NORTH ATLANTIC TREATY ORGANIZATION

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Strategic Foresight Analysis (SFA) Workshop Report

Strategic Foresight Analysis (SFA) 2017 Report
Workshop - II
26-27 September 2016
Bydgoszcz, Poland
1. Background.

1.1. Since our last workshop in Lucerne, there have been extensive and profound events in the world: the UK BREXIT vote, China’s rejection of The Hague arbitration tribunal decisions on the economic rights across large swaths of the South China Sea, the terrorist attack in Nice, France, a failed coup attempt in Turkey and the latest attack in USA, just to name a few. The NATO Warsaw Summit declared that “(t)here is an arc of insecurity and instability along NATO’s periphery and beyond. The Alliance faces a range of security challenges and threats that originate both from the east and from the south; from state and non-state actors; from military forces and from terrorist, cyber, or hybrid attacks.” These developments and Warsaw Summit outcomes were taken into account during the two days discussions.

1.2. The second joint SFA/FFAO Workshop in Bydgoszcz, Poland builds upon the findings of the Lucerne Workshop bringing together a wide variety of experts from Nations, NATO Commands and Agencies, COEs, National and International think tanks and industry. This workshop is part of our continuous engagement and interaction with all the stakeholders in order to deliver SFA in time to inform the development of the Political Guidance aligned with the NATO Defence Planning Process.

1.3. The aim of the SFA portion of the workshop was to:

1.3.1. Finalise the trends, and the defence and security implications list accordingly;

1.3.2. Maintain transparency through open collaboration with member and partner Nations, academia, think tanks and industry.


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<th>Attendees</th>
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<td>NATO HQ and Agencies</td>
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3. Foundational documents: The SFA 2013, SFA 2015 Update Reports and Lucerne Workshop Report were used as the basis for the discussions.

4. Workshop Findings: The attendees of the SFA workshop were divided into groups and assigned one of the five SFA themes to research and discuss in breakout sessions. Prior to the event, attendees were asked to prioritize to which theme they wanted to be assigned. Most assignments were based on choice as well as expertise backgrounds. Subject Matter Experts (SME) and moderators, supported by ACT SPP Strategic Analysts and ACT Capability Development Defence Planners, were assigned to run and report the findings of each respective breakout session. The findings are summarized in the following sub-sections. The majority of the overall findings will be used to set the foundation of the SFA 2017 Report research and development.

4.1. Unconference: Before the breakout sessions, time was allocated for unstructured discussions ("Unconference") which enabled us to get views from the participants on a wide variety of issues. Unconference also allowed us the opportunity bring out-of-the-box thinking/ideas. The following areas were covered during the Unconference and details of the discussions are at Annex A.

4.1.1. Will it destroy us? – Artificial Intelligence (CDR Jean-Luc DEVILLERS)
4.1.2. “I’ll be back” – Future of Robotics (LTC Aaron BAZIN)
4.1.3. Brexit – EU Disintegration/Integration (CDR Dave SHERRIFF)
4.1.4. Who owns the Moon/Space? – Space exploration (LTC Richard PLEJSANT)
4.1.5. Impacts of 3D/4D Printing (Dr Timothy POVICh)
4.1.6. Can we save the world? – Climate change (Mr. Chris HOUGH)
4.1.7. Will Polarization continue? Ideology & Religion – Fractured identities (CDR Gro Ooen)
4.1.8. What happens when we run out of water? – Water Scarcity (Ms Swathi VEERAVALLI)
4.1.9. Changing demographics – Impacts of migration (LTC Sven SZABO)
4.1.10. The Future of the State (Dr Kristi RAiK)
4.1.11. The Future of Money – Blockchain & Bitcoin (Dr Adrian KENDRY)
4.1.12. Superman 2.0 – Is Human enhancement ethical (Dr Stefan RESCHKE)
4.1.13. Income inequality – Growing War between the ‘Haves’ and ‘Have Nots’ (CDR Chuck CORDON)
4.1.14. Challenges to the International Norms-South China Sea (LTC Darry GROSSNICKLE)
4.2. Political Theme. The Political Theme breakout session was divided into three sub-groups. The breakout session started with a review of defence and security implications of the six trends that were identified during the Lucerne Workshop. The overarching themes were the Re-distribution of Geostrategic Power; Challenges to Governance; Non-state Actor Influence in Domestic and International Affairs; Power Politics; Public Discontent and Disaffection; Interconnectedness and Polycentrism. Elaborations continued on the challenges to the international order posed by the rise of new powers and increased confrontation, domestic challenges within NATO and in its neighbouring regions, and increased complexity and interconnectedness characterising the political domain. The group made some adjustments to the trends and drafted new implications and key take-aways under each theme. The order of trends was also changed to reflect a logical flow.

4.2.1. The Re-distribution of Geostrategic Power. Many members of the group supported replacing 'geostrategic' with 'geopolitical', since the trend does not tackle the strategic level but rather recognises a shift in terms of resources and actions. The redistribution of economic, military and population resources, most notably in favour of Asia, continues to contribute to the relative decline of the West. At the same time, actors with relatively limited resources such as Russia may also succeed in enhancing their power position in international affairs due to bold use of the resources and capabilities that they have. Both hard and soft power instruments influence shifts in the power balance. In this process, lack of leadership, unity and resolve may play to the disadvantage of the West. The trend leads to the following implications and key take-aways:

4.2.1.1. Challenges to the rules-based order. Establishment of duplicate structures and disregard of international agreements and norms by some of the rising powers.

4.2.1.2. Potential conflict in power transition. Emerging powers may challenge status quo by use of force.

4.2.1.3. Euro-Atlantic relations and Alliance cohesion challenged. Alliance cohesion will be challenged due to increasingly diverging priorities.

4.2.1.4. Need for improved strategic communication including public diplomacy. Potential to clarify and communicate better our strategic narrative.

4.2.1.5. Cooperation with other actors. The requirement to cooperate with like-minded partners has increased. Effective partnerships might help to mitigate relative decline of the West and decreasing capabilities.

