimension. The recent developments have underlined the inadequate nature of the information and data base on which both governmental and non-governmental actors are basing their analyses and conclusions. Nuclear proliferation is an activity that is carried out in a secret, often clandestine manner and concealing information about both technical capabilities and intentions is routine.

The characteristics of the state and non-state patterns of proliferation appear to be very different from one another. The main motivations for state programmes underway to acquire nuclear weapons appear to be:

- to deter either the use of nuclear weapons by other possessor states or to deter the use of force by an adversary with superior conventional military power,
- to obtain the international prestige and associated political benefits that their possession brings,
- the result of a technological momentum that develops within the scientific community of the state following the initiation of nuclear research and development programmes.

Given these objectives states that have already developed nuclear weapons or that are on the threshold of doing so (India, Pakistan and North Korea) are likely to want to build relatively large arsenals of weapons to achieve a degree of security in the face of the risk of a preventive “first strike”.

The progressive efforts by the international community to restrict and deny useful technologies to countries and programmes of nuclear proliferation concern mean that states are likely to seek the full development and production cycle associated with nuclear weapon research, development, design, production, storage, handling and delivery.

The risk that a small arsenal will be vulnerable to pre-emption as well as the efforts by other states to develop more effective active and passive defences make it likely that these states will pursue a range of missile and/or combat aircraft delivery systems. The

need for dispersal and concealment of arsenals are likely to lead to the pursuit of robust (i.e. incorporating redundancy) command and control systems.

The main motivation for sophisticated terrorists to acquire a nuclear explosive device appears to be the catastrophic use of that device against civilians. Advanced societies recover from terrorist attacks and adjust to a new threat environment. Consequently, to maintain their effectiveness and achieve their objectives sophisticated terrorists are likely to be driven to ever more spectacular and destructive attacks.

In contrast to the relatively large “footprint” of state programmes, sophisticated terrorists are likely to operate in small numbers and in unknown locations. Moreover, to accomplish their objectives they require only one or at most a handful of devices. The need to conceal their activities and the nature of their requirement means that such groups are likely to be seeking to procure only the equipment necessary for the shaping of fissile material into a crude (probably “gun-type”) device and necessary for handling the device prior to delivery. Delivery itself could not be via sophisticated means such as an advanced combat aircraft or a missile. Covert delivery using improvised means would be more likely.

2. Prognosis

The prognosis for state based and non-state actor based proliferation to the year 2015 is different, in line with the different characteristics of their programme requirements. India, Pakistan, Israel and North Korea—are likely to continue to take steps to develop their stockpiles, command and control systems and delivery systems. In conditions where all of these states must see their existing arsenals as vulnerable, greater transparency about inventories, capabilities and nuclear doctrine are unlikely in the next decade. States likely to hold open the option to develop nuclear weapons by developing the relevant technological base are likely to be those with an existing nuclear research and technology base on which they can build combined with a security environment that requires a high level of deterrence. This security environment is certain to be strongly influenced by local and regional factors but might also be heavily conditioned by the policies of the United States.

A number of recent books and articles have examined the characteristics and environment that appear to influence nuclear weapon decision-making. The group of states that combine these characteristics include Iran, Egypt, Taiwan and South Korea. A number of states that have been identified as having a potential requirement for nuclear weapons (such as Saudi Arabia, Turkey and, to a lesser extent, Syria) lack the technological basis for a weapons programme. A number of states that have a technological base that would allow the development of nuclear weapons—including Japan and Brazil—currently lack the rationale to develop nuclear weapons.

An important aspect of proliferation by states has been the willingness of the international community of states to accommodate it. Few states that have developed nuclear weapons have faced sustained sanctions. Modification of international

agreements (most notably the Nuclear Non-Proliferation Treaty (NPT) to clarify the obligations of states and what constitutes non-compliance with those obligations or to strengthen implementation appears to be impossible. Violations of international agreements (including bilateral safeguards agreements with the International Atomic Energy Agency) have not attracted sanctions when discovered. At the same time, the international community has not consciously adapted itself to creating stability in a world system containing multiple nuclear weapon states.

By contrast there has been a clear signal that states are not willing to contemplate the access of non-state actors to nuclear explosive devices. A number of legal processes at the global, regional and national level have been initiated to give effect to this determination to keep such destructive devices from terrorists. Moreover, a wide and comprehensive range of measures (including military interventions) are likely in cases where terrorist groups might establish a foothold in countries with emerging nuclear capacities. In this regard the nuclear weapon programme of Pakistan probably represents the main and most difficult non-proliferation challenge of the next decade in that it is not possible to either accommodate.

Most international interventions of late are peace support missions, where the objective is to keep a territory under control until the political situation is stabilized and security can be safely transferred to local forces. However, it has proven very difficult to establish a safe, secure and stable post-conflict order, particularly to rebuild devastated economies. It is therefore difficult to predict whether the international community will have the patience to continue the current path of increasing the number and depth of international interventions, or revert to earlier reluctance to commit resources and soldiers.

3. Links to European science and technology policy

The very brief analysis of nuclear proliferation trends emphasises the inter-woven political, strategic, economic and technological dimensions of the issue. Major choices include approaches to development, the willingness to strengthen governments in failing states and the preparedness to invest in peace support operations.

In relation to nuclear weapons studies that might enhance the current understanding and help to formulate effective policies include:

- e) A study exploring the respective role of and relationship between verification, transparency and safeguards as instruments to help achieve the objectives of multilateral nuclear arms control;
- f) A study of how states have prepared to implement the Additional Protocol to their Safeguards Agreement with the International Atomic Energy Agency (IAEA).
- g) An analysis of the implications for international security of an emerging “second nuclear age” in which nuclear weapon possessor states are greater in number and have different strategic relationships from those of the cold war.
- h) An analysis of the potential role of regional mechanisms, as opposed to global approaches, to ensuring stability and security.

- i) A study of the nuclear research establishment of countries in the Eastern Mediterranean and the wider Middle East of nuclear proliferation concern including the identification of facilities (such as institutes and research reactors) where knowledge and materials are located.
- j) A technical study of the means of nuclear weapon delivery available in the countries of proliferation concern with a view to establishing their provenance.

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8. Key Policy Issues for the Security of the EU until 2015: Trends in Poverty Reduction

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1. Introduction

In accordance with our brief, this paper seeks to identify trends in poverty reduction until 2015 as a key policy issue for the security of the EU. Following an initial explanation of the relevance of poverty reduction for security and *vice versa*, the current state of play in terms of efforts towards poverty reduction is presented. Drawing on this data, future trends are identified, with particular attention to those regions of strategic importance to the EU. Finally, in drawing out some priority issues for the EU we have selected not only those with direct relevance for EU science and technology policy, but others with implications for wider EU strategy and policy in terms of poverty reduction and security.

1.1. The poverty reduction framework

Poverty reduction is firmly on the global agenda. The internationally agreed set of targets, the Millennium Development Goals (MDGs), place human development and poverty reduction at the heart of global development objectives and provide the international development community with a common framework of time-limited, quantifiable objectives to guide its policies and programmes and to evaluate effectiveness of action taken in the multiple aspects of poverty reduction until 2015. Since 2000, the eradication of poverty has also been the declared principal aim of the European Community's development policy and its associated external assistance. Most recently, the new EU Commissioner for development and Humanitarian Affairs has promised to make the MDGs central to all the European Commission's policies and, furthermore, has committed to reviewing and updating Community development policy as it relates to the MDGs laid down in 2000 in the light of subsequent developments.⁷

1.2. Linking poverty, conflict, and security

The EU recognizes that security and development go hand in hand. Not only is security a precondition of development, but a lack of development, inequality and poverty are often a source of instability, trapping many countries and in a cycle of conflict, poverty and insecurity. Underscoring the relationship between conflict and poverty, human development within conflict-ridden countries is generally lower in areas that suffer directly from conflict.

⁷ Stefania, Bianchi, *EU Promises Action Over MDGs*, Global Policy Forum Press Release, 22 September 2004.

Lack of security (national or regional) destroys physical and social infrastructure, undermines government capacity and leads to a host of problems including lawlessness and a breakdown of public service provision. Conflict also undermines the economy, deters investment and creates obstacles that impede delivery of aid targeted at poverty reduction. Poverty, lack of development prospects, inequality across groups and regions, marginalization and exclusion create a climate of instability and lie at the root of many conflicts. Competition for natural resources – especially water – likely to be aggravated by climate change over the next few decades can also contribute to tensions.

These conditions provide fertile ground for extremism and terrorism so endangering national, regional – even global – stability. Poverty also fuels voluntary migration, which not only robs developing countries of dynamic and valuable human resources, but in turn can cause problems in host societies including alienation particularly of young people which can contribute to extremism.

Poor governance often lies at the heart of these problems. Corruption, inefficiency and a lack of commitment to undertake policy and institutional reforms are inimical to reducing poverty. The post Cold War period has additionally seen State failure characterized by weak (and in some cases collapsed) State institutions, abuse of power, corruption and lack of accountability. This situation compounds regional instability, while providing opportunities for organized crime, which thrives on the opportunities for illicit profits presented by conflict.

Transnational crime (including trafficking in drugs, small arms and light weapons, illegal migrants, women and girls etc.) and is especially associated with failing States and regional clusters of unstable states. State failure and organized crime can rapidly expand and be consolidated if neglected. This highlights the need for preventative action before a crisis occurs.

Tensions and violent conflict, weak States and organized crime, as well as exploding population growth on Europe's borders all pose problems. It is particularly in the EU's interest that countries on the borders are well governed and violent or frozen conflicts (such as that in Moldova) are resolved. Combating poverty, inequality and marginalization outside of the immediate region is also relevant for European security. As the European Security Strategy recognizes: "With the new threats the first line of defence will often be abroad".⁸

In this connection, commentators have drawn attention to divisions in the international community on how to ensure effective security and they have emphasised the danger of responses to terrorism overshadowing the poverty reduction agenda. The concern is that development should not become an objective *only* in a security context, but should remain a goal in its own right. Of particular concern is the balance of EU resources between development and external action under the Common Foreign and Security Policy.

⁸ *A Secure Europe in a Better World: European Security Strategy*, Brussels, 12 December 2003, at p.7.

2. Trends in poverty reduction

2.1. Overview of current trends in reaching the MDGs

A number of caveats regarding the reliability of data upon which projections are based should be noted.

- Most goals data is not available beyond 2002 and most projections for possible outcomes in 2015 start from the base year of 1990. This makes them heavily weighted by results achieved before the MDGs, possibly generating an unduly pessimistic outlook for future outcomes.
- The common use of averages to measure MDG progress, while providing an overall sense of trends can also be misleading. Failure to disaggregate by gender, for example, may bring a result far from the reality experienced by many women.
- The use of national performance indicators hides national disparities, reflecting neither regional differences, nor the gaps along economic, social, cultural, gender and ethnic cleavages, which can destabilize human development as a result of social unrest, political disputes, violence and conflict. This is the case particularly in some Middle Income countries, where increase in national indicators does not necessarily mean that all groups benefit at the same rate.
- The long-term impacts of trends in climate change as well as HIV/AIDs and other communicable diseases are yet to be fully felt and present something of an unknown. The effects on the goal of poverty reduction are, however, potentially catastrophic.⁹

Overall, there have been notable advances and cause for hope in some areas. While some significant progress is being made towards meeting some of the targets in some of the affected countries, progress is, however, uneven across and within regions and even countries. In many cases progress is patchy, too slow or non-existent, with the poorest nations (landlocked and least developed) and those in sub-Saharan Africa seeing little significant progress and, in some cases, regression in achieving MDG targets.

Poverty and hunger

On the positive side, global income poverty rates continue to fall. After an increase in the late 1990's poverty rates have declined in many regions,¹⁰ which would suggest the 2015 target to reduce poverty by half will be met. Whether this can be regarded as an overall trend is, however, debatable, especially given that much of the global progress has been due to a rapid decline in Asia – particularly China where poverty estimates show large discrepancies.¹¹ There is still massive poverty in South Asia, which has 25% of the world's population and where increases in agricultural production have not translated into poverty reduction and equitable distribution of wealth is inhibiting human development. In sub-Saharan Africa many countries are caught in a poverty trap, with over 40% of the population still living below the poverty line of \$1 per day.

⁹ See, the October 2004 report *Up in Smoke*, published by a coalition of aid and development agencies, according to which global warming threatens to make the MDGs unobtainable and even reverse human development achievements.

¹⁰ N.B. Differentiation of data and trends by region generally follows World Bank categorization.

¹¹ Jan Vandemoortele, *Are the MDGs Feasible?*, UNDP, New York 2002.

There has been little or no progress in Latin America and the Caribbean and in Eastern Europe and Central Asia poverty has actually increased, returning to pre-transition levels. Since the fall of communism, the region has seen rapid socio-economic change as well as increasing population mobility. In addition to an increase in absolute and relative poverty levels in the past decade, income inequalities have also grown in many countries, increasing regional vulnerability to violent conflict, and providing fertile ground for extremism and terrorism. In North Africa and the Middle East unresolved conflict as well as unemployment and economic underdevelopment and stagnation – contrary to the high expectations of a predominantly young population and potentially leading to social unrest – are of major concern.

Education

In those countries that have laid a good foundation for growth, indicators of social development are also improving. Education is crucial for achievement of the MDGs and progress towards universal primary education is generally steady if lagging in some areas. Targets have been met in 37 of 155 developing countries. Three regions – East Asia and the Pacific, Europe and Central Asia (despite a decline in universal primary education in European CIS countries), and Latin America and the Caribbean – are on track to achieve the goal. Based on trends in the 1990s, another 32 are likely to achieve that goal, but 70 countries risk not reaching the goal unless progress is accelerated, meaning if current trends persist, children in more than half of developing countries will not complete a full course of primary education in 2015.¹²

Sub-Saharan Africa lags farthest behind, despite some progress. South Asia has chronically low enrolment and completion rates and completion rates in the Middle East and North Africa stagnated in the 1990s, reflecting key deficiencies in education and knowledge due to structural institutional barriers.¹³ In particular, the relative lack of well-funded and attended science education had a direct impact on technological achievement. The “brain drain” of well-qualified Arab professionals to the West because of a lack of opportunities and stifling political environment is also undermining economic development in the region. Although progress in achieving equal access for girls to primary and secondary education have been met or are on track elsewhere, gender discrimination in enrolment also remains a concern in several countries in these regions: more than half of Arab women are estimated to be illiterate.