4.2.2. Power politics. A more appropriate name of the trend would be 'Return of power politics', so as to indicate what makes this a trend. Although power politics never disappeared from international relations, recent years have seen a worrying increase of confrontation between major powers involving the use of diplomatic, informational, military, economic and
other instruments of power. This trend is strongly linked to the first trend 'changes in the international structure and balance of power typically increase the likelihood of conflict and confrontation. Both trends are further enhanced by the rise of nationalism in many states. The trend underscores the increased importance of the core functions of NATO. The main implications and take-aways are:

4.2.2.1. Increased potential of confrontation and conflict. Increased importance of defence and deterrence.

4.2.2.2. Synergy between hard and soft power/ different instruments of power. Need to include both in planning and operations.

4.2.2.3. Increased nationalism globally and within the Alliance. Divergent perceptions of threats and risks may cause changes in defence priorities and challenge cohesion within the Alliance.

4.2.2.4. Increased requirement for defence spending. Burden sharing within Alliance remains an issue.

4.2.3. Non-state Actor Influence in Domestic and International Affairs. Continued growth of the number and influence of non-state actors was seen as a continuing trend, supported by technological development and interconnectedness. The huge diversity of actors under this category, ranging from humanitarian NGOs to terrorist groups and from huge transnational corporations to super-empowered individuals, complicates efforts to analyse the trend and develop policy responses. The need to invest in policy-makers' capabilities to identify the relevance of non-state actors, e.g. their role in inter-state or intra-state conflicts, emerged as one of the conclusions. NATO needs to be able to identify the 'good guys' and 'bad guys', develop its capability to cooperate with the former and counteract the latter. It is also important to acknowledge that non-state actors may operate independently, but often they are in some degree of dependence on state actors and may also act as proxies of the latter. The group discussed the following implications and take-aways of this trend:

4.2.3.1. Existence of a wide variety of non-state actors. Need to differentiate between 'good guys' and 'bad guys'.

4.2.3.2. Requirement for closer cooperation with non-state actors. Need to clarify political, legal and ethical issues in dealing with different types of non-state actors.

4.2.3.3. Security is not limited by borders. Non-state actors have trans-national and trans-border influence.

4.2.4. Interconnectedness. While the first three trends focus on the actors of global politics, their goals and instruments, this trend highlights the increased density and complexity of
relations between actors and between policy areas. States and citizens are increasingly dependent on and affected by flows of information, energy, trade and people. Interconnectedness often involves interdependencies which may contribute to cooperative and peaceful relations, but may also produce risks, vulnerabilities and increase the likelihood of conflict. Improved understanding about the positive and negative aspects of interconnectedness, and different forms of interdependencies, is of paramount importance. The group discussed cyber space as one of the areas where interconnectedness is creating both vast new opportunities and new security concerns. Our dependence on global flows and connections underscores the need to improve resilience of critical infrastructure and safeguarding of ungoverned spaces. The group also noted signs of a counter-trend: increased appeal of protectionism, inward-looking nationalism and isolationism in many states within and outside NATO. The implications and take-aways of the trend are:

4.2.4.1. Greater complexity and uncertainty. Increasingly challenging to deal with unintended consequences.

4.2.4.2. Increased interdependency. Involves both risks and opportunities. Adversaries can leverage interdependency.

4.2.4.3. Globalization of security. Need to protect critical infrastructure and security of supply.

4.2.4.4. Potential counter-trend of isolationism and protectionism. Failure to manage the risks and costs related to interconnectedness increases the appeal of isolationism.

4.2.5. Challenges to governance. The group saw the need to specify the focus of this trend and suggested a redefinition into 'Challenges to governance in nearby regions'. The discussion focused on the sources and implications of instability in the southern and eastern neighbourhoods of European NATO allies. Major governance problems related to corruption, socioeconomic inequality and weakness of state institutions and public services generate public mistrust that may lead to further protests and intra-state conflicts. State fragility contributes to the spread of extremism and terrorism. The risk of the emergence of new failing or failed states remains considerable. The instability can be accelerated and utilized by external powers/adversaries. Instability in nearby regions continues to have severe implications for European NATO allies, inter alia in the form of migration pressures and risk of increased terrorism. Responses to this trend need to build on a comprehensive understanding of security. The trend has the following implications and take-aways:

4.2.5.1. Spread of instability alongside and across NATO’s borders. Lack of effective governance will create power vacuums with spill-over effects.

4.2.5.2. Spread of radicalization, extremism, terrorism. Radicalization will continue in failed and failing states causing local and regional instability.
4.2.5.3. Migration caused inter alia by instability and conflicts. Lack of effective governance and security in Europe’s neighbourhood will cause further migration.

4.2.5.4. Importance of comprehensive security concept including use of non-military tools. Military approach may not address all aspects of conflict and might cause further instability. Therefore a comprehensive approach to address all aspects of security challenges is required.

4.2.6. Public discontent and disaffection. The group emphasized that this trend focuses on political dynamics within NATO states and more broadly in the West, while it noted connections between this trend and challenges to governance in nearby regions. The rise of populism, extremist nationalism and racism is a strong trend in established democracies. The agenda of the populist groups is often anti-EU, anti-NATO and anti-globalization. The reasons include the economic crisis, unemployment, sudden increase of migration, and perceived lack of leadership in addressing the related problems. The trend is a major cause of concern for NATO, as it threatens to undermine the cohesion and capabilities of the Alliance. Yet it has to be addressed primarily at the national level, since NATO has few means to counteract it. The name of the trend might be slightly changed into ‘Public discontent and polarization’ so as to highlight increased confrontation among different political and social groups within Western societies. The main implications and take-aways:

4.2.6.1. Rise of populism and anti-establishment sentiment. Increased inward-looking nationalism, anti-EU and anti-NATO sentiment challenges Alliance cohesion.

4.2.6.2. Lack of trust in elites and governments. Need to address root causes of polarization and public discontent such as unequal distribution of the costs and benefits of globalization. Need to improve effectiveness of narrative.

4.3. Human Theme. The Human Theme breakout session was divided into two sub groups, both aimed at reviewing, revising and complementing the security implications elaborated during the Lucerne Workshop. The overarching trends were asymmetric demographic change; increasing urbanization; fractured and/or polarized societies and increasingly connected human networks. The breakout session started with a brief review of the four trends and their respective security implications which required further analysis. Summarizing, after merging their elaborations, the two sub groups reworded and drafted new security implications while cancelling some of the security implications from the Lucerne Workshop.

4.3.1. Asymmetric Demographic Change. The group agreed that this trend is still valid. Demographics is a factor which is always relevant; what is becoming more important is the asymmetric characteristics associated with demography. The consequences of population dynamics like diverse fertility rates between Western nations and developing nations, the shift in median age to an older population in the West (and developing and developed nations, i.e., China, Japan) contrasted to the youth bulge in the East/South will influence the future security
environment. In some areas of the world, the imbalance in the ratio of males to females is worsening, thereby cascading further demographic imbalance and instability. The combination of global economic inequality, labour options, education access and healthcare provision might exacerbate the possibility for future conflicts.

4.3.1.1. **Aging beyond Western nations including China.** Aging is expected to increase the demand on resources for medical and social welfare. Therefore, there will be increased strain on national budgets to allocate necessary funds for defence and security.

4.3.1.2. **The youth bulge is of particular importance.** In developing countries, unemployed, undereducated, disenfranchised youth may lead to social unrest and instability. Furthermore, hopelessness, such as lack of a secure future for youth, has led and is expected to drive migration. Migration might lead to destabilization in the country of origin as well as in transit and receiving countries. Additionally, migration of educated youth might cause brain drain in the country of origin.

4.3.1.3. **Failed integration of migrants.** In receiving countries, lack of effective policies or national will to provide equal opportunity and to integrate migrants into society might lead to frustration and disenchantment that creates vacuum allowing for radical and extremist groups to recruit. As the number of youth continue to migrate, this might create social and financial strain in receiving countries as well as increases security concerns. In the past, mass migration has been less confrontational in receiving societies because of the desire to assimilate. Assimilation is no longer a desire of the displaced, as migrants “hive” and wish to maintain the cultural identity of their homeland rather than their host.

4.3.2. **Increasing Urbanization.** The group agreed that this trend is still valid. The group also stated that it is important to focus on urbanization as a phenomenon, and not focus solely on megacities when discussing security implications. In addition the group emphasised that urbanization might not only create new challenges, but also create opportunities. For instance as societies become more open and liberal, shared interdependencies and mutual interests make conflict less desirable. A proper understanding of the metabolism of densely populated areas may be necessary to achieve and preserve strategic objectives.

4.3.2.1. **Increasing urbanization might lead to resource inequalities.** People will increasingly live in crowded and dense urban environments that will require proportional demands for natural resources, energy, raw material, food and goods to sustain the daily life of their inhabitants and their economic activities. This might lead to a resources scarcity across all domains and aggravates the distribution of the available resources.
4.3.2.2. Uncontrolled growth within the urban terrain. This development will challenge governance to such a degree, that efficient and just governance might not be possible or that there will be a total absence of governance. A lack of cohesion due to diverse stratification (vice assimilation and harmonization) of cultural identities (e.g., tribal mind-set) may prohibit consensus building to allow governance. Consequently, there is a potential for the growth of non-state actors to fill the vacuum created by the absence of governance. In addition, these areas may be more vulnerable to natural and man-made disasters, pandemic and epidemics.

4.3.2.3. Ownership and control of critical infrastructure. Urban areas include large scale engineered infrastructures (e.g., electric power, water supply and transport networks) that convey natural resources (directly or in the form of transformed resources) to people in cities. Ownership and control of the infrastructure and the information domain might be highly contested.

4.3.2.4. Increased urbanization will require a tailored security force. Future security forces that are required to operate in rapidly changing urban environments need to adopt a comprehensive approach. The environment of a densely populated area may challenge a necessary intervention by merging different responsibility realms (e.g., police vs. military) which demands proper legislation beforehand.

4.3.2.5. Littoral nature of urban areas. Urbanization increase will concentrate in coastal areas in the future. The populated areas will therefore be highly dependent on resources supplied via sea lines of communication (SLOC). In addition, will these areas be more vulnerable to natural disasters (e.g., rise of sea levels).

4.3.3. Fractured and/or Polarized Societies: This trend is still valid. There is a strong reinforcing link between this trend and the political theme. This trend is a worldwide challenge, but western developed nations are particularly vulnerable because of the wider scope of individual empowerment. Moreover, each of the security implications are closely interconnected and are reinforcing each other. The common denominator is the differing and possible diverging interest of individuals which might be political, social, religious or economic. These can gradually cause a lack of cohesion and disagreement within society, which can eventually lead to civil unrest or ultimately into civil war and, in the worst case, a failed state. Rapidly evolving and adapting forms of governance are necessary to mitigate this challenge. Authoritarian societies may paper over these fractures and seem to be stable longer, but they can shatter quickly; whereas democratic societies, because they are more transparent, appear to be more fragile, but are in fact more resilient due their openness to discuss and address challenges.

4.3.3.1. Fractions could lead to a lack of unity. A lack of unity might hamper a society addressing and solving problems because they cannot agree on substantial
challenges and how to deal with them. Such societies are also more susceptible to external influence and pressure.

4.3.3.2. **Internal fractions and polarization might undermine trust.** Lack of trust in existing governance might lead to a loss of political participation which might cause the rise of alternative/unofficial types of governance. Loss of political participation also leads to less collective thinking and makes focusing on common issues difficult, potentially making the Alliance vulnerable to adversaries.

4.3.3.3. **Internal fractions and polarization might complicate governance.** Where individual interests prevail, there is little chance of governing in the common interest of the population. Things that would otherwise be easy to deal with become hard.

4.3.4. **Increasingly connected Human Networks.** This trend is still valid. Physical and hierarchical entities, like nations and organisations, including NATO, are in a constant competition with sometimes non-physical human networks and ever-changing actors that follow few rules and laws. To avoid being outflanked by these networks and actors, the hierarchical entities need to morph and change at a fast pace, using a very agile way of sensing. However, these networks are able to adapt faster than we can react. In the future, it might be more difficult to target and monitor relevant human networks because of their quantity and their nature of acting in cross-domain environments. Taking the fast technological improvements into consideration, virtual networks might become more important than physical entities.

4.3.4.1. **An increasing demand to monitor human networks.** Human networks will need to be increasingly monitored and assessed for antagonistic aims and potential for violence. This will require a close cooperation across all possible areas and domains (e.g., between military and local/national law enforcement). A greater familiarity of human networks will be necessary for understanding the extent of legal, political, social, religious and economic issues.