Gender equality, women’s empowerment and maternal health

Advances in gender equity remain a serious challenge, with advances in women’s representation in national parliaments – as well as at regional level – being slow or non-existent across the board. In South Asia, women have limited access to decision-making forums. Female poverty is also major problem with South Asian women forming the majority of the poor, illiterate and unemployed. Wage-employment rates of women have changed little in any region since 1990 and are far below those for men in all regions

¹² World Bank projection, at; <http://www.developmentgoals.org/Education.htm>.

¹³ See further, UNDP regional reports: *Creating Opportunities for Future Generations*, Arab Human Development Report, 2002; and *Building a Knowledge Society*, Arab Human Development Report, 2003.

except Latin America and the Caribbean. Monitoring of maternal mortality rates caused by poor reproductive health and complications in labour and pregnancy, is notoriously difficult and so does not allow any definite assessment of trends, but recent estimates indicate continuing high rates in sub-Saharan Africa and South Asia. Data on the proportion of births attended by skilled medical personnel – accepted as being closely correlated with maternal mortality – saw improvements in North Africa, East and South Asia, with moderate change in Latin America and the Caribbean and little or no change in sub-Saharan Africa and the Middle East. To meet the MDG experts say that by 2015 skilled attendants will need to be present at 90% of births; recent data for Africa indicates a rate of 46.2%.

Child mortality

Overall, with the exception of Northern Africa, Latin American and the Caribbean, and South Asia progress on child survival is disappointing. At current trends no region, except possibly Latin America and the Caribbean, is on track to achieve the target of reducing under-five mortality rates by two thirds of their 1990 levels by 2015. Progress has been particularly slow in Sub-Saharan Africa, where civil disturbances and HIV/AIDS have driven up rates of infant and child mortality in several countries

Environmental sustainability

Significant improvements have been made in rural access to drinking water in almost all regions, but only a few countries have achieved improvement at a rate sufficient to meet the target. Urban access is almost universal except in sub-Saharan Africa where it has declined. Even in regions such as East Asia that have made significant progress in reaching many of the other goals, efforts to ensure environmental sustainability are far too slow.

Communicable diseases

The major communicable diseases, such as HIV/AIDS, malaria and tuberculosis, are disproportionately rife among the poor in developing countries and present a serious threat to economic growth and sustainable development in the worst affected areas. While poverty facilitates the spread of disease, the illness (and death) that follows pushes those affected and their households into poverty and makes it harder for them to escape from it. Aside from the implications for the socio-economic status of those directly affected by disease, at premature adult mortality and morbidity rates have significant demographic implications, resulting in unfavourable dependency ratios and proportions of workers relative to social protection recipients. Analysis in relation to HIV/AIDS, in particular, suggests that the destruction of human capital and impediment of its transmission to subsequent generations can have a negative impact on annual economic growth rates, which can significantly reduce GDP levels over time.¹⁴

In sub-Saharan Africa the HIV/AIDS pandemic continues unabated in the majority of countries with the exception of Uganda, which has had some success in reversing the trends having reached crisis proportions – showing that with the will, commitment and

¹⁴ See further, *Reversing the Epidemic - Facts and Policy Options*, HIV and Human Development in Central and Eastern Europe and the Commonwealth of Independent States, UNDP Regional Report, 2004.

right policies, change can be affected. This region is also the worst affected by malaria which shows no signs of diminishing and TB rates are also on the increase. In addition, parts of Asia have recently seen a dramatic increase in the spread of HIV/AIDS with South Asia having the second largest prevalence in the world, despite relatively low percentage rates, due to its large population base. While the epidemic is relatively recent the trend is for growing rates with women becoming increasingly infected. There is a chance to arrest the epidemic at the present stage rather than allowing it to become generalized, but in order to do so it will be necessary to address structural factors associated with prevailing socio-economic conditions including high levels of poverty and inequalities that have intensified with economic liberalization, as well as social stigma and discrimination that can enhance vulnerability to infection. Low levels of public expenditure on basic services, poor quality of care, the high proportion of informal sector economic activity and lack of adequate social security which all add to vulnerability of the poor require urgent attention.

Eastern Europe and Central Asia have also been subject to a rapid growth in HIV/AIDS, with intravenous drug use the most common form of transmission. The potential for a generalized epidemic is undeniable, with Western CIS countries and Northern Baltics, which lie along the main narcotics trafficking routes having the region's worst epidemiological trends. These countries also have the most unfavourable demographic trends characterized by aging populations and declining birth rates, shrinking labour forces and unfavourable dependency ratios. Countries in Central Asia and the Caucasus are also the region's poorest and have limited health care capacity. While the disease has spread too far to permit rapid reductions in prevalence today, further rapid growth can be prevented. Best available projections of likely trajectory in Russia see dramatic increases in HIV prevalence rates among the labour force until 2025, particularly as the disease is concentrated in the under-25 age cohort. HIV/AIDS is also projected to dramatically accelerate Russia's ongoing population decline, with average life expectancy dropping rapidly. The epidemic could also have important sectoral impacts in countries such as Russia where it could affect the critical extractive industries (e.g. non-ferrous metals) many of which make use of migrant labour (which is generally associated with a relatively high HIV/AIDS risk).

As the UNAIDS fourth Global Report demonstrates there is no region where HIV is not a potential serious threat to the population, including the EU neighbourhood – and even the EU itself. A generalized epidemic would raise issues e.g. for the Baltic States that are introducing high HIV prevalence rates into EU. Theoretically, this could raise tensions with neighbouring countries that may wish to tighten border controls or engage in other “unfriendly” activity.

It is not clear altogether how trends in HIV/AIDS will develop, especially in regions where it is a relatively new but spreading phenomenon. Moreover, new diseases can spread rapidly and become global threats. Achievement of all the MDGs will depend in part in turning around current trends in communicable diseases – which in itself relies on achievement in reaching the other MDGs. In the meantime, their prevalence continues to

place additional resource burdens on developing countries and increase their needs for ODA and other assistance.

Developing a global partnership

While success in meeting the MDGs depends on the developing countries themselves, the inclusion of Goal 8 recognizes that success will come only with the cooperation and support of richer nations, including through a re-energized commitment to expanding access to trade and technology for poor countries, increasing aid, and delivering more meaningful debt relief.

Sluggish growth in the world economy may account in part for the slow pace towards the MDGs, but insufficient progress has been made in restructuring the global trade system – particularly in agriculture – including through increased access to markets, the dismantling of subsidies, lowering tariffs etc. In the meantime, the long-term downward trend and volatility in non-fuel commodity prices pose a major challenge to exporting countries. Countries being left behind rely heavily on exports of primary commodities and find it difficult to diversify where there is low human development. Failure to produce favourable results at the WTO’s Ministerial in Cancun regarding the Doha round of trade talks highlighted the still insufficient voice of developing countries when it comes to global trade rules. More positively, recognition that little progress will be made on meeting the MDGs without additional funds has led to a positive trend in ODA in terms of both quantity and quality. Much of the increase, however, simply represents a catch-up after a long period of decline and the resources fall far short of that needed to achieve the goals.

Although attainment of the MDGs is still technically feasible, at the current pace many countries and regions will not be able to meet them. According to the UN Secretary General “the window of opportunity is narrowing and the political will remains largely absent”. A lot depends on the five-year review in 2005 if positive trends are to be accelerated and the negative turned around, but “a major breakthrough is needed if the 2015 targets are to be met”.¹⁵

3. Priority Issues for EU Strategy and Policy

Trends in poverty reduction and the key impediments thereto, as identified above all have important implications for EU strategy, including, but not exclusively, in terms of science and technology policy. While progress towards the MDGS rests on the combination of a large number of factors, the EU, with the Community and its member States has a vital role to play – especially given that it provides some 55% of global ODA, is the world’s largest multilateral grant provider (at 63%), the world’s largest single market and the main trading partner of most developing countries. The following 8 areas have been selected as those where EU intervention can add particular value in spurring progress towards poverty reduction, stability and security.

¹⁵ United Nations General Assembly, *Implementation of the United Nations Millennium Declaration*, Report of the Secretary General, UN Doc. A/59/282, 27 August 2004, para. 42.

3.1 Trade policy

While developed countries are committed under the MDGs to expanding access to trade for developing countries – and despite some significant recent initiatives – trade policies in rich countries remain highly discriminatory against the products produced in the poorest countries, especially in agriculture, textiles and clothing. EU steps granting trade preferences to developing countries, providing quota and duty free access for LDCs to European markets and the opening of negotiations with all ACP regions for Economic Partnership Agreements are so far limited. With regard to the latter, WTO membership rules need to change if fragile ACP economies, heavily dependent on commodities, are to survive, grow and develop. In order to promote a more open and balanced trade system the EU should, therefore:

- Commit to specific targets and deadlines at the 2005 Doha Round, particularly in terms of increased access to markets by removing tariffs on poor country exports as well as the removal of agricultural subsidies.
- Ensure that non-tariff barriers such as the increasing number of health and environmental standards do not wipe out potential gains from increased market access and raise this as an issue on the Doha Development Agenda.
- Undertake a more systematic and far-reaching review of existing and future EU trade policies to improve coherence and increase the Union's credibility in the international debate on reform of the international financial architecture.
- Use its weight to influence global institutions such as the UN (post-enlargement the EU comprises 15% of UN membership), World Bank and the WTO to further the trade interests of developing countries

3.2 Promoting foreign direct investment

Foreign private investment is one of the largest sources of external funds for developing countries as a whole. Experience shows that high FDI generally generates progress in economic growth, employment and integration, so contributing to political stability and development. However, it generally demands a favourable investment climate, macro-economic stability, trade openings and sound financial and legal institutions.

FDI therefore tends to be heavily concentrated in a few countries and largely bypasses the poorest. Less stable situations present a higher risk for investors and tend to attract those seeking high returns in the short-term and is unlikely to contribute to sustainable development for those trapped in poverty. Stagnating economies, lack of opportunity and of hope is a major stimulus for migration, which in turn deprives countries of valuable human capital. The EU should, therefore:

- Do more to encourage long-term investment that will benefit the poorest and most marginalized in countries where instability and/or other factors present a less than favourable investment climate e.g. by underwriting initial investments.
- Provide more – and more effective – assistance to governments to improve their investment climates, particularly through the technical assistance on the design and implementation of policy improvements.

3.3 Investing in, and sharing, technology for poverty reduction

Investments in technological innovations deserve high priority as they have the capacity to overcome the constraints of low incomes and weak institutions, so accelerating progress towards the MDGs. The harnessing of developments in technology for poverty reduction is currently insufficient, despite the commitments made by rich countries to transfer technology in the agreement on Trade-Related Issues for Implementation Property Rights (TRIPs). The EU should, therefore:

- Invest in **research** to address enduring problems relating to sustainable development with special attention to areas important for developing countries and/or neglected by private research e.g. on medicines for tropical diseases, cheap communication tools and clean and efficient technologies. Where the market does not function to promote investment because the recipients cannot pay public-private partnerships should be explored.
- Extend EU action on **communicable diseases**, including by supporting access to a tiered pricing of medicines and by supporting prevention through education. In line with recommendations of the WTO and others, shift EU actions on this disease from prevention to ensuring access to antiretroviral and other treatment and support this with further sustained resources.
- Invest in those **technologies** particularly usable among the poorest groups e.g. high-yielding drought and pest-resistant strains of food crops; access to water, sanitation and clean energy for rural populations; low cost wire-less battery-operated computers, etc.

3.4 Aid policy delivery

While the EU has declared its aim to put poverty reduction at the heart of external assistance, much of its focus still remains on associate countries and strategic partners, rather than on the reaching the world's poorest. Top priority and high priority countries need large injections of donor aid to invest in the core foundations for economic growth (health education, agriculture, water and key infrastructure etc.). The EU should therefore:

- Come forward at the 2005 MDG review with a renewed pledge for increased resources for development, setting new targets for the medium and long term, given that they are already on track to meet the "Barcelona Targets" for increase in European ODA.
- Focus a higher proportion of aid on Low Income Countries, building on the limited progress so far (over 43% of resources were allocated to low income and LDCs by the EU in 2003 compared to 34% in 1999).
- Do more to address the needs of Middle Income Countries, especially those in acute crisis. Policy interventions should be targeted at the impediments to development – especially the inequalities between regions and groups that result in uneven progress towards poverty reduction – in order to benefit the most vulnerable and marginalized (whether due to gender, ethnicity or geography).

3.5 Conflict prevention

A stable and peaceful environment is critical for poverty reduction, for attracting external funding (investment, tourism etc.) and ensuring that economies are not undermined by conflict. The EU has a conflict prevention strategy and purports to deliver conflict-sensitive programming, but this is not always the case in practice. Understanding the root causes of conflicts is key to preventing violence and an inaccurate diagnosis of the political and socio-economic context of a development intervention can mean that interventions exacerbate latent tensions. The EU should therefore:

- Build on existing Country Conflict Assessments and undertake further research into what can trigger conflicts and options for preventing and mitigate them to ensure that any intervention including aid delivery does not exacerbate underlying structural causes.
- Be more vigilant and dynamic in ensuring coherence in all policies – aid, trade, agricultural, political, environmental, migration etc. – to ensure that they are in line with conflict impact assessments and that one does not serve to undermine the benefits of another. Poverty reduction, conflict prevention and good governance should all take precedence over trade interests.
- Ensure strong multilateral cooperation with other actors including the UN, regional organisations etc.