4.3.4.2. **The understanding of human networks.** Understanding and familiarization with human networks is a necessity to be comfortable with their ambiguity, where every actor within a network can have multiple roles, identities and interests quickly changing from friendly to neutral to hostile. These networks transcend borders, therefore cultural awareness and coordination at different levels of organization are also required.

4.3.4.3. **The need for influencing human networks is increasing.** Human networks can be influenced by effective strategic narrative, and a comprehensive knowledge of these networks is important to influence them. The ways of influencing
human networks are far beyond just military means, therefore a holistic comprehensive approach is necessary.

4.3.4.4. Increasing individualism results in an accelerated requirement for precise strategic communication. Taking into consideration changing public opinion and perception will be increasingly more important. The nature of human networks makes it necessary to address countless networks with countless messages. Each of these messages has to be precise and tailored to the intended recipient, therefore STRATCOM needs to be more elaborate. Increased individualism may decrease STRATCOM effectiveness.

4.4. Science & Technology Theme. Over the two day period, 31 subject matter experts participated in a review of the S&T trends work from the Lucerne SFA workshop. The outcome of this work resulted in no significant changes to the existing trends or new trends. However, there were several modifications to existing defence and security implications and several new implications suggested. The session began with five subject matter experts presenting in the areas of Human Performance Enhancement, Space Impacts, Quantum Systems, and the Internet of Things to set the stage for new technology areas that may impact the trends. With the Lucerne Workshop results as a base, the group then worked to review and analyze the trends and related implications and provide additional implication recommendations. Similar to the Lucerne results, a common theme that arose was that the behavioral, organizational and cultural changes in response to new technologies will have the most implications, not necessarily the individual technologies themselves. In summary, five S&T trends and their associated defence and security implications were reviewed and discussed during the S&T syndicate in the Bydgoszcz Workshop. There were no significant modifications of the previous S&T trends identified in the Lucerne Workshop. However, many defence and security implications were modified and several new implications were identified.

4.4.1. Convergence Revisited. In the Lucerne Workshop, the idea of convergence was identified as needing further discussion. As described in the Lucerne Report, convergence refers to the coming together of different trends, the outcomes of which may be very challenging to predict but should be considered nonetheless. One group preferred the term confluence to denote that gradual coming together and mixing of trends rather than the idea of intersecting trends. Convergence was discussed in the syndicate and two main ideas arose. First, convergence is especially relevant in the Rate of Technology Advance trend. An increased rate of advance in individual technologies when combined together will lead to new technologies and novel usage that will have major impacts. Secondly, there was overall agreement that the discussion of convergence should not be relegated to the science and technology theme but should be added as a forward to the SFA document to signify the impacts of convergence/confluence of all trends, to include technology. An effort at the outset should describe the impacts it has overall and the relationship between the trend areas – not specific to technology trends. In future SFA conferences, a deeper analysis of the technology trends combined with social, political, and economic trends would help identify potential flash-points.
that would generate areas for more detailed analysis. This was not attainable in the current format of the workshop.

4.4.2. Rate of technology advance. This trend was determined to be valid and the rate of technology advance is increasing. The cyclic nature was validated and emphasized. All technologies are not advancing steadily but advances in single technologies lead to advances in other technologies which then have amplifying effects. It is easy with a small amount of money to develop a new technology by combining existing technologies. The abundance of new technologies also makes it difficult to foresee all possibilities and will lead to surprising combinations and novel applications. The societal response to this advance was also discussed. Technology adaption is influencing behaviour in education and creating generational gaps (e.g. the use of E-readers, the loss of writing skills, lack of concentration and changing perception of authority/leadership and expertise). A changed mindset is needed to keep pace with the advance and to facilitate the adoption of new technologies (i.e. use of incrementally/stepwise improving beta-versions of new technologies that may not be fully developed within the life cycle management process of systems). This rapid change will also necessitate adaption and changes to our organizational and legal structures. Different ethical interpretations of the use of new technologies can strain the Alliance (e.g. offensive cyber) and the disproportionate rates of development amongst Alliance Nations could lead to interoperability issues or even incompatibility to operate in the same environment. Based on the discussion, the potential defence and security implications are:

4.4.2.1. The rapid pace of advance will require change across a variety of other domains, such as policy, organizational structures, laws and regulations, societal use norms, and cultural adaptation to name but a few.

4.4.2.2. Exploitation of state of the art technology will require a change to Defence and security organizations’ acquisition and life cycle management processes otherwise they will be unable to keep pace, potentially resulting in less than state-of-the-art capabilities in some areas.

4.4.2.3. Because of the rate of technology advance, the Alliance will need to be comfortable with uncertainty and the surprising use of emerging technologies (increasingly fungible systems are a key enabler of innovation).

4.4.3. Access to Technology. This trend emphasizes the ability of the individual or state to access technology and was determined to be valid and still increasing. It was emphasized that in addition to non-state actors, some state actors will not be constrained by specific cultural norms valid in NATO member states as well as the testing and implementation of new technologies that are associated with the emerging technologies. Furthermore, prevalent ethical constraints may even hinder thinking outside of the "compliance" box and thus prevent anticipation of adversaries' non-conformal technology use (i.e., abuse). The restrictions of current national product development and approval processes in the defence industry may
hinder the fielding of new technologies within the forces and provide adversaries, who are not restricted by these requirements, advantages in some areas. Because of this, Nations may need to be prepared to operate without technical advantage in some areas. Another area identified was that the increased access to technology empowers individuals to conduct research and development and to operate in new technology areas which have potentially positive societal impacts. The emergence of “professional hobbyists”, crowd funding and technology communities of interest created and facilitated by global networks may play a role in creating technologies that are outside the control of managed entities like States and commercial business. With respect to defence and security implications, the following were discussed and validated:

4.4.3.1. Access to technology enables disruptive behaviours, allowing individuals to become non-state actors and acquire capabilities similar to those of states (in some areas).

4.4.3.2. Others (Non-state and some state actors) may be less constrained as to how they employ (beta or unproven) technologies, unlike state actors who are obliged to remain within internationally agreed norms such as the Law of Armed Conflict or national product development and approval processes.

4.4.4. Global Network Development. It was determined that this trend is valid and still increasing. Global networks will not only carry information and physical items, but also commodities and capital assets (e.g. the use of Bitcoin and Block Chain technology) which can have a large influence on commerce and economies. The scale and speed of these global networks allows individuals immediate access to vast amounts of information and knowledge and provides for immediate exchange of many of these items. However, it is not only that more data can be transmitted faster, but that more data is being harvested through massive deployment of sensors (for many purposes) and that this data can be real-time processed. This means that environment and personal information is more readily available both to NATO and its adversaries. In a sense, it is the real-time collection and transmission of high fidelity data through many high quality (but low cost) sensors that is having the impact. Technologies (such as quantum) mean that data acquisition and processing will increase still further in terms of quantity, fidelity, and transmission speed. This creates a greater challenge for dealing with massive amounts of data and will require changes in how we process, store and manage data. With respect to defence and security implications, the discussion also led to the implications of restricting the network—controlling the network and restricting access to information for nations is a true threat as nation states are able to influence the environment within their borders (e.g. Russia and China). Also, because of the speed of information transfer, small, unpredictable effects can be amplified due to global networks. Small incidents of violence that in and of themselves would not be significant can be amplified when shared an enormous number of times across a network. The opportunities provided by the global networks were also discussed. To truly leverage global networks, nations need to leverage the opportunities
to engage and transfer information to a much larger population which would allow for global opinion shaping. Based on the discussion, the following are potential implications:

4.4.4.1. The increase in global networks results in vulnerabilities from a defence and security perspective. The element of surprise (for example in covert operations) is increasingly challenged due to these dynamic networks.

4.4.4.2. Global networks will have the ability to promote the transfer of information at an unprecedented rate, without discrimination, based on the intent of the end user; potentially placing valuable knowledge in the hands of non-state actors with malicious intent. However, they also provide the opportunity to engage and transfer information to a much larger population for exploitation and global opinion shaping.

4.4.4.3. Data processing and use (both procedures and mindset) will need to be adjusted to account for the evolving nature of global networks.

4.4.4.4. Small, unpredictable effects can be amplified due to global networks.

4.4.5. Dominance of commercial sector in technological development. This trend was determined to be valid and increasing- there will be continued dominance in the commercial sector of specific technologies. As a result of this dominance, government entities may lose control over the use and modification of certain commercial technologies. Commercial control of intellectual property (IP) may not allow Governments to adapt technologies as well and may lead to a denial of government’s ability to access latest commercial innovations, technical solutions, data, etc. Improved interagency and multinational cooperation will be needed to help influence commercial entities. However, the dominance of commercial sector cannot be taken for granted in all areas. Some science and technology areas will not be addressed in the commercial sector so the need exists for a strategic view of the defence industrial base to ensure that the Alliance will not lose perishable skills that cannot be easily recovered. Targeted Government research and development will be needed to ensure technology advantage. Intellectual capital will flow where economic resources and opportunity lie and there may be a geographic consolidation of some technologies within states that have more control over the commercial sector (e.g. supercomputers development in China) and have a greater ability to exploit new technologies. There is a need to reestablish our ability to exploit technology quickly. Finally, the potential for a heterogeneous shift of intellectual capital was discussed. While traditionally from West to East, the question arose about whether the trend is reversing and it was identified by the group that this requires further study. Based on the discussion, the following are potential implications:

4.4.5.1. State acquisition approaches are not in keeping with the commercial sector, which is driven by and responds to a different market, one that currently
demands quick advances over high quality control. Maintaining state-of-the-art capabilities may require serious changes in national R&D and acquisition policies.

**4.4.5.2.** Exploiting commercial-off-the-shelf (COTS) may seem appealing due to the lower cost and rapid rate of advance; however, the quality control, security, and fit-for-purpose implications should not be underestimated.

**4.4.5.3.** Product support and alignment with national procurement programmes and regulations will remain a challenge in the area of COTS.

**4.4.5.4.** Government industrial base will not drive technological development in all areas of the defence sector. Some R&D areas are not covered in the commercial sector, and Nations need to have a strategic view of the defence industrial base so that perishable skills are not lost.

**4.4.5.5.** The dominance in commercial sectors may result in a denial of government ability to access, or tailor, the latest commercial innovations or technical solutions/data/etc.

**4.4.6. Dependence on Certain Technologies (previously Reliance on Certain Technologies).** This trend was determined to be viable and increasing as both society, and defence and security increasingly depend on certain technologies. The suggested change of wording from “reliance” to “dependence” puts a stronger emphasis on the fact that it will become increasingly difficult to operate without such technologies as wireless communication, global navigation satellite systems, and the internet. We are now dependent on many technologies to the extent that we are losing the ability to devise alternative solutions. In response to this dependence, there is a need to introduce more resilience into our operators and decision makers in terms of reacting to the loss of first line technologies and into our design of systems. Further, this dependence could lead to a drain of resources and intellectual capital in maintaining, supporting and protecting the critical infrastructure that support these technologies (e.g. Cyber resources). Finally, the syndicate determined that the previous implication “Increasing reliance on certain technologies may drive towards an increasing demand by society for the use of technology to solve problems” was redundant and should be removed. The potential defence and security implications were:

**4.4.6.1.** As militaries fall back onto single stream technological solutions, there will continue to be an erosion of skills and mindset that would enable the necessary resilience to counter these vulnerabilities. There needs to be resilience built into the design and use of systems. We also need to retain the ability or mindset to solve problems in alternative ways without leading edge technology.
4.4.6.2. There is an increased necessity to protect critical infrastructure, as it increasingly becomes part of how military capability is delivered, just as well as meeting a civil societal use.

4.5. Economics & Resources Theme. The Economics and Resources breakout group focus was to develop implications of the trends agreed to in the previous Lucerne workshop that were relevant to NATO. A “what if” and “so what” approach was taken to foster ideas on potential consequences, impact, and effect. There was considerable overlap and cross correlation of trends in areas for potential for conflict; insecurity and instability situations that the trends might induce, individually, or compounded. For instance, although decreasing defence expense expenditures has been a trend itself, the impact of the other trends on an alliance nations’ capacity to budget necessary defence expenditures as a matter of collective defence and cooperative security was of keen interest. The title for the trend regarding the resources theme is still inadequate or misleading. At the Lucerne workshop the title was changed to “Increased Competition for Natural Resources,” from “increased resource scarcity.” “Increased competition” still does not capture that in one of the principal markets, fossil fuel, there is actually an oversupply inducing a profound impact on the economic well-being and stability of oil producing nations. “Geopolitical Dimensions of Resources” was suggested as a more encompassing title. The Resources discussion was asked to consider the implications of water as a market commodity and the implications of availability-scarcity on security and stability situations.