3.6 Engaging in conflict and post-conflict situations

Support for countries undergoing or emerging from crises is crucial, but raises thorny issues for aid deliverance in terms of avoiding improper use and ensuring that it reaches those most in need i.e. the poor. The transition from short-term service delivery to long-term development assistance also raises particular problems. The EU should improve its performance by:

- Implementing its 2001 commitment to the policy of linking relief, rehabilitation and development (LRRD), and further develop of a system whereby humanitarian, rehabilitation, development and sometimes peace-keeping operations can interact at the same time.
- Develop its capacity to carry out peace-building and rehabilitation, especially in terms of promoting good governance, access to justice, land reform etc. as early as possible.

3.7 Promoting good governance

The root causes of conflicts are very often linked with failures of governance whereby the poor and vulnerable find themselves excluded in terms of political access, economic opportunities etc. Good governance and the promotion of democracy is crucial for stability and poverty reduction and the EC has increasingly focused its attention on promoting good governance and the rule of law especially in conflict-ridden or prone countries. Development aid provides an important tool in addressing governance issues, but also raises qualitative challenges arise in terms of the interaction of aid delivery, human rights and governance issues. The EU should, therefore:

- Properly integrate its existing good governance and human rights policies into security sector policy.
- Develop a more clear methodology, strategy and policy for conflict-prone and failed states and find alternative approaches to the strict application of conditionality and embargoes in order to deliver the resources in a way that gives the right incentives and accountability.
- Coordinate with UN and regional organisations in these endeavours.

3.8 Improving cooperation partnerships

Coordination and cooperation is crucial, not only within the Union itself but with other partners whether it be other donors or partner countries receiving aid. The EU currently has a reputation as an inflexible partner. In order to improve performance capacity the EU should, therefore:

- Ensure **that bilateral and multilateral policies within the Union are consistent** and, in particular that bilateral aid of all states, including new members, is focused on poverty reduction
- Develop better **complementarity of policies and programmes** not only within the Union, but with other donors – especially in the context of country-by-country strategies. Lack of donor cooperation can undermine recipient priorities (due to the reception of numerous donor missions, preparation of multiple reports etc.) The Feb 2003 Rome Declaration on Harmonization reflects a strong commitment to action which should now be realized.
- Develop better **cooperation with partner countries** ensuring that they can set their own priorities and take responsibility for their own development strategies.

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9. Organised Crime and the European Union (EU): Priorities and Challenges

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In December 2003 the EU published its most recent policy document on security concerns. Included in the five 'key threats' was a clearly identified concern over organised crime:

Europe is a prime target for organised crime. This internal threat to our security has an important external dimension: cross-border trafficking in drugs, women, illegal migrants and weapons accounts for a large part of the activities of criminal gangs. It can have links with terrorism.

Such criminal activities are often associated with weak or failing states. Revenues from drugs have fuelled the weakening of state structures in several drug-producing countries. Revenues from trade in gemstones, timber and small arms, fuel conflict in other parts of the world. All these activities undermine both the rule of law and social order itself. In extreme cases, organised crime can come to dominate the state. 90% of the heroin in Europe comes from poppies grown in Afghanistan – where the drug trade pays for private armies. Most of it is distributed through Balkan criminal networks which are also responsible for some 200,000 of the 700,000 victims of the sex trade world wide. A new dimension of organised crime which will merit further attention is the growth in maritime piracy.

1. Organised crime: The Scale and Nature of the Problem

The problem of Transnational Organised Crime (TOC) in Europe is far from new. However, global trends coupled with the expansion of the EU have combined to create new opportunities for TOC groups, new markets and new sources of finance and income. Up until the 1980s, however, the notion of threat from organised crime was seen to be an external one to the EU and mainly from drug cartels.

Since then, change has been rapid. The exploitation and existence of extant opportunities (demand) coupled with an increase in the availability of 'commodities' for trafficking, ranging from drugs, to people, to bushmeat (supply) has encouraged organised crime groups to identify EU countries as lucrative locations for their operations. Opportunities for organised criminal activity within and amongst EU member states have never been greater.

Drugs

- Patterns of consumption of hard, soft and designer drugs differ significantly amongst member states, as do governmental responses and legislation.
- Opiates originate overwhelmingly in Afghanistan (95% of heroin entering the UK is from Afghanistan).
- Cannabis remains the most widely used drug within the EU.
- Pakistan organised crime groups are increasingly linked to similar organisations in Turkey and the Balkans.
- Cocaine from Colombia and Bolivia is entering via Spain – 5% of Bolivia's cocaine production is sold in member countries.
- There is no consensus upon whether law enforcement or public health should lead on tackling drugs and related issues.
- There are 7-9,000 deaths in the EU each year from drug abuse.

Illegal Small Arms and Light Weapons (SALW)

- Overall, effective policing by member states has especially reduced demand for weapons of war that are difficult to conceal, e.g. assault rifles. The demand for concealable weapons, pistols and sub-machine guns is generally much higher and will probably increase as gun cultures develop.¹⁶
- Accession states have weaker controls and are geographically closer to regions where proliferation is a major concern – the Balkans and Former Soviet Union, especially.
- Available data sets from member states are generally poor, especially the security forces are decentralised.
- The total estimated stockpile in pre-enlargement in EU member states exceeds 67 million, 17.4 guns for every 100 people [Small Arms Survey 2003, 64].
- The growth in organised crime is increasing the supply and demand for illegal SALW.

¹⁶

A SALW study on Albania in the late-1990s concluded that whilst there despite the active existence of trafficking routes from Albania to Italy and Greece, the demand for illegal weapons was remarkably low [Smith and Sagramosa].

- Gun violence associated with organised crime ‘turf wars’ is increasing.
- The proliferation of illegal SALW is especially pronounced in the immediate aftermath of conflicts – for example, Balkans, Northern Ireland - and the activities of organised crime groups also tend to increase to take advantage of opportunities provided by policing vacuums.
- Internet selling an increasing problem.

Smuggling/Trafficking

The main concerns relate to,

- Prostitution
 - Forced labour and enslavement
 - Adoption
 - Paedophilia
 - Human Organs
 - Bushmeat
-
- It is important to differentiate between trafficking and smuggling of human beings. Smuggling is usually illegal migration to escape underdevelopment and entitlement deficits – a search for a better life. Trafficking implies that individuals are being moved against their will and sold into various forms of slavery. Trafficking is more likely to start off as smuggling, exploiting victim willingness or desperation. Trafficking and smuggling are used interchangeably in relation to commodities.
 - There is a link between smuggling/trafficking and insurgency that is poorly understood – not all organised crime groups are driven by financial gain alone.
 - The links with terrorist groups should also be considered, which may increase in the future.
 - Many smuggling/trafficking operations rely on the acquisition of false documentation – passports and associated breeder documents (driving licence, birth certificate etc.). The quality of false documentation from passport factories is extremely high.
 - Organised crime will always be sensitive to market forces, demand in particular. For example, some ‘new communities’, which now have a critical mass in member countries have collectively created a demand for ‘bushmeat’, which is currently of great concern from both wildlife protection and public health perspectives (bushmeat can carry the HIV and other viruses). London is a major destination, via containers importing cut flowers.

- In general, smuggling and trafficking operations will target ‘commodities’ that are lo-density/hi-value and easily marketable, narcotics being the most rewarding according to this formula.

Money

- Credit card fraud in the UK has risen 85% over the past year, to Eur85.4 million and total credit card fraud for UK card holders current stands at Eur700 million per annum. The costs are borne by the banks. Organised credit card fraud is mainly run by Romanian organised crime groups.
- ‘Chip and Pin’ measures have reduced fraud considerably – 80% in France since its introduction in France ten years ago.
- The outsourcing of call centres to developing countries is now seen as a major opportunity for indigenous organised crime groups, e.g. India.
- Organised crime groups are placing members in finance firms to gain access to computer stored financial information that is stolen using i-pods and mobile phones to transmit data. There is a growing demand for ‘illegal wealth creators’ within organised crime groups.
- Laundering the proceeds of organised crime operations is a major endeavour, through ‘fronts’ such as small businesses.
- The ‘hawala’ system continues to operate and is especially relevant to countries with soft currencies, e.g. South Asia.
- At least one insurgency group from outside Europe is running credit card and load fraud to finance its operations, including illegal arms procurement worldwide.

Other significant but less consequential areas of organised crime activity include large scale smuggling to avoid excise, cigarettes in particular, and the export of stolen cars – in the mid-1990s some 80% of the cars in Albania are thought to be stolen from within the EU.

2. Organised Crime: The EU Response

The European Council met in October 1999 to discuss exclusively Justice and Home Affairs for the first time, notably the Vienna Action Plan designed to build an integrated approach to crime. The current framework for TOC-related organised crime brings together the Council of the European Union, the European Commission, Europol, Eurojust, the European Judicial Network and relevant agencies, departments and ministries of the member states. Europol looks set to take on a more expansive role.

With the relevant policies and instruments in place, the EU can now move forward on addressing the spiralling problem of organised crime, at the borders of the EU at least. Whether or not the Council can move beyond current progress and co-ordinate with root cause areas such as development and conflict remains to be seen.

There are obvious concerns and problems over the horizon. Already, commentators have alluded to the lack of transparency amongst EU political elites in framing responses to organised crime. This is not a good start. Inevitably, the EU will have to grapple with some fundamental problems along the way to combating organised crime and it is important that, in the search for a more secure European Union, the principles of freedom and justice remain at the forefront; civil liberties and human rights can often fall victim to measures intended to underpin security.

The role of science and technology is already important. The debate on the virtue and efficacy of biometric passports and associated identification is relatively new. There are thought to be serious constraints on whether biometric passports can work in the environment of a busy port or airport – certainly the biometric ‘technical fix’ is viewed with great suspicion, even disdain, in some security quarters. The majority of developing countries will certainly take many years longer to introduce their biometric equivalents, which will always be offset by the ability to forge the less complicated breeder documents that provide access to passports.

Any effective response to organised crime raises the inevitable, recurring issues of partnership in a rapidly expanding union, diversity of national capabilities and commitments and the harmonisation of legislation. The combination of political constraints and institutional barriers will ensure that the security forces will always be combating organised crime with one hand tied behind its collective back.

The emerging trends will make responses more urgent on the one hand and more complex on the other. The enormous financial gains available to organised crime groups and the widening gyre that separates the EU rich and developing country/ weak-/failed state poor will continue to attract new actors. Over the past few decades analysis and understanding of organised crime dynamics has been largely ethnographic. Ethnic distinctions that define most organised crime groups are beginning to erode. A more ethnologically pragmatic, network-based approach to organised crime makes sound business sense in a globalised world and amongst actors unfettered by political constraints such as sovereignty. It will, however, make the roots and dynamics of organised crime more difficult to analyse, comprehend and counter. One positive outcome of the dynamic, however, will be the fading opportunity for ‘alien conspiracy’ based analysis.

The links between global terrorist networks and transnational organised crime are in their infancy. As financial empowerment proceeds apace, other issues will gain in prominence for organised crime groups, such as religion and identity. Obversely, terrorist groups may emerge that need to make common cause with criminal organisations to either

facilitate or bankroll their operations. Contemporary links most certainly exist, but they could yet become much stronger, mutually enforcing and more difficult to control.

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10. Trends in Space Technology

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1. Definitions

For the purposes of this paper, *space* includes launch vehicles, satellites, services (imagery, bandwidth, navigation signals). This integrated approach is inevitable because the various elements are essentially inseparable: the demand for services if fueling technological innovation in launch vehicle and satellite technology. Demand also channels further technological development - the higher the commercial or governmental demand for a particular service, the more R&D funds will flow into technology supporting that service. The reverse is also true. Where demand dries up, existing technology can be rendered irrelevant, often at great cost to the investor as was the case with the Iridium system. Furthermore, technology itself often creates new types of services, generating its own demand, as is the case with new precise satellite navigation signals and their potential application on air traffic control

This paper will therefore first address trends in the types of services provided by space assets. Second, it will list some of the technologies that are in the development pipeline. Thirdly, it will link the two and discuss how technology could alter, expand or shrink the envelope of services currently provided by space technology. And lastly, it will briefly discuss one “wild card” issue: the trend toward increasing militarization of space, which creates a set of specific problems and opportunities for civilian and military users alike.

2. Trends in types of services provided by space

Without a doubt, trend lines point to increasingly more widespread use of space technology in everyday life. The number of artificial satellites in space has gone from several hundred in 1998 to 4,000 today by one estimate.¹⁷ Space technology services are used by more and more users on Earth. Whereas satellite navigation was accessible to only militaries and the most demanding of civilian users five years ago, today they are a nearly standard part of automobile equipment. One manufacturer of GPS devices, US company *Garmin*, has gone from obscurity in the mid 1990s to a market capitalization of nearly \$6 billion today.

As the quality of services provided by space technology improves, new possible applications open up, which in turn fuel demand for more space assets. Satellite navigation is a prime example – the increase in the precision of the GPS signal in 2000 led to an explosion of new applications; and the introduction of Galileo only promises to

¹⁷ Glenn Elert [Ed.], *Number of Artificial Satellites*, The Physics Factbook, 2004.
<<http://hypertextbook.com/facts/2004/VadimBlikshteyn.shtml>>.

improve further the quality of the signal, and to new, previously unthinkable applications in areas such as air traffic control.

While an increasing number of individuals use space assets, governments and specifically militaries remain very significant customers. The demand by the U.S. military for satellite communication capacity has increased tenfold between the first and second Gulf Wars (1991 and 2004).¹⁸ Satellite navigation and imagery highly sought after. And while satellite navigation remains a government domain, an increasing portion of imagery and navigational capacity is being provided to the military by civilian users. In fact, one of the first acts of the U.S. Congress after Sept. 11 was to approve funds for purchase of commercial imagery in preparation for the wars in Afghanistan and later Iraq. One company alone – Space Imaging – was granted a contract worth up to half a billion dollars.¹⁹ One of the main drivers for commercial providers of space technology will hence be the potential to supply military need for bandwidth and imagery.