The discussions are summarized as follows:

4.5.1. Globalization of Financial Resources. Discussion centred around three key implications which will be further discussed in respective sub paragraphs. The growth in global debt in all sectors, government and corporate, is at unprecedented levels as a percentage of GNP, lending to fragility in the global economy. There is disillusionment and disenfranchisement as a result of globalization. Globalization has opened markets but has also shifted jobs to poor countries with cheap labour, eroding the economic base for the working middle class in western countries. This has direct implication on ability for governments to generate tax revenue. This may ultimately lead to a rejection of globalization, as an example, BREXIT. Blockchain technology has the potential to have a disruptive effect on national economies due to control, tractability, and the threat to security through cyber.

4.5.1.1. The debt crisis in the corporate sector will create macroeconomic misbalances. Renationalisation and rejection of globalisation might seem to be the easy solution to the debt crisis. What will happen to emerging markets in such a scenario?

4.5.1.2. In a global economic downturn scenario, could a burgeoning debt crisis spark a protectionist sentiment and rise in nationalism? This could have far reaching implications on the solidarity and cohesion within the NATO alliance, as nations become less inclined toward burden sharing and defence expenditures. As a 2nd order effect, could a severe economic downturn worsened by national debt liability further momentum toward the rise in city states.
4.5.1.3. New financial systems will emerge. By 2025 Bitcoin will be mainstream. Monopoly systems outside of governmental structures will develop. Fintech — cyber currency exchanges pose an increasing security threat to national critical infrastructure via malware and hacking vulnerabilities. Protection of critical infrastructure will become an increasing burden to government and political systems that could detract from expenditures in other defence development and procurement. Abuse of Fintech exchanges by organized crime networks and non-state organizations to avoid transaction tractability and tax liability will be an increased challenge to governments.

4.5.1.4. Globalization has “helped the few, but not the many.” The upper 10% of population in net wealth have experienced the biggest gains since the recovery of the 2008 economic collapse with the gains becoming increasingly exponential for the upper 1% to the upper 0.01%. On the other end of the spectrum, the poorest have realized and improvement in quality of life through access to basic services (water, healthcare, food, shelter), and have modest increases to income. The bulk of the world’s population, the middle class, particularly in western society has felt the squeeze due to stagnation in real earnings after inflation adjustments, loss of benefits and overall compensation as the private sector has sought to reduce expenses by outsourcing support and labour costs and shift to part time vice full time employment. Globalization, free trade, etc., has allowed for jobs to be shifted externally to low labour cost regions. This has fuelled nationalism and in turn a counter incentive to allow a massive influx of refugees in an increasingly competitive job market. Much of this discussion overlaps with migration trends and discussion of increasing global inequality (Sec 4.5.4).

4.5.2. Geopolitical Dimension of Resources (Increased Competition for Natural Resources). There was a lengthy discussion concerning the validity and clarity of this trend. Recommendations for new titles included ‘Geopolitical Dimensions of Resources’, ‘Increased Resource Challenges’, ‘Increased Complexity to Resource Challenges’, or ‘Increased complexity in natural resource geopolitics’. A discussion of natural resources and its impact on geopolitics led to the view that natural resource exploitation could lead to the rise of new developing powers or strain existing coalitions and alliances, as new (and necessary) national and/or regional self-interests are formed. This is already shaping regional rivalries with other powers. The major factors with implications discussed for this workshop included, oversupply of fossil fuels, water as a commodity, and rare earth minerals. Resource supply and availability was thought to have considerable cross correlation and impact on factors such as megacity development and potentially mass migration as populace will be forced to move to where demands can be met, jobs can be had, and general services obtained. The following were determined to be potential implications:

4.5.2.1. There is a shift in global markets from fossil fuel scarcity to oversupply, with the offshore shale oil and natural gas boom, principally from the US, flooding the
market. Oversupply has caused instability to the economies of historically oil rich producing nations (i.e., OPEC, Venezuela, Russia) with reversal of supply-demand economics. A 2nd order effect compounding natural energy oversupply in the United States is the increase in coal exports to Europe. In consequence, cause-effect, a 3rd order effect discussed was environment/climate concerns due to burning natural gas (methane by-product) vs. coal (CO2 by-product), where methane is 25 times more damaging to ozone than CO2. The implication of this looking forward is that most oil and gas producing reliant economies are not prepared (or have the political will) to deal with a decarbonized world energy system in light of climate change the implications and restrictions that will incur. Overall, these factors could be a destabilizing force on national and regional economies. A “Black Swan” was introduced in the concept of innovation in energy storage technology as a positive consequence to climate change, i.e., “necessity being the mother of invention.”

4.5.2.2. Reinforced/No change from Lucerne: New technologies demand new resources and change geopolitics. This is particularly indicated in rare-earth resources required in advanced electronics. Nations that have an advantage in rare earth resources can leverage this in power politics and hybrid warfare.

4.5.2.3. Reinforced/No change from Lucerne: Increasing interdependencies between energy, raw materials, water and other resources can have either a balancing, stabilizing effect (quid pro quo) or cause further compounding destabilization if held by a single power broker.

4.5.2.4. There was a significant discussion on the implications of water as a commodity. Water scarcity and water availability as factors toward power politics, mass migration, and sources of conflict. Conflicts would mainly ensue within cross border relationships (e.g., Nile River Project), where a river is shared and a downstream user might be adversely effected by an upstream nation in competing self-interests. Hoarding, development of dam projects, and transport pipelines are potential areas of conflict and causes for instability. On a positive note, much in the same as climate change, necessity may drive innovation in desalinization technology and tapping of new resources (e.g., water reservoirs under the Sahara?). Concern of shifts in water demand will be realized in areas of increasing population (e.g., Africa, Nigerian youth bulge). As a matter of cross correlation, climate change could have a significant effect on major areas of agricultural production, thus, regions where fresh water is needed to grow food.