However, the demand for space services can also turn downward, as was the case with some of the early space-based services that were replaced by terrestrial alternatives. Optical fiber cables are rapidly replacing satellites as the main means of transatlantic communication. The share of fiber has gone from 2 percent in 1998 to 80 percent in 2000, reducing satellite communication to a mere 3-5 percent of the market.²⁰ Similarly, the commercial demise of Iridium due in part to proliferation of cellular phone technology should be a warning lesson to investors in space technology. Also, there is a possibility that if photocell technology and new materials technology advances, networks of unmanned aerial vehicles could replace satellites in relaying communication signals or some forms of imagery currently provided by satellites. The important point is that technological developments in terrestrial technologies can have a disruptive effect on space applications, in particular their commercial viability. It will be essential for private and public investor to keep their eyes to keep a watchful eye on promising terrestrial technologies that could provide a more commercially viable alternative to satellites

3. What are some of the key new technologies?

The technologies described below are based on a survey of available literature. The list contains ideas at different stages in the development pipeline. Some are already being used commercially; others are further away from widespread application. What they have in common, however, is that they represent areas of significant investment and focused attention by either governments or laboratories worldwide. There is a reasonably high expectation that they will mature to the point where they find broad use in day-to-

¹⁸ Lt. Col. Peter Hays, *Civil, Commercial and National Security Space Policy Drivers*. Presentation to the Center for Defense Information – Brussels, March 30, 2004.

¹⁹ *Space Imaging Receives Multi-Million Dollar Pentagon Contract for Commercial Satellite Imagery*, press release, Space Imaging, Jan. 17, 2003.

<http://www.spaceimaging.com/newsroom/2003_clearview.htm>.

day applications. They also promise to have potentially revolutionary impact on how space technology is being built or used

Nanotechnology refers to production of materials engineered at the atomic or molecular level. Nano-engineering allows for the production of devices and materials built literally one atom or molecule at a time. This has two important implications:

- 1) Increased relative surface area: as a particle decreases in size, a greater proportion of atoms are found at the surface compared to those inside. For example, a particle of size 30 nm has 5% of its atoms on its surface, at 10 nm 20% of its atoms, and at 3 nm 50% of its atoms. Thus nanoparticles have a much greater surface area per unit mass compared with larger particles. As growth and catalytic chemical reactions occur at surfaces, this means that a given mass of material in nanoparticulate form will be much more reactive than the same mass of material made up of larger particles.²¹
- 2) Quantum effects: in materials reduced to nanoscale, quantum effects begin to dominate their behavior. This affects their optical, electrical and magnetic properties. For example, some compounds like titanium dioxide reduced to nanoscale become transparent yet they absorb ultraviolet radiation – not surprisingly, they are being used in sunscreens.²²

Information technology (IT) is another area of continuing research with obvious relevance to space. As one report noted, “amazingly, the progress of computer technology has not slowed down since the 50s. Indeed it shows signs of continuing at a more furious pace. The digitization and virtualization of the world has extended our ability to communicate, visualize and control beyond any natural human ability.”²³ IT revolution comes in several dimensions:

- 1) Hardware: processing speed is continuously increasing. So-called Moore’s law postulates that researchers will double processor speed every 18 months. Amazingly, this has held true since 1995, although by 2010 – barring dramatic changes the architecture of modern chips – their physical properties will slow down the pace of speed increase
- 2) Software: ongoing improvements allow for greater quantities of data to be processed at greater speeds.
- 3) Networks: networking drives further increases in computing power. Some of the fastest supercomputers today consist of little more than skillfully networked PCs.

Propulsion and materials technology: a number of exotic propulsion concepts are being researched (the use of antimatter, magnetic sails, solar sails) but in the near- to medium-term timeframe, the most promising advance lies arguably in scramjet technology. The main advantage of scramjet lies in that they use of atmospheric oxygen (instead of liquid oxygen), mixed with fuel, to produce thrust. This removes the need to carry oxygen

²¹ *Nanoscience and nanotechnologies: opportunities and uncertainties*, The Royal Academy of Engineering and The Royal Society (United Kingdom), 2003. <<http://www.nanotec.org.uk/report/chapter3.pdf>>.

²² Ibid.

²³ Drachma Denarius, *Technology Trends – Preliminary Report*, Organization for Economic Cooperation and Development, SG/AU/SPA(2004)2, May 7, 2004. <<http://www.oecd.org/dataoecd/62/34/31825107.pdf>>.

tanks, thus reducing the overall weight of the vehicle, increasing its speed and range. An X-43 experimental vehicle built by NASA has been tested twice successfully.

4. What is the impact on new technologies on space?

In Transit

Paradoxically, while demand for space-based technology increases, number of launches steadily dropping. Reasons primarily having to do with supply glut but also other, more intractable problems such as export controls, launch controls, insurance difficulties. That is not a permanent state of affairs, however, and in the long-term launch capacity is expected to remain in demand as new services using space assets continue to be introduced

When it comes to transit, the main concern remains price – it is still very costly to put assets into space, making many possible new applications of space technologies cost-prohibitive. The current average cost \$10,000 per pound on a space shuttle, a little less on an unmanned rocket such as the Ariane. This is not much when it comes to large space probes such as Cassini, which cost on the order of hundreds of millions of Euros to build and an extra €30 million or so for launch represents a relatively small part of the budget. Launch costs, however, do have a crippling effect on the feasibility of smaller, cheaper space technologies such as microsattellites. They form a choke point, keeping the price of deployment of a space asset high in absolute terms irrespective on how little it cost to actually build the asset that is to be deployed

Scientists are striving to reduce the launch cost to about \$1,000 per pound in the medium term, and there are several technologies under research that could change the launch picture radically. *Space elevator* is another possibility under consideration. The term refers to a physical connection between the Earth and orbit. It is impossible to build such connection with current technologies, particularly if it is to reach into the higher, geostationary orbit. A more modest version, linking the top of the Earth's atmosphere with the lower orbit may be within reach.

Its main advantage would lie in reducing the minimum speed of the launch vehicle, thus possibly drastically reducing launch cost. In other words, to reach the lower end of the elevator, one would not need a vertical take-off vehicle such as a rocket or the shuttle, a horizontal take-off plane with much lower maximum speed would also be capable of reaching the bottom of the cable, whence the cargo would further travel by elevator.²⁴

The above concepts are made all the more feasible by advances in materials science (whether through nanotechnology or other means), which allow for reduction in payload weight. The lighter the cargo to be carried in space, the more diverse the range of vehicles capable of delivering it into space.

²⁴ *Space Elevators An Advanced Earth-Space Infrastructure for the New Millennium*, <<http://www.affordablespaceflight.com/spaceelevator.html>>.

In Space

Nanotechnology in particular promises to revolutionize the way in which satellites are built and used. New materials are reducing the weight of assets, driving down launch cost. Nanotechnology may lead to creating of significantly more efficient batteries, expanding the average lifespan of a satellite. It may also improve our ability to convert solar energy to electrical – crucial for space assets, which rely primarily on solar power to run their systems.

Continued pace of development in *information technology* has an essentially twofold impact on space: it is constantly improving the performance of space assets in all areas – lifespan, weight reduction, performance in key areas: imaging, data communication, satellite navigation.

Continued IT revolution also continues to fuel demand for space services. As ever more data is being generated it also needs to be transferred at ever more higher speed to ever more farther distances. Space is often the most logical avenue.

5. Militarization of space

Government interest in use of space for military purposes is continually increasing. Warfare is becoming technologically ever more complex with increasingly larger proportion of systems dependent on space. Imagery, navigation signals, bandwidth – all are absolutely crucial to modern warfare. For example, in the first Gulf War, only 8% of ammunitions dropped on Iraq were precision-guided whereas 12 years later, in 2003, 68% were – and most of these were bombs using satellite navigation, technology only enabled through use of space assets (GPS satellites).

The trend lines are clearly pointing in the direction of more use of space in warfare. In particular, military demand for satellite communication is booming, for obvious reasons – while fiber cables have better carrying capacity, only satellite communication offers the ability to deliver data to rapidly moving troops. The militaries – particularly the U.S. military – also increasingly relies on commercial providers of satellite communications (although this may change with the planned introduction of a dedicated GIG system

Space is not yet being used directly as a weapons platform but this may not last. Programs are under way in the US for Space-based Laser (SBL) and other methods of delivering offensive strikes from space at targets on the ground. The increasing proliferation of ballistic missile technology in particular is driving the militarization of space – faced with the challenge of shooting down a missile in flight, governments look to space as a logical launch point for anti-missile munitions.

In response, many militaries in the world are developing own weapons designed to attack space assets. Their main intended purpose is to deny enemy the use of GPS, satellite communication, and to deny the potential ability to disable one's own weapons; missiles in particular. Not surprisingly, the counter-response consists of increasing drive to

protect space assets – to make them more impervious to enemy attack. The U.S. National Security Strategy speaks specifically of the need to “harden” space assets, whether it is by making them more maneuverable or by ‘thickening their skin.’

All this raises significant questions and challenge for commercial providers. Are civilian assets in danger? The answer is: in case of a strike against a military satellite, significant damage to unintended targets is quite possible. Either the primary strike (through EMP, radiation) or its secondary effects (fragments) can severely damage or destroy commercial assets. This leaves private and non-military public users with a difficult choice whether to protect their assets. Serious costs are involved – the cost of hardening satellites is estimated at 2-3% of program costs.²⁵ The question of space asset protection is moving from the realm of hypothetical to practical. The more military establishments worldwide turn to space as a battleground, the more vulnerable civilian space assets become.

²⁵ Hays, *Civil, Commercial and National Security Space Policy Drivers*.

11. Trends in nanotechnology

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1. Diagnosis

Nanotechnology (NT) is about investigation and manipulation of matter at the scale from 0.1 to 100 nanometres (1 nm = 10^{-9} m, atoms measure several 0.1 nm). With the potential for much more powerful computers, stronger but lighter materials, new ways of interacting with and modifying life processes, NT is a broad area of technologies that will be revolutionary and disruptive, even if the predictions of some about self-replicating nanorobots, superhuman artificial intelligence etc. will not materialise (so-called *molecular* or *advanced* NT, Drexler, 1986; Chemical, 2003).

Already in the civilian sector, NT applications will pose risks that will need regulation. In the short term, the problem is with nanoparticles; later broader questions will come up, from jobs via surveillance to modifications of the human condition. Since at the nm scale all matter is subject to the same laws of nature, various sciences and technologies meet and overlap at that scale; increasingly, the notion of converging technologies is used, comprising NT, biotechnology, information technology, cognitive science and more (Roco/Bainbridge 2003; Roco/Montemagno 2004; HLEG 2004).

NT can also be used in the military sector (Altmann, 2004; Altmann, i.p.). As usual in military research and development (R&D), the USA is in the lead, with annual spending around \$250 million (1/4 to 1/3 of the total funds of the National Nanotechnology Initiative). Of this, about one half is for basic research, the other half for applied research and advanced technology development. The rest of the world combined is probably spending 1/10, however this could increase markedly if partners or potential opponents will decide to follow the U.S. example.

In the USA, military NT R&D is fully integrated with the general goals of global military superiority using high technology, with central keywords: Dominant Maneuver, Precision Engagement, Focused Logistics, Full-Dimensional Protection (Chairman, 2000).

2. Prognosis

NT could be applied in nearly all military areas. Several applications would be close to parallel civilian developments (computers, materials, some types of sensors, medical applications, robotics). Such areas have a high dual-use potential. Others would be rather military-specific (such as variable camouflage, improved explosives, miniature guidance systems, miniature precision missiles). A first survey found several categories of military

uses that would cause particular dangers to international peace or civilian society and should be limited preventively (Altmann, 2004):

- distributed small sensors,
- metal-free firearms,
- small missiles,
- implants and other body manipulation,
- autonomous fighting systems,
- small robots,
- small satellites and launchers,
- new chemical and biological weapons.

The limits should be specific, preventing military uses while not overly restricting legitimate civilian applications.

If such limits will not be in place, many new threats also for Europe have to be expected. An NT arms race is likely - even between partners -, instability in crisis regions may rise, and terrorists would have new, potent tools at their disposal. Intrusions into privacy by state and non-state actors would be much easier. Implants and other body manipulation applied to soldiers could undermine existing barriers in society and pre-empt a societal debate about rules for such manipulation.

Molecular NT is not imminent. Should self-replicating nanobots for cheap autonomous production of goods arrive, they could lead to an exponentially growing production of weapons, giving an advantage to early start and creating strong pressures for preventive attack (Gubrud 1997).

3. Links to European security and defence policy

In the general utilisation of NT, armed forces of European countries will take part anyway, and special EU measures to support that do not seem required. The European specificity could rather be expressed in a quest to keep and promote stability. European values call for a multilateral approach to security problems, a preference of arms control over arms races, a broader view of international security that does not focus narrowly on the own military strength.

For EU crisis-prevention and intervention forces, the particularly dangerous military NT applications listed above, do not seem urgently needed. In realistic scenarios, EU forces will rather face low-technology opponents. Military application of NT in many other areas – from computers via materials to sensors – will likely occur in parallel to NT utilisation in civilian society and economy.

Consequently, the EU should act for preventive arms control in the areas listed. Internally, the EU should work for co-ordinated restraint among the EU member states active in military high technology. On the international stage, the EU should further discussions on various levels with a view to agreed limitations, preferably by global treaties, alternatively by export-control measures. Politically, one of the most important

tasks should be to engage the USA as well as its potential opponents in talks about preventive limits.

4. Links to European science and technology policy

In NT R&D, aspects of dual use should be kept in mind. In the problematic areas, restraint should govern. Ethical rules for dealing with dual-use R&D should be developed. These can build on the ones in force already now, e.g. in the areas of human experimentation, however need to be much more differentiated, and more grey areas will remain. Questions of knowledge proliferation should be looked at, and contradicting goals - expansion of knowledge, international co-operation, prevention of threatening new technologies - will not always be reconcilable. Adherence to ethical and specific procedural rules should be demanded from the R&D contractors.

The EU should support R&D in the areas of better protection against terrorist attacks using chemical or biological agents. This concerns mainly sensors as well as neutralisation and decontamination substances and devices.

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12. The Threat from Biological and Toxin Weapons

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1. Introduction

Biological warfare is the intentional application of disease-causing micro-organisms or other entities that can replicate themselves—such as viruses, infectious nucleic acids and prions—against humans, animals or plants for hostile purposes. It may also involve the use of toxins, which are poisonous substances produced by living organisms, including microorganisms (e.g., botulinum toxin), plants (e.g., ricin derived from castor beans) and animals (e.g., snake venom). Their synthetically manufactured counterparts are also biological weapons (BW) if they are used for warfare purposes.

Biological agents have the potential to cause mass casualties: on any given day over two billion people are estimated to be seriously ill. One-quarter of all deaths worldwide and about 50 per cent of all deaths in developing countries are attributed to infectious diseases. The World Health Organization estimated in 1999 that each year more than 13 million people die from infectious disease alone.²⁶ Biological weapons may thus cause casualties of the order of magnitude of a nuclear weapon. Today, the principal tool against biological warfare is the 1972 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (Biological and Toxin Weapons Convention, BTWC). Since its entry into force in 1975 there have been some confirmed cases of material breaches and several other allegations of biological warfare and BW armament programmes. This has increased the calls to equip the convention with instruments to verify and enforce compliance. To date efforts to strengthen the BTWC by means of a supplementary legally-binding protocol have failed. The BTWC regulates behaviour between states.

The apparent interest of some terrorist and criminal entities in biological agents has added a new dimension to the threat, which states can address primarily through national measures implementing the BTWC, and measures to prevent such incidents from occurring or, should they take place, to manage the consequences. Besides its intrinsic weakness, the BTWC is also being challenged by rapid developments in biotechnology and genetic engineering. The convention contains a comprehensive ban on the development, production and possession of BW. States parties reaffirm the prohibition in the light of the technological developments during the periodic review conferences of the convention. However, as a consequence of the failure of the 5th Review Conference in 2001–02 the norm has not been updated since the 4th Review Conference in 1996. Failure of the 6th Review Conference in 2006 would severely challenge the relevance of the BTWC. Biotechnology and genetic engineering hold out many promises to improve the quality of life. At the same time, much of the knowledge can easily be

²⁶ World Health Organization, *Removing Obstacles to Healthy Development*, WHO document WHO/CDS/99.1 (WHO: Geneva, 1999), URL <<http://www.who.int/infectious-disease-report/pages/ch1text.html#TopAnchor>>.

converted for hostile purposes in order to improve the stability and virulence of existing warfare agents or even to create new agents based only on some components of an organism.

2. The nature of the threat

The threat posed by the hostile use of disease-causing mechanisms manifests itself on three levels. First, state programmes remain a serious cause of concern. Second, non-state entities appear to have a growing interest in non-conventional weapons, including biological agents. Third a significant segment of the BW threat lies in the future as developments in science and technology may enable states, organizations or even individuals to develop stable and controllable agents to cause indiscriminate harm.

2.1 State-level threats

After World War 2 the Soviet Union and the United States (and to a lesser extent the United Kingdom) were the principal states continuing research, development and production of offensive BW. The USA formally halted its programme in 1969 and proceeded to destroy existing BW stockpiles. This unilateral gesture helped to pave the way for the BTWC. The Soviet Union, however, did not reciprocate and even accelerated its BW armament despite the fact that it was one of the three co-depositaries of the BTWC (the other two being the UK and the USA). The programme survived the 1991 breakup of the Soviet Union essentially intact, and, despite assurances by the Russian leadership, there remain considerable doubts as to whether Russia has terminated all of the activities prohibited under the BTWC. At the heart of the concern about Russia's compliance with the convention is that there is no verification or monitoring of activities in the former BW facilities. After having confronted Russia with detailed evidence of its prohibited BW programmes the United States, the United Kingdom and Russia agreed in September 1992 to reciprocal visits to certain facilities.²⁷ The trilateral verification and transparency exercises soon faltered and the lack of any access to some key facilities has increased international suspicion of Russian non-compliance. Meanwhile the Russians closed some key facilities to foreign researchers, and in August and September 2002 a US Congressional delegation was refused access to one of the former Soviet BW facilities, despite the fact that the United States is providing Russia with millions of dollars to increase security and retrain the Soviet scientists.²⁸

The mix of countries with a chemical or biological warfare programme changes continuously and it is difficult to make firm statements about which countries possess such weapons. Claims of proliferation may refer to a past programme or an allegation of use made decades ago. Since the terrorist attacks of 11 September 2001 there has been a narrowing of the focus on a few countries that are considered to be of extreme proliferation concern, support terrorism, and are generally hostile to Western interests.

²⁷ Joint Statement on Biological Weapons by the Governments of the United Kingdom, the United States and the Russian Federation, 10-11 September 1992, document available from URL <<http://projects.sipri.org/cbw/docs/cbw-trilateralagree.html>>.

²⁸ Warrick, J., 'Russia denies US access on bioweapons', *Washington Post*, 8 September 2002, p. 25

The attempts to isolate them from the rest of the international community is reflected by the use of terms such as ‘rogue states’ or ‘axis of evil’. There is nevertheless uncertainty about whether the programmes are offensive or defensive or about their level of sophistication. It is also unclear at what point a country should be considered a BW proliferator. The criteria to be considered include: if it has the scientific, technological and industrial base to support a BW programme; if it has an R&D programme, if it produces BW; if it stockpiles them, if it deploys BW with the armed forces; or if there is clear evidence that BW have been assimilated into military doctrine. The criteria by which a state is judged may differ from country to country. Moreover, a country which has an antagonistic relationship with the state making the intelligence assessment is at greater risk of being deemed a proliferator than one which enjoys a friendly relationship. The perceived intent of a state is a major subjective component in the threat assessment. The willingness of some states, including the United States and the United Kingdom, to use military force based on the mere assumption of the presence of unconventional weapons is a highly destabilizing development, more so, as demonstrated by the situation in Iraq, the leadership chose not to believe the (correct) evidence produced by international on-site inspections.

2.2 Threats posed by non-state actors

In 1994 and 1995 the Japanese religious cult Aum Shinrikyo carried out two attacks with the nerve agent sarin. Police investigations into the cult’s activities showed that it had also been investigating pathogens and toxins and had attempted several times to release them, apparently with no effect.

Letters containing anthrax spores were delivered to members of the US Congress and the US media in the aftermath of the terrorist attacks of 11 September 2001, killing five people and infecting a further 17. The fine quality of the spores suggests that a military laboratory—most likely located inside the USA—was used in their preparation, but until today the perpetrator or perpetrators have not been found. The incidents demonstrated how people who were not normally considered as being at risk from a biological terrorist attack (postal workers, secretaries and members of the public) became the first victims and how such types of attack may close down facilities despite the low number of casualties. The extensive and costly clean-up operations were also hampered by the lack of consensus about what constitutes a safe environment following decontamination. Military standards to ensure the continuation of operations on the battlefield cannot be applied in a civilian setting.²⁹

The mail-delivered anthrax spores also demonstrated the potential of such attacks for widespread social and economic disruption. Earlier preoccupation with terrorism involving BW focussed on the potential to cause large numbers of casualties. The probability of such events occurring remains low, because of the technological challenges involved in the development, manufacture and dissemination of biological agents, and the demands these challenges place on the organizational structure of the terrorist entity.

²⁹ For a detailed overview of the attacks with mail-delivered anthrax spores, see Zanders, *et al* (note 7), pp. 696–703.

However, beyond causing human casualties, acts of terrorism can be directed at generating economic sabotage or disruption. Agricultural terrorism comes easily within reach of single-issue groups, criminals and less-structured organizations. Biological agents arguably offer the prospect of large-scale economic disruption as they can be used to infect livestock or destroy crops. Given the time needed for an animal or plant disease to develop the attack will invariably stretch over a prolonged period of time and the demand for containment, remediation and compensation will draw in authorities ranging from the local to the national levels of governance. The economic damage will not be limited to the destruction of produce, but will also affect other enterprises that depend on agricultural activities and international trade. Countries, regions or communities that depend on monocultures for their livelihood are particularly at risk.

Governments face a multitude of biological terrorism threats, but the most catastrophic scenarios involving mass casualties, though possible, are not likely to occur. (Catastrophic scenarios involving non-conventional weapons, which feature in many policy debates, are often made plausible by insistence on the existence of a threat posed by state-sponsored terrorism.) Nevertheless, because of the potential consequences for the targeted society of a terrorist attack with BW, governments must be prepared for such an attack. The key issue is thus to devise and execute balanced policies. Overreaction can lead to countrywide anxiety and paranoia. In such an atmosphere, hoaxes may become as efficient—especially in terms of economic terrorism—as actual attacks with BW.

3. Scientific and technology developments

Biological warfare is closely correlated to the knowledge of diseases. The opportunities for the weaponization of disease began with the scientific breakthroughs in the early 1970s. In 1973 the first gene was cloned; three years later the first company to exploit technology based on rDNA was founded in the USA. The revolution has continued along two main lines: genomics and proteomics. Together, they represent powerful experimental and modelling techniques that enable the modification of living organisms and their products in precise and predictable ways. They also enable small molecules to be designed to interact in specific ways with proteins in order to predictably alter their functioning.³⁰ The core of the future biological warfare threat will probably not consist of large weapon stockpiles. It will more likely be made up of the capability to produce warfare agents (and their antidotes or prophylaxis) on a large scale in a short time frame in a crisis.

Biotechnology may improve biological warfare capabilities through product and process improvements. Product improvements may involve the genetic modification of pathogens or the creation of novel agents, as well as the development of new equipment for analysis and production. Process improvements relate to the way in which the agents are manufactured. Optimization of production processes, for instance, can lead larger production batches in shorter time frames or to the use of smaller, less conspicuous

³⁰ Wheelis, M, and Dando, M, 'New technology and future developments in biological warfare', *Disarmament Forum*, no. 4 (2000), p. 44.

equipment (such as fermentors), which would make it easier to hide the BW programme in legitimate activities and installations. R&D in biotechnology leads to many 'enabling technologies', which lay the foundation for future product and process improvements. Of particular importance today are the automation of sequencing in genome projects; bioinformatics, which contributes greatly to the storage and analysis of research data; and the advances in combinational chemistry and high throughput screening of compounds.

4. The dual-use question

Many of these products and processes are being researched and developed for civilian application in medicine, pharmaceuticals, and agriculture, as well as for purposes that are legitimate under the BTWC, such as defence, detection, protection and prophylaxis. However, their investigation also generates considerable knowledge about the potential offensive use of certain substances to interfere with the biological processes in humans, animals and plants. In certain cases, the offensive properties of known or potential biological warfare agents are being actively investigated in order to develop adequate defensive technologies and procedures. Such activities raise the question whether they are permissible under the BTWC. The question may be difficult to answer, because it ultimately depends on the intentions of the state conducting such research and development programmes. Transparency may be the key as greater secrecy will make the international community less inclined to accept the benign purpose of these programmes.

5. The Biological and Toxin Weapons Convention

At the heart of the current regime against BW is the BTWC. It was opened for signature on 10 April 1972 and entered into force on 26 March 1975. As of October 2004, 151 states have ratified or acceded to the BTWC and another 17 have signed, but not ratified the convention. It encompasses a comprehensive prohibition of preparation for biological warfare. According to Article I, states parties cannot acquire or retain BW under any circumstances. The Fourth Review Conference of States Parties, held in 1996, formally expanded the interpretation of this article to cover BW use. The prohibition is reinforced by the requirement in Article II to destroy or divert all BW to peaceful uses and by the nonproliferation provision of Article III.

By current standards the BTWC is a weak treaty because it lacks verification and enforcement mechanisms. Despite its intrinsic weaknesses the convention has been able to retain its relevance through the periodic review conferences, during which the parties interpret the treaty provisions in the light of political and technological developments or try to devise mechanisms to enhance confidence in the treaty regime. In particular, the review process has reaffirmed the applicability of the core prohibition of Article I to the rapid developments and discoveries in the field of biotechnology. The review conferences have also attempted to increase the transparency of activities relevant to the convention on a voluntary basis. During the Second Review Conference in 1986 the states parties agreed on annual data exchanges to serve as confidence-building measures (CBMs).

However, participation in these confidence and transparency-building measures has been limited and is not systematic in most cases. In addition, the parties are only required to provide their declarations in one of the six UN languages and no organization has been designated to administrate, translate, distribute or analyse the submissions. As noted earlier, the failure of the 5th Review Conference cast a shadow over the convention's future relevance. The question of verification and compliance enforcement has still not been resolved. A weak proposal for a monitoring regime, which was being negotiated by an Ad Hoc Group of states parties to the BTWC,³¹ was rejected by the United States in the summer of 2001 because it would negatively affect its national interests. The 5th Review Conference, which had originally been scheduled between 19 November-7 December 2001, was hastily adjourned until November 2002 following a last minute surprise move by the United States to terminate the negotiation mandate of the Ad Hoc Group.³² In 2002, the 5th Review Conference did not finalize its review of the operation of the BTWC, but instead adopted a proposal calling for a 6th Review Conference to be held no later than in 2006 and meanwhile to hold three annual meetings, which will be preceded by expert group meetings. The mandate of the groups is limited and all decisions are to be taken by consensus.³³ At present, the efforts to strengthen the BTWC through a supplementary legally-binding document have stalled.

6. Addressing proliferation concerns: transparency

Proliferation studies principally focus on the transfer patterns of tangible objects, such as agents and equipment, and the threat of the immediate realization of the dual-use potential of these objects, whereby the recipient countries (or sub-state actors) of concern acquire technology developed for civilian use and apply it instantly for the purpose of acquiring BW. Yet, at the core of the biotechnological revolution is information: data collection and processing, knowledge, techniques and skills. This information core permeates the society in which the development takes place.