4.5.3. Decreasing Defence Expenditures in the West\(^1\). This trend was not taking up directly, but was well discussed as a 2\(^{nd}\) order consequence of other trends that may have

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\(^1\) NATO SECGEN speech at Harvard Kennedy School, 23 Sep 2016 “After the Cold War, defence spending fell across the alliance but last year, the cuts stopped and this year, 22 NATO allies will increase defence spending in real terms.”
commonalities in their implications. Baseline understanding is that the Wales Summit declaration formalizes agreement that alliance nations agree to reverse the trend in budgetary decline in defence spending and reach the aim of 2% GDP guideline within a decade (2024). Trends which could increase burden on national economies (e.g., loss of tax revenue from employment, economic downturn caused by global recession, strain on social welfare systems due to shifts in population demographics, expenditures dealing with influx of mass migration), would increase competing demand for limited resources. In such cases, budget for national defence spending could lose out. An additional consequence of some trends is that they may induce nationalism and cause strain on alliance and cross border relationships. Potential implications of decreasing defence expenditures to be explored are as follows:

4.5.3.1. (Sustained from Lucerne): Competition and stressed government budgets limit NATO reaction options, i.e. level of ambition and expectation will have to align with fiscal realities and constraints.

4.5.3.2. (Sustained from Lucerne): Individual nations may be forced to specialize in military capabilities in order to meet sovereign defence requirements and/or form collaborative partnerships with allies to manage costs and limit expenditures in defence spending. This may create potential critical shortfalls in the Alliance Minimum Capability Requirements.

4.5.3.3. (Sustained from Lucerne): A weakening of Alliance resilience through capability and capacity shortfalls.

4.5.3.4. (Sustained from Lucerne): A reduction in defence spending caused by government revenue shortfalls from a declining tax base as jobs are replaced by technology and automation. Additionally, powerful multinational corporations will increasingly use tax avoidance strategies, further constraining national budgets.

4.5.4. Increased Global Inequality. Many variables and factors that trigger global inequality were considered. Access to education and resources including technology, employment opportunity, social and civil order (or unrest), discrimination (of every form: age, gender, race, religion) for example. There is much data and evidence that reveals that gap between the have and the have nots is increasing exponentially. F. Scott Fitzgerald in the Great Gatsby wrote that, “the rich grow rich, and the poor have children.” This is the “it takes money to make money, syndrome.” A cycle that is becoming increasingly difficult to break. With factors (e.g., opportunity), there are many symptoms, for instance, in western society the ballooning burden of education debt and then inability to find a living wage paying employment. In most alliance nations, age demographics will continue toward older populations and fewer children. An older population will ultimately place a higher burden on social welfare systems, such as healthcare and national pension plans. There will be a shift in tax burden to fewer workers, the worker of tomorrow. A compounding factor to opportunity is increasing competition for employment with outsourcing to cheap labour in repressed regions. In the future, more jobs done by people
will be lost to automation. Recent estimates are that 45% of tasks presently performed by people in employment will be replaced by automation or performed by artificial intelligence. The biggest threat to economic stability will be adapting and training populace for jobs and opportunity that the future will hold. No doubt, the disparity between the have-have-nots, the need for basic services, and refuge from conflict to security and stability has fuelled mass migration. The following implications were identified:

4.5.4.1. (Sustained from Lucerne): Instability caused by mass migration. Mass population movement either (or both) across national borders, or within, may further mega city trend and urbanization lending to fragmentation and fracturing of political stabilities, cultural (nation state) identification, stress on resources as tax base is reduced.

4.5.4.2. (Sustained from Lucerne): Terrorism, radicalization, and polarization. A 2nd order effect of mass migration. Hiving of populace, either by design (segregation), or through cultural identities may increase civil unrest, and pose a threat to democratic government systems.

4.5.4.3. (Sustained from Lucerne): Aging demographics reduces tax revenue caused by more pay-outs than those paying into systems. Amplified by increased life spans, thereby time as a beneficiary. This gives rise to an increased social welfare burden on young adults and young families who increasingly cannot find well paying full time employment. Younger adult job opportunities are in direct competition with a loss of jobs caused by automation.

4.6. Environment Theme. After introductions and opening remarks, the group reviewed the findings of the Lucerne Workshop to assess if any changes or refinements were required in the identified trends. It also looked at the initial set of defence and security implications, drafted in Lucerne, and then spent time discussing these and adding where required. The group also considered presentations from Mr Hough, the Syndicate SME; from Ms Veeravalli, US Army Corps of Engineers, on Climatic Trends, Security and Scenario Planning; and from Ms Lewis, UK Meteorological Office Hadley Centre, on climate change and future security. The group also considered a Hadley Centre collaborative work on the human dynamics of climate change. The main takeaways were that the trends remain valid – the climate is changing and, regardless of international mitigation efforts, impacts will be felt through the 2035+ timeframe of interest. Natural disasters will have increasing impact, partly due to overall increases in severe weather events, but also due to changes in the areas and times of the year where these events may occur, especially if they are densely populated or not accustomed or prepared for such events. The interconnectedness and inter-dependence of global supply chains and the low stock-holding levels, common in advanced supply systems, can also expose nations to risks of impact from disaster in other areas of the world, which may not necessarily be obvious to them. On a positive note, prediction and early warning will become increasingly far-sighted and there is much that can be done to address the defence and security implications through intelligent application of risk-based
methodologies to plan, prepare and respond to climate-, environment- or natural disaster-related events. Furthermore, there is an increasing consensus on the science supporting indications of, and a growing international willingness to invest and act to mitigate or adapt to, the changing climate. International agreements and efforts to combat this global "common enemy" in themselves could act as a unifying stabiliser in international relations.

4.6.1. Environment and Climate Change. The draft potential defence and security implications of Environment and Climate Change started in Lucerne were reviewed, adjusted and added to as follows:

4.6.1.1. Allies will need to consider climate stressors, extreme weather events etc. in their Situational Awareness and their risk-based planning processes.

4.6.1.2. Allies will more frequently be working in areas of humanitarian aid, which will require fully comprehensive (military, governmental and non-governmental) interoperability.

4.6.1.3. Legitimacy of governments could be undermined by their inability to respond to evolving climate and environmental stressors, and thereby failing to uphold the implicit social contract with their populace.

4.6.1.4. Under governed or un-governed areas due to newly inhospitable local climates could provide refuge or safe havens to potential adversaries.

4.6.1.5. Nations will need to address climate adaptation measures for their defence and security infrastructure and equipment. Increased pressure will probably be placed on the military to shoulder its share of climate mitigation plans as well.

4.6.2. Natural Disasters. Potential Natural Disasters implications are:

4.6.2.1. As nations increasingly respond to disasters with the use of their military forces to aid civil powers, there will be a subsequent effect on military readiness and availability.

4.6.2.2. A large scale, environmentally-triggered disaster within a NATO Nation is possible, requiring a major re-employment of their military to relief operations. This could affect the collective abilities of the Alliance.

4.6.2.3. Given the increased likelihood of civ/mil cooperation being required, enhanced understanding and trust will be needed between civilian and military entities, including non-governmental stakeholders, to ensure effective strategic coordination, planning and execution.
A better understanding will be required of the vulnerabilities of Nations to climate- or natural disaster-related disturbances in the global supply and distribution system of food, water and key resources.

5. **Conclusions and the Way-ahead.** The SFA Bydgoszcz Workshop provided an open and transparent environment that allowed extremely useful discussions on the SFA 2015 Update Report. It also enabled finalise the discussions on the potential implications for consideration that were started in Lucerne WS in development of the SFA 2017 Report. This report should be read as a reflection of the discussions during the workshop and breakout sessions and should not be perceived as the views of the Alliance or ACT on any particular subject. It is recognized that the trends and associated implications/key take aways are evolving on different trajectories and the travel of direction of each trend is affected by regional, global, economical and technical events that have taken place over the last years.

6. The findings outlined in this paper will be further analysed and captured in detail to form a solid foundation in the development of the SFA 2017 Report. The SFA 2017 Report will reflect the changes in trends and associated implications/key take aways in the SFA 2013 and SFA 2015 Update Reports and will include the discussions and outcome of the workshops.


8. **Office of Primary Responsibility (OPR).** The OPR for this document is Strategic Analysis Branch, Strategic Plans and Policy Division, Headquarters, Supreme Allied Commander – Transformation. Points of contact are Colonel Tibor Szabo, tibor.szabo@act.nato.int and Mr Mehmet Kinaci, Mehmet.kinaci@act.nato.int

9. Conference slides are available at [http://www.act.nato.int/futures ws-5](http://www.act.nato.int/futures ws-5)

Annex -A: Unconference Report
NORTH ATLANTIC TREATY ORGANIZATION

ANNEX A TO ENCLOSURE 1 TO
5000/TSC-PAX-0100/TT-161318/Ser: NU0886(INV)
DATED 25 OCT 16

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Strategic Foresight Analysis (SFA) Workshop, Unconference Report

Strategic Foresight Analysis (SFA) 2017 Workshop - II
Unconference Report
Unconference: This was the first time we used ‘unconference’ to enable open discussions in small groups moderated by SA team members and SMEs. Unconference engaged participants to discuss and share views on a wide variety of topics, allowing out-of-the-box thinking/ideas to be shared. The key points were captured from the discussions are provided below.

1. Will it destroy us? – Artificial Intelligence (CDR Jean-Luc DEVILLERS)

1.1. All three sessions generated very similar discussions. The first part of each sessions focused on what constituted AI and its impact. It was acknowledged that there are no “standard” definitions as to what constitute AI. Opinions ranged from “automation” to full self-aware and self-learning system. As to what impact AI would have within society, the emphasis was placed on the level of control that can be “programmed” into AI, i.e.: the culture or Values of the creator will shape it’s influence on the knowledge it is gaining. Also, when two AIs faced with the same problem, they would not necessarily draw the same conclusions, for example “western” AI vs “Chinese” AI could come to a different solution.

1.2. The second part focused on the actual question “will it destroy us?”. The overwhelming majority of participants agreed that it would not, there is a given expectation that control will be put in place. However, some interesting thought were brought up, such as AI VS AI deterrence, the Bias that can be programmed into AI, and the general expectation that a line will be set as to what extend AI will be given access to weapon systems.

1.3. Overall, AI was perceived as a “good thing” that will improve human life in various forms.

2. “I’ll be back” – Future of Robotics (LTC Aaron BAZIN)

This unconference topic posed the question to the audience as follows: What is the Future of Robotics? The audience was presented with pictures of the three anthropomorphic robot archetypes:

2.1. The Killer (e.g., the Terminator)

2.2. The Helper (e.g., R2D2)

2.3. The Lover (e.g., ex Machina), and,

queried as to where they felt the majority of future robots would fall along this spectrum.

In general, the group felt that robots would fall along the entire range, but primarily fill the role of helper. They also felt that the line between robots and humans would continue to blur as people would become more connected with machines in the future. The other key discussion points included the fact that robots, when combined with artificial intelligence, could become all-knowing. The group felt that Asimov’s four laws of robotics were already violated to some degree. Additionally, robots have the potential to change the global economy (especially in China) and free up humans either to be more productive in some areas (e.g., the arts, philosophy, etc.) or more lazy. In conclusion, the group also felt that real transformative change would occur when the human left the decision loop and supply chain entirely, and AI would design robots that would be constructed by robots, and delivered by robots. When this happens, the international community may want to consider using regulation to control the use of killer robots on the battlefield to limit abuses and exercise adequate control. Overall,
the outcome of this discussion is that the SFA should look to address both the positive and negative aspects of the use of robots in the future as a key component of the future security environment.

3. Brexit – EU Disintegration/ Integration (CDR Dave Sherriff)
Participants were asked to state ‘Yes’, ‘No’ or ‘Don’t Know’ to the following question, and then explain and discuss their reasoning: Q. Will the EU disintegrate post BREXIT?

3.1. YES
3.1.1. The EU is taking away too much national sovereignty. It will be the breaking issue
3.1.2. The EU will not be able to satisfy national needs and/or expectations
3.1.3. The EU is already disintegrating and BREXIT is an effect of that, not a cause

3.2. DON’T KNOW (or MAYBE IT DEPENDS)
3.2.1. This is a wake up call for the EU, which does need to change
3.2.2. The EU leadership needs to cultivate an EU identity for people to believe in
3.2.3. It depends what the British settlement looks like – it needs to deter others from leaving (ie be painful for UK)

3.3. NO
3.3.1. There