However, with today's globalization and growing interdependence it inevitably diffuses across national borders. While lateral proliferation processes are undeniably taking place, the greatest challenge to the future BTWC regime may actually come from a sudden massive application of civilian biotechnology for the purpose of acquiring a biological warfare capability by a state party facing a security threat. If a future verification regime of the BTWC is to remain relevant for many decades, it will require mechanisms to deal

³¹ For a summary of the history of the negotiations and the contents of the last version of the draft protocol before the negotiations collapsed, see Zanders, J. P., Hart, J. and Kuhlau, F., 'Biotechnology and the Future of the Biological and Toxin Weapons Convention', SIPRI Fact Sheet (Stockholm International Peace Research Institute: Stockholm, November 2001), available from URL <<http://projects.sipri.org/cbw/research/cbw-papersfactsheets.html>>.

³² Zanders, J. P., Hart, J. and Kuhlau, F., 'Chemical and biological weapon developments and arms control', *SIPRI Yearbook 2002: Armament, Disarmament and International Security* (Oxford University Press: Oxford, 2002), pp. 673-77.

³³ UN Department of Disarmament Affairs, Draft Decision of the Fifth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) Weapons and on Their Destruction, document BWC/CONF.V/CRP.3, 6 November 2002. Review conference documents are available from URL <www.opbw.org>.

with the possibility of instant realization of the dual-use potential of biotechnology. In addition to the traditional verification and monitoring of the destruction and non-production of BW in states parties, it will have to incorporate an understanding of biotechnology and technology transfer processes that goes beyond mere products (agents, production equipment, etc.).

The aim of this new set of tools is to render transparent technology transfers between economic units (e.g. individuals, laboratories, companies, etc.) within a state party and between economic units across national boundaries (including states and transnational companies and organizations). All economic units involved in a transaction will share the responsibility of ensuring that the dual-use potential of the technologies is not realized.

The explicit commitment by the economic unit, whether a supplier or a recipient, to uphold this responsibility will then become a key component for granting the transfer license. The principle also applies to scientific and student exchanges as in-depth background knowledge will enhance the transparency about the institute's and the individual's activities. The national authorities and the international organization to be set up under a future legally-binding instrument will monitor the transparency of all relevant technology transfers. This mechanism of shared responsibilities between suppliers and recipients can facilitate assistance to countries such as Russia as confidence in the compliance with the BTWC will grow, while making it much harder for a future Iraq or representatives of terrorist organizations to acquire the BW-relevant technologies.

This set of tools will nonetheless have to be supplemented with extensive positive security guarantees in order to reduce the disproportionate military advantage a state party might gain from defecting from the treaty. These guarantees do not solely entail the right of access to assistance and protection (subject to the transparency conditions mentioned above), but also involve dynamic decision-making procedures in order to be able to respond swiftly and decisively in the case of a rapidly developing crisis. If adequately implemented, the mechanisms to enhance the transparency of technology transfers may be able to provide sufficient advance warning of an impending massive transfer of civilian technology for prohibited purposes.

7. Prevention and preparing for the aftermath: generic measures

Given the uncertainties and the wide range of plausible scenarios of terrorism with biological agents, it may be opportune to identify generic and cost-effective countermeasures, which can also contribute to a society's overall health and safety standards. Among such measures are investments in the health infrastructure so that there is a good regional distribution of emergency wards and a spare capacity of beds. It may be sound policy to fund the establishment of an adequate number of specialized laboratories in geographically distributed hospitals for rapid identification of rare pathogens in order to be able to rapidly give first responders and other emergency personnel information about the nature of the infection. Annual refresher and training courses for doctors and other medical staff can be used to familiarize them with unusual diseases in order to improve their ability for rapid and accurate diagnoses.

Other important investments are in areas of compatible communications technologies for the different emergency services and adequate field detection and diagnostic equipment for the civil emergency units, and the creation of sufficient supplies of medication and equipment. Recurring realistic exercises must be conducted in order to test and improve procedures and equipment. Legal and political instruments developed and implemented before an act of biological terrorism takes place make up a second group of generic, cost-effective measures. In particular, anti-terrorism provisions in national criminal law ought to be based on the general purpose criterion (GPC) of the BTWC and the CWC (with regard to toxins, but also with regard to any other toxic substance). The GPC basically holds that any manipulation or possession of pathogens, toxins and poisonous substances for purposes that are not explicitly permitted by either convention is prohibited. The incorporation of the GPC in national legislation (whether as part of laws to make the prohibitions in the international conventions applicable to natural and legal persons on the territory or under the jurisdiction of a state party or as part of criminal law) enables law enforcement authorities to apprehend terrorists or criminals before they have committed their act on the grounds that their possession of agents or equipment cannot be justified under the terms of the BTWC and the CWC. Ideally states coordinate their legislation with each other, especially in the framework of political, economic or security regional arrangements, so that terrorists cannot exploit the legal weaknesses of one country to prepare their attacks against targets in another country.

Through international cooperation under the BTWC and the CWC programmes can be set up to assist parties to the conventions in drafting adequate national legislation if they request so. For the civilian authorities it is equally important to realize that the military standards for chemical and biological decontamination differ fundamentally from those required in a civilian setting. Military standards for decontamination are governed by operational necessity on the battlefield and under certain circumstances military commanders have to accept chemical or biological casualties. There is no such tolerance for casualties in civil society. However, if the civilian standards are set at unnecessarily low levels or, worse, no commonly accepted levels have been adopted, then the normalization of activities will be considerably delayed and cause more social disruption and economic losses than the actual terrorist attack. It is possible for governments and public authorities to take wide-ranging preventive measures against biological terrorism without resorting to mass mobilization of national resources as if the country is waging total war. Such measures are generic and cost-effective. Moreover, they are no dead investments. Society as a whole will benefit greatly from the improvements in the health and emergency infrastructure and emergency procedures.

These can all be applied in the event of natural disasters or major industrial accidents (although certain aspects will necessarily be specific to biological terrorism). However, it is important for the governments and public authorities to realize that counter- and preventive measures must be taken before a biological terrorist incident occurs and that such preparations take several years before achieving maximal effectiveness. Here is a clear and present responsibility of parliaments and governments.

13. Trends in cognitive science and information technology

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1. Diagnosis

Cognitive science investigates human intelligence, cognition, emotions, consciousness etc. Some part is devoted to artificial cognition. It has connections to psychology, neurophysiology, brain research and computer science. Despite significant progress, many fundamental questions are still unanswered (Foresight 2004). Research is using new techniques for non-invasive real-time imaging of brain activity, as well as multi-electrodes recording the parallel activity of hundreds of neurones in animal experiments and with human patients.

Information technology (IT) provides means for storage, retrieval, transmission, reception and processing of information. Electronic systems and digitalisation have enabled the phenomenal quantitative and qualitative growth of IT. Miniaturisation is still progressing, Moores law (doubling of integrated-circuit components every 1.5 years) is still describing actual development (however, soon fundamentally different principles will be needed for its continuation). Computers have pervaded all parts of society, and the still expanding internet creates worldwide instant communication. Even though software has become much more flexible and adaptive, there is still the software bottleneck hardware capabilities increase much faster than software ones.

Goals of artificial intelligence - reproducing abilities that seem effortless for humans, such as face recognition or moving in the natural environment - have proved to be much harder than expected. Decades of work were needed to arrive at first commercial programs for artificial vision or speech recognition. First robots for simple tasks such as lawn mowing or vacuum cleaning have just appeared on the market. While a computer has defeated a human chess champion a few years ago, advance in emulating human intelligence is still very slow. One can speculate that a revolution in the understanding of how the human brain works would immensely accelerate the pace of artificial intelligence R&D. However, there are not many indications that such a revolution is pending. Extrapolations by some that a PC would in about 20 years transcend the raw processing power of a human brain (Kurzweil 1999) do not convincingly show that real intelligence would come alongside.

The military, in particular in the USA with its 2/3 share in the global military research and development (R&D) expenditures, have supported computer R&D from the beginning and were the most important customer for a long time. Recently, the U.S. armed forces have made IT the backbone of the so-called revolution in military affairs (RMA), characterised by keywords such as "system of systems", "dominant battlespace

knowledge", "net-centric warfare". While precision weapons exist already, the RMA concept sets a long-term framework for on-going R&D.

In the hardware sector, U.S. military R&D in IT is pursuing miniaturisation towards nanometre structures, including new paradigms such as nanotubes and molecules as memory elements or switches. In software, military R&D has far-reaching goals, aiming at artificial-intelligence systems that would interact like a human or perceive and understand the world and at robots that decide autonomously without a remote human operator (DARPA 2003). A considerable part of the military IT R&D is basic research and advanced technology development, similar to civilian work. Thus, there is a high potential for dual use.

With growing importance of IT for the military as well as for the economy, IT systems and IT infrastructure are becoming central military targets. Information warfare comprises attacks of the more traditional kind, against command and control systems, electronic warfare, psychological operations; new possibilities arise with net war or cyber war - information-based attacks against civilian or military computers and communication nodes.

2. Prognosis

Cognitive science will probably proceed at about the present pace for the next 5 or rather 10 years. In IT, the trend to ever more powerful, smaller computers will likely continue for at least two decades according to Moore's law. Software, including artificial intelligence, will probably advance much more slowly, as in the past. With further increasing dependence on IT in societies, the vulnerability of the infrastructure to criminal or even military attack will remain a strong concern.

In the areas of software agents and robots, significant advance will likely occur over the next decade. Cognitive science and IT may converge in artificial cognitive systems that would have increasing levels of capabilities. Connected with sensors and actuators, some with own mobility, such systems might at some stage have human-like intelligence and consciousness (and might later even transcend human capabilities). Predicting whether and when this can occur is practically impossible today.

In the military, similar developments will take place. On command levels, decision-support systems will play an increasing role. If unchecked by preventive limitations, autonomous systems will increasingly be used on the battlefield. Building on surveillance drones, first uninhabited combat air vehicles are already being tested at present; robotic systems for land and sea warfare could arrive later. They could lead to destabilisation of the military situation between potential opponents, arms races, and proliferation, and would endanger the international law of warfare. Depending on cost and availability, robots could also be used for crimes, including invasion into privacy and terrorist attacks.

3. Links to European security and defence policy

Following its prerogative in strengthening international stability, agreed arms limitation and multilateral, peaceful solutions to conflicts, the EU should work for preventive limits in the most urgent areas of military uses of cognitive science and IT, and should show own restraint. The most important present tasks are:

- Containing information warfare (a very difficult subject) and
- Banning or at least limiting autonomous military systems, in particular those for combat.

Based on well-founded investigations, concepts for preventive limitation should be developed and then debates on various international levels should be started.

4. Links to European science and technology policy

Since generally, for achieving civilian technological progress military R&D is rather a detour, the EU should not actively support military R&D in cognitive science or IT. The armed forces of the member states will likely care for their own needs in these areas. In supporting generic R&D in these areas, the EU should consider also the dual-use problem. Knowledge e.g. in robotics should not lead to development of military robots elsewhere that in turn would increase threats to the EU or its societies. Efforts should be taken to separate, as far as possible, dangerous military uses from the ones that one would wish.

R&D of IT security should continue.

On a general level, the EU should care that in the course of research in cognitive science, traditional ethical concerns about human experimentation should be considered. (There is a certain danger in military R&D, also internationally.) As soon as artificial entities approaching human levels of intelligence would become actually foreseeable, the associated fundamental ethical problems should be investigated and tackled.

Unlike the area of nanotechnology (see paper A.11), in-depth technology assessment of military uses of cognitive science and IT and studies of preventive arms control are missing. Due to its time urgency, in particular the area of autonomous combat systems should be investigated.

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14. Identifying trends in science and technology-based military innovation in the US

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1. Background

The research and development (R&D) phase is normally seen as the first phase in the process of producing military equipment. However, there is another early part of the process that may be called 'S&T-based military innovation'. While the 'D' in military R&D refers to the specific development of military equipment with defined characteristics, the 'T' in military research and technology (R&T) emphasizes the exploratory development of military technology. S&T-based military innovation implies deliberate military exploitation of both domestic and foreign S&T in support of ideas and problem solving related to the development of new military capabilities.

S&T results have always been important as inputs to military R&D. However, S&T-based military innovation as a deliberate activity is likely to become more pronounced in the major military R&D countries. The research branches of ministries of defence and armed forces are likely to increase their financial support to and various forms of cooperation with national and foreign S&T organizations in specific areas and disciplines as a result of the reformulation of military doctrine from threat-based to capability-based strategies. This change supports a need to develop a range of capabilities rather than a set of defined military platforms. This is further supported by anti-terrorist warfare and the risks for asymmetric threats; the increasing military usefulness of commercially available technologies and equipment because of rapid turnover of technologically advanced civilian products compared with long development and production cycles of major weapon platforms; the lack of sufficient national military expenditure for new and advanced military platforms; and globalization of processes for technological development and production.

S&T-based military innovation implies deliberate, long-term support of S&T activities by defence ministries, military R&D and/or acquisition organizations, and armed forces. Such support may be extended to individual scientists or selected projects and take the form of, for instance, direct financial support, exchange programmes, shared facilities and joint research programmes, or it may involve military participants in 'centers of excellence'.

In other words, it implies an increasing involvement of non-military participants in the military innovation process, such as universities, other public and private organizations as well as business enterprises. There are three additional characteristics of these activities. First, military support, participation and sharing of results are normally not complicated by military security restrictions since S&T-based military innovation activities are

generally not defined as military activities. The S&T results may be manifested in a variety of forms, ranging from intangible individual knowledge and skills to tangible outputs in the form of scientific reports and other publications, the creation of new research equipment and methods, and the production of final goods.

Second, S&T-based military innovation need not be expensive for the military. Normally, military funding is added to ongoing S&T projects in the civilian sector or the military is one among several supporters of new projects. Thirdly, for such relatively limited expenses the military gets direct access to S&T results and need not wait for them to be circulated through normal dissemination channels. This is important for the speed of the national military R&D process as well as for increasing the chances of being ahead of competitors and foes.

It should be obvious that only a few nations or groups of nations have the capabilities to organize complete and effective S&T-based military innovation. The USA is of special importance, not only because it is the largest R&D spender. It has used S&T-based military innovation as 'standard procedure' since at least 1945 by which it has 'tapped' national as well as foreign S&T. The USA is an international (ab-)'norm', and comparisons are often made between US and European military R&D expenditures.

2. US S&T-based military innovation

The USA has a varied military R&D structure. One aspect of this structure is the diversity of agencies involved. In App. D there are four agencies listed under the Department of Defence (DOD) as well as the three military services. There are also Federally Funded Research and Development Centers (FFRDC) administered by industrial firms, by universities and colleges, or by (other) non-profit organizations. To the four defence agencies listed in App. D one may add at least five other agencies: the Ballistic Missile Defense Organization, the Defense Information Systems Agency, the Defense Logistics Agency, the Defense Threat Reduction Agency, and Special Operations Command. The Director of Operational Test & Evaluation may also be relevant as well as Test & Evaluation under the Deputy Under Secretary of Defense.

In the Appendices broad trends in US R&D funding are presented. It is possible to distinguish S&T-based military innovation within these trends by focusing on the 'neutral' aspect of S&T, i.e. funding mainly for basic research by a military donor such as the DOD and its agencies and armed forces to non-military recipients/users such as universities and colleges and other non-profit organizations in the US and abroad. In fact, much of the military sponsoring of basic research has been and is made by the special R&D organizations of the military services. Apart from the Navy's Office of Naval Research, the Air Force in particular developed a strong research-based innovation ambition supported by organizations such as the Air Force Office of Scientific Research, the Air Force Technology Division, and the Office of Aerospace Research. In addition, every US military branch established organizations focusing on foreign S&T, such as the Army Foreign Science & Technology Center, the Air Force Foreign Technology

Division, and the Naval European Research Contracting Program. Offices were established abroad to exploit promising foreign S&T, primarily from Europe, such as the Office of Naval Research/London, the European Office of Aerospace R&D and the Army European Research Office. Since the early 1970s, these offices have been located in London.

The existence of US S&T-based military innovation does not mean that it will always be successful in all its aspects. However, the correct question is not really whether it *can* be successful or not, but rather *how* successful it can be - the results from S&T-based military innovation can only be evaluated against capabilities generated in the future. And the policy is still relevant. A US National Research Council 2002 study reflected a commitment of the US scientific, engineering and health communities to help respond to the challenges after 11 September 2001.³⁴ The emphasis on anti-terrorist warfare and homeland defence has had a direct impact on the FY 2004 R&D appropriations.³⁵ One of the four major directorates in the Department of Homeland Security (DHS) established in late 2002 is science and security, and two of the DHS budget function categories are national defence and general science. The DHS is also looking for technologies and expertise in friendly nations.³⁶

3. European relevance

It has been suggested that the transatlantic gap is not at the level of basic technologies but at the level of military applications.³⁷ All comparisons show that Europe spends less than the USA on military R&D. Europe does not have a regional S&T-based military innovation policy, although the military relevance of the multi-faceted nature of S&T has been reflected in the European Cooperation for the Longer-term in Defence (EUCLID) cooperative programme and in national definitions of strategic technologies.³⁸ Moreover, the potential military relevance of European S&T is suggested by the US military exploitation of European S&T.³⁹

³⁴ National Research Council of the National Academies, *Making the nation safer: The role of science and technology in countering terrorism*, Washington, DC: The National Academies Press, 2002.

³⁵ Smith, C., 'Homeland Defense and Security big winners in proposed funding for federal R&D', *News & reporter help*, American Association for the Advancement of Science, Washington, DC, 19 Aug. 2003, URL <<http://www.aaas.org/news/releases/2003/0819rd.shtml>>; American Association for the Advancement of Science (Washington, DC), 'Congress proposes increases for Defense and Homeland Security R&D, flat funding for other programs', August status report on R&D in FY 2004 appropriations, 19 Aug. 2003, URL <<http://www.aaas.org/spp/rd/sum81503.pdf>>.

³⁶ National Science Foundation, *InfoBrief*, NSF 04-300, Arlington, VA: Oct. 2003; National Science Foundation, *Data Brief* (Division of Science Resources Studies), 26 Feb. 2001; 'Science and society: A NATO asset in a global world', *NATO's Nations and Partners for Peace*, no. 4, 2002, p. 265.

³⁷ The Center for Strategic and International Studies, *The future of the transatlantic defense community*. Final report of the CSIS Commission on transatlantic security and industrial cooperation in the 21st century. Washington, DC: CSIS Press, Jan. 2003.

³⁸ See chapters in Gummett, P. and Stein, J. A. (eds.), *European defence technology in transition*, Amsterdam, the Netherlands: Harwood Academic Publishers, 1997.

³⁹ Hagelin, B., *One for all or all for one? A study of Pentagon tapping of foreign science and technology*, Report no. 42, Uppsala University, Department of Peace and Conflict Research: Uppsala 1997).

With growing military ambitions and political initiatives such as the EDA and security research, initial steps towards a European S&T-based military innovation policy might have been taken. But without a deliberate policy, a functioning policy is far off. Besides, there is no discussion about possible European exploitation of S&T knowledge outside Europe with the notable exception of repeated references to US technology. Important strategic decisions in the EU that may have consequences for future European S&T-based military innovation and for future transatlantic 'balance' in this particular field include what military ambition Europe should try to achieve, how to do this, and to what extent this ambition should depend on US and/or European capabilities.

Moreover, should the EU develop an S&T-based military innovation policy it will have consequences for public transparency and democratic control. Military funding of S&T is today not regularly compiled by all EU nations, not easy to come by when compiled, and it is not available on a regional European level. It is therefore not possible to make comparisons between individual European countries or between the EU and US or other foreign countries with regard to the implementation of a S&T-based military innovation policy.

Since S&T-based military innovation implies more involvement of non-military participants in military innovation it might also bring ethical complications for the non-military performers involved. Part of the ethical problem is to know what kind of military innovation is supported by particular S&T activities to which one might be contributing, and whether this is in support of national security or the security of a foreign country. This makes transparency of S&T-based military innovation all the more important.

The main purpose of S&T-based military innovation is to strengthen security. But activities aimed at staying technologically ahead of potential opponents are related to another, less explicit purpose, namely to gain commercial benefits over military competitors. While international cooperation to support the security of friends and allies is a common goal, cooperation in order to gain commercial benefits over competitors in the same countries may not be, especially if the partners are based on either side of European national borders or sides of the Atlantic and if the purpose is to tap partner S&T skills for national benefits.⁴⁰

In short:

- as the US is, at the same time, a European partner and competitor, since transatlantic technological relations are at times problematic, and since the importance of what has here been defined as S&T-based military innovation may be increasing, more detailed knowledge of US S&T-based military innovation in the post-cold war security environment could contribute to the formulation of EU policies and implementations in this area. The appendices suggest one source for gaining such knowledge. There is more

⁴⁰ It has been noted that questions surrounding the reduction and restructuring of inherited scientific and industrial capabilities have not been subject to any systematic international discussion; Bailes, A. J. K., Melnyk, D. and Anthony, I., *Relics of Cold War. Europe's Challenge, Ukraine's Experience*, SIPRI Policy Paper no. 6 (SIPRI: Stockholm, Nov. 2003), p. 19.

detailed information to be found in data sources published, for instance, by the DOD and R&D agencies of the US military services;

- should the EU be concerned about the transatlantic military R&D gap or rather be concerned about certain aspects of that gap, such as S&T-based military innovation and military applications of S&T/R&D;
- should the EU be concerned about DOD tapping of European S&T results and the lack of information about such activities;
- does the EU need a deliberate S&T-based military innovation policy;
- should such a policy include the deliberate search for foreign non-US S&T results in support of EU military R&D;
- do the answers to these questions have consequences for EU position and policy in areas such as technology transfers and military acquisition.

15: Trends in Conventional Military Technology

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This report considers trends in conventional military technology. It does this by considering two aspects: the trends in cutting edge conventional military technology, predominantly led by the United States, and trends in the proliferation of conventional military technologies. Finally, it asks what implications this might have for European Union science and research policy.

1. Trends in Conventional Military Technology Research and Development

Any survey of trends in conventional military technology research and development must inevitably concentrate primarily on the plans of the United States, as the United States is the undisputed leader in conventional military technology. The size of the US defence market is attractive to non-American firms and so American R&D strategies are normally followed by major European firms as well. Similarly, the demands of NATO interoperability and the desire of leading European military powers not to fall far behind the USA in military technology tends to mean that American military innovation is adopted to a greater or lesser extent by European countries even if initial reactions were negative (missile defence being one example).

It is important to stress that the United States is pre-eminent not just because it spends the most on military technology research, but also because of the robustness and vibrancy of its commercial R&D capacities. Graphs 1-3 in the supporting statistical annex show there are clearly differentiated patterns in EU and US research spending. Overall, the US spends slightly more of its gross domestic expenditure on research and development than the EU's big spender, Germany, and considerably more than the EU average but a far greater proportion of this spending is on defence R&D (Graph 1).

If we consider government budget appropriations (GABORD) in isolation an even clearer picture emerges (Graph 2). In 2001 (last available all-EU figures), although the EU spent more on civil research than the USA (there is more proportionally more commercially funded civil R&D in the USA), the US government spent far more on defence R&D. Finally, if we consider trends in GABORD (Graph 3), we are not seeing (contrary to some reports) vast increases in US spending on defence R&D but rather a consistent proportion of GABORD dedicated to it, giving a degree of predictability to US researchers and firms. In contrast, in the EU we see little consistency either on the appropriate amount of GABORD to be dedicated to defence R&D or in spending trends. Some countries, like Sweden and Spain (although there are some doubts about the Spanish data), are steadily increasing their spending on defence research, others like Britain, France and Germany remain relatively consistent but with vastly differing

proportions of GABORD invested in defence (an average over the last five years of around 35% in Britain, 23% in France and 8% in Germany).

These figures point to very differing views on the importance of defence research as an economic driver and security necessity across the EU. It should also be noted that in the EU it is customary to expect defence firms to bear some of the costs of R&D themselves; this is not the case in the US.

One thing is clear: the US spends most on defence research. In defence research, unlike in civilian research, it tends to be the customer (government) rather than the firms, who sponsor and encourage major technology shifts (Dombrowski, Gholz and Ross, 2002). This means that US implementation of its defence transformation plans and their funding of the RDT&E that underpins this implementation must be considered key to the future of conventional military technology. According to Zimet et al (2003) the process of transformation involves new technologies (war-fighting systems), new operational concepts (network-centric warfare, effects-based operations, rapid reaction forces), and new organisational structures (homeland defence, special forces, joint operations).

The overall aim of this transformation is to develop joint, network-centric, distributed forces capable of superior rapid decision-making and massing their effects across the battlefield. Crucially on a technology front, the key to US defence transformation is a move away from a focus on more advanced versions of traditional platforms like ships and planes towards system integrated technology. This shift is already beginning to have an impact on the US defence industrial base, which will also affect European firms wanting to enter the US defence market. The move to systems integrated technology, like the RMA of the 1990s, depends considerably on being able to 'spin in' existing civil technologies (from the current explosion in civil technological advances) into military use.

The trend away from defence research 'spinning off' to produce civil breakthroughs and thus economic growth, which has been visible since the 1980s, thus seems set to continue. This is shown by the breakdown of current US defence RDT&E spending, which shows that most money is spent on evaluating and testing existing technologies (Figure 1 and Table 1). Indeed, the Bush administration has moved away from viewing defence R&D as a way to enhance US commercial industrial competitiveness (a trend in the Clinton administrations); the defence mission's needs to provide security are the clear priority. This, in marked comparison to EU security research plans, is also the case with US Homeland Security research spending.⁴¹

It is thought that three technological breakthroughs may make these new sorts of weapons possible: the further miniaturising of computers, advances in robotics and nanotechnology (molecular scale machines). These developments are all likely to be achieved by civil not defence research as pointed out above. Conventional ships, planes and missiles are close to the limits of useful performance and engineering advances.

⁴¹ See the forthcoming proceedings of a NATO Advanced Research Workshop 'Science and Technology in the Anti-Terrorism Era' held at Manchester University in September 2004.

Highly centralised information and battle management systems like AWACS are vulnerable to saturation attack by precision-guided weapons and to swamping by electronic warfare. However, a new range of small weapons-cum-sensors: micro aircraft that fly by their own sensors and mini-computers; intelligent jumping mines, that can communicate with one another and other systems; networked groups of missiles using different sensors and each carrying many self-guided sub-munitions including mini-nukes: is thought likely to be developed. Such weapons could form a dense, decentralised web, sharing information and building up a picture of attacks or targets through their separate sensors (Hirst, 2001). Such a network would be also much harder to destroy. However, it will also be considerably harder to keep this technology in one country's or a small group of allies' hands.

2. Trends in Conventional Military Technology Proliferation

The arms trade has developed over the past century to a situation where for the small group of states at the forefront of military technological innovation, a qualitative edge has become a critical component of military strength. The processes of spread and continued technological advance are mutually re-enforceable, and when the diffusion of military technology increases more rapidly, so do the demands for extra budget resources in militarily powerful states to re-establish their lead. Since the end of the Cold War the following trends can be discerned:

- Overall, the volume of the arms trade has decreased since the end of the Cold War (SIPRI, 2003) and we are now seeing two groups of purchasers: rich buyers buying the now more available advanced weapons technology and others focussing on acquiring second-hand weapons and small arms and light weapons. This latter group has received much academic, NGO and media attention over the last ten years as the devastating effects of SALW proliferation in internal wars became clear.
- The end of the Cold War though and the development throughout the 1990s of an increasingly commercial and international arms trade, facilitated by a growing use of devices like offsets, which have enlarged the pool of buyers at the top end of the market, has also speeded up the proliferation of advanced military technology, not only through direct transfers but via the diversion of these technologies to unauthorised uses and banned third parties. Decisions on arms trade policy have acquired an economic rather than security focus (see for example section 2 of European Commission (2003)).
- There is a current lack of expertise in the arms control of advanced conventional military technology, but some reports (e.g. Smith and Larson: 2002) suggest that a better understanding of how this part of the arms trade functions and the subsequent development of improved control mechanisms will be key needs in the next decade.
- The rising use of offset has also enabled a growing number of countries to set up defence production capabilities (with varying degrees of success), which may in future lead to further proliferation. The dependence, discussed above, of today's

cutting edge conventional military technology on dual-use and commercially developed technology, which is commercially widely available, means that these new infrastructures will be able to advance more quickly than in former times towards advanced weapon production capability.

- Markusen (2004) argues that the need for the United States to keep its quality edge in this environment, is leading to industry and the armed forces calling for the development of next generation technology faster than they otherwise would have, thus pushing up defence spending unnecessarily. The requirements of interoperability for its allies risk drawing them into an arms race.

3. Implications for European Science and Research Policy

General Remark

The trends suggest that at present investment in conventional military research is unlikely to produce major scientific or economic advances. It would make sense therefore to limit this to any specific needs defined by the European Defence Agency. If the European Security and Defence Policy is going to develop very different military doctrines to those in the US (as is sometimes suggested), its technology needs may be different. The needs of peacekeeping operations for example would be likely to be a substantially higher priority. Community funds should be additional to, rather replacing national spending and aimed at those areas specified by the EDA as needed to implement the ESS. Any allocation of resources to research in this area though should be user-driven rather than defence industry driven, to avoid any inadvertent push towards the adaptation of technologies that are inappropriate for European security goals but commercially attractive, as they are already being sponsored by the US. These decisions should be decoupled from the question of possible subsidy of the defence industrial base, which is predominantly a security or industrial policy question.

4. Recommendations for decisions taken today for FP 2007-2013

Threats

- There is a danger that the EU-US disagreements on civilian aerospace subsidy will spill over into the defence field, and that the perceived need to compete with the US would draw the EU into an economically destructive arms race. Ensuring that needs are defined by users not industry as outlined above should help to limit this threat.

Challenges

- We need to better understand how civilian technological advances can be spun into meet internal and external security needs as defined by user groups in both cases. Sweden currently seems to be managing this successfully in the field of network centric warfare, and their system should be investigated. There should be funds made available for the evaluation, testing and demonstration of the potential of these technologies for security use.

Opportunities

- To avoid duplication, ways of encouraging national defence research organisations to put in joint bids for such funds should be investigated. Could a special scheme, including all the necessary security provisions, similar to that currently operated by the European Science Foundation be put into place? Or by offering such funds to the EDA to use through the Europa memorandum system?
- A focus on the specific needs articulated by the EDA should help funding to be targeted in a way that moves ESDP further down the path of being able to fulfil all Petersberg tasks as quickly as possible.

Risks

- The problem of conventional weapons proliferation needs to regain political saliency as an issue. We need to understand better how the arms trade operates and what the consequences of proliferation of all types of conventional military technology are, how proliferation is likely to occur in the future and what the security consequences are. It will be necessary to develop new types of arms control strategies to deal with new types of actors and technologies. Social science research in this area should be encouraged. While the Commission's wish to break down barriers between military and civilian research and to internationalise research is understandable, it may have undesirable security consequences. The reasons why these barriers were put into place deserve revisiting.

Scenarios

- The US will continue to be the most advanced country where conventional military technology is concerned; however its belief that technology especially via missile defence can provide almost total security is already pushing countries that feel threatened by the US to concentrate on finding ways round these defences, thus pushing up US defence spending to even higher levels. If the European Union avoids the temptation of trying to compete with the US in this field, but instead tries to develop a comprehensive holistic security policy, it may paradoxically achieve greater security.

5. Recommendations for DG Research based on trends looking to 2010

Threats

- Proliferation of advanced conventional weapons technology may increase dramatically if new defence industrial powers like India, South Korea and South Africa who invested substantially in the 2000s in developing defence industrial capacities, now need to break into the world export market to make the maintenance of large DIBs feasible, and so sell cheap advanced technology to a wider pool of buyers. The ESS should be amended to take this threat into account if the arms trade does evolve in this direction.
- The EU decided to try to compete with the US in conventional weapons technology thus changing the ESS to mirror the US NSS, and is now locked into an arms race, which requires ever greater resources to be diverted into the military sector with predictably disastrous economic consequences.

Challenges

- Ensuring that the money available for testing, evaluating and demonstrating the potential of civilian technology for internal and external security purposes is both open to small, niche firms or research programmes and encouraging greater European co-operation but also maintaining security.

Opportunities

- Hopefully, by this point the EDA will be sufficiently well developed to be able to build on growing links between European defence research agencies and duplication of research can be further reduced by its research programmes.

Risks

- As outlined at point A.

Scenarios

- Probably continued American dominance but much will depend on the extent of the success of the defence transformation project – early signs in Iraq suggest that technological military supremacy does not equate to absolute military supremacy.

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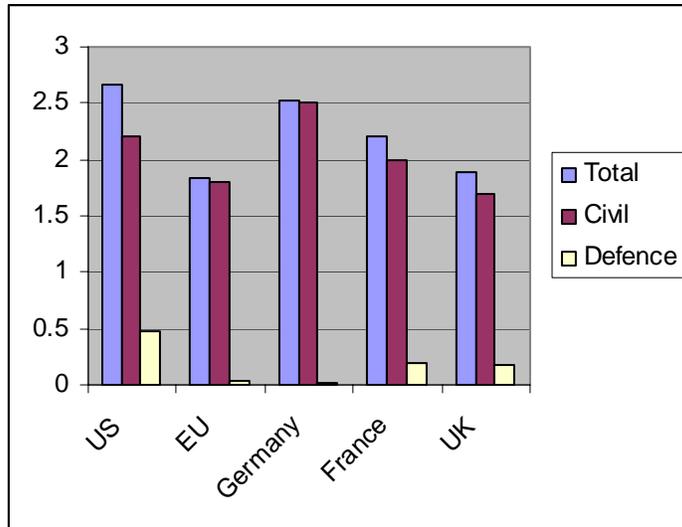
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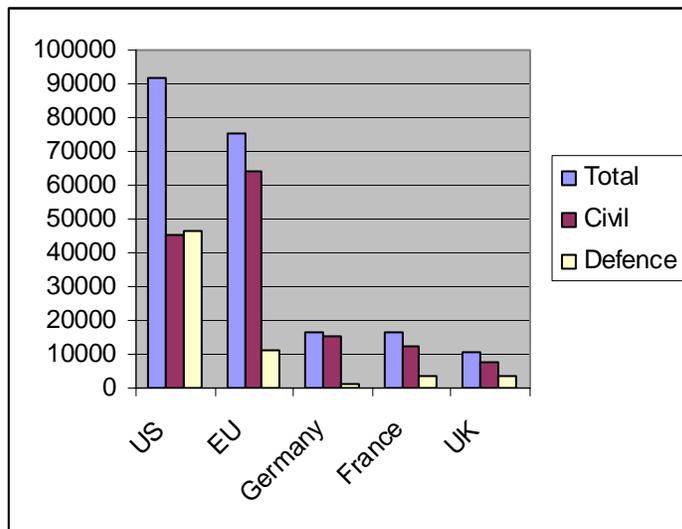
Supporting Statistical Annex

Graph 1: Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP in 2002



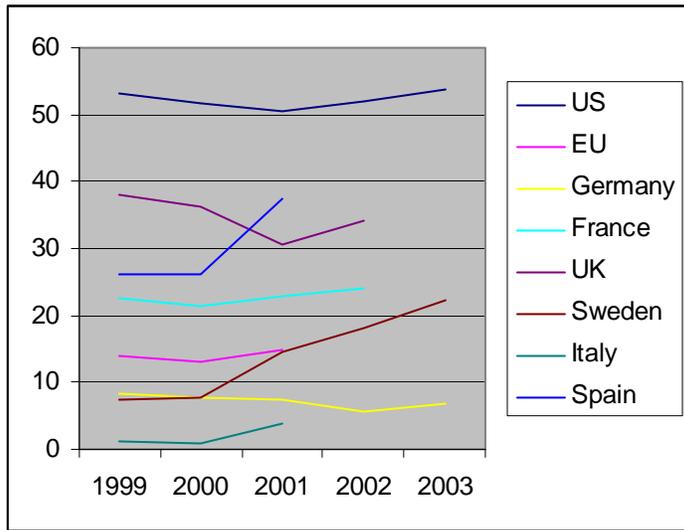
Source: OECD Main Science and Technology Indicators May 2004

Graph 2: Total Government Budget Appropriations or Outlays for R&D (GABORD) in 2001 (million current PPP \$)



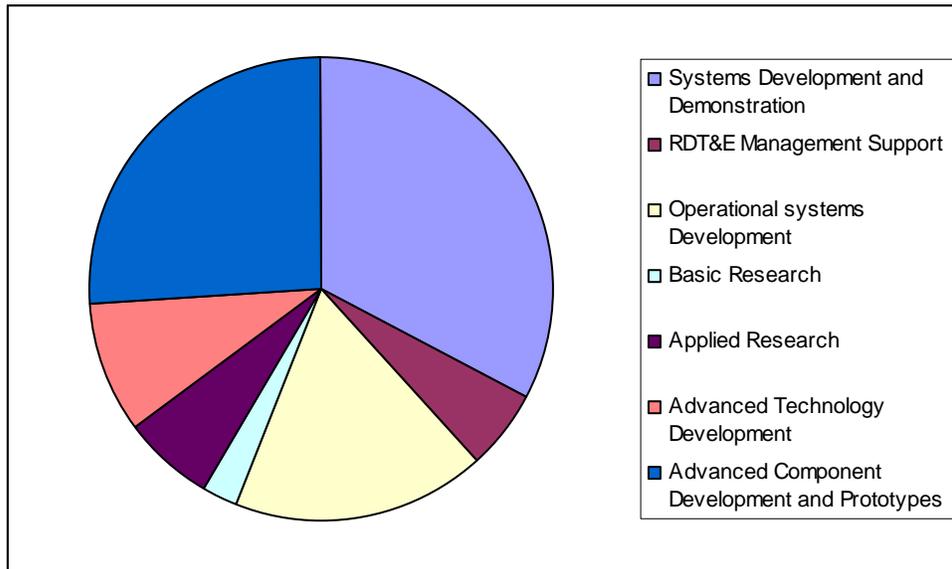
Source: OECD Main Science and Technology Indicators May 2004

Graph 3: Defence Budget R&D as a Percentage of Total GABORD



Source: OECD Main Science and Technology Indicators May 2004

Figure 1: Distribution of 2005 US Defence RDT&E Budget across Budget Activities



Source: Derived from Department of Defense Budget Document R-1

Table 1: The Largest 20 US RDT&E Programmes

| Project Name | Organisation Name | Budget Activity Name | 2005 Budget Request (\$ thousands) |
|---|---------------------------------|---|---|
| Ballistic Missile Defence Midcourse Defence Segment | Missile Defence Agency | Advanced Component Development & Prototypes | 4384775 |
| Armoured Systems Modernisation (ASM)-SDD | Army Budgeted by DoD | System Development and Demonstration | 2700455 |
| Joint Strike Fighter | Air Force Budgeted by DoD | System Development and Demonstration | 2307420 |
| Joint Strike Fighter | Navy Budgeted by DoD | System Development and Demonstration | 2264507 |
| SC-21 Total Ship System Engineering | Navy Budgeted by DoD | System Development and Demonstration | 1431585 |
| Comanche ⁴² | Army Budgeted by DoD | System Development and Demonstration | 1229664 |
| Ballistic Missile Defence Terminal Defence Segment | Missile Defence Agency | Advanced Component Development & Prototypes | 937748 |
| VHXX Executive Helo Development | Navy Budgeted by DoD | System Development and Demonstration | 777398 |
| Transformational SATCOM (TSAT) | Air Force Budgeted by DoD | Advanced Component Development & Prototypes | 774836 |
| Ballistic Missile Defence Tests and Targets | Missile Defence Agency | Advanced Component Development & Prototypes | 713658 |
| Advanced EHF MILSATCOM (SPACE) | Air Force Budgeted by DoD | Advanced Component Development & Prototypes | 612049 |
| Advanced Hawkeye | Navy Budgeted by DoD | System Development and Demonstration | 597015 |
| Ballistic Missile Defence Sensors | Missile Defence Agency | Advanced Component Development & Prototypes | 591957 |
| Satellite Communications (SPACE) | Navy Budgeted by DoD | Operational Systems Development | 573092 |
| Multi-Sensor C2 Aircraft (MC2A) | Air Force Budgeted by DoD | System Development and Demonstration | 538860 |
| Ballistic Missile Defence System Interceptor | Missile Defence Agency | Advanced Component Development & Prototypes | 511262 |
| Space Based Infrared System (SBIRS) High EMD | Air Force Budgeted by DoD | System Development and Demonstration | 508448 |
| Materials and Electronics Technology | Defence Adv. Research Programme | Applied Research | 502044 |
| Non-Line of Sight Cannon | Army Budgeted by DoD | System Development and Demonstration | 497643 |
| Multi-Missile Maritime Aircraft | Navy Budgeted by DoD | System Development and Demonstration | 496029 |
| Ballistic Missile Defence Boost Defence Segment | Missile Defence Agency | Advanced Component Development & Prototypes | 492614 |

Source: Derived from Department of Defense Budget Document R-1

⁴² A decision was subsequently taken not to proceed with the Comanche Programme in March 2004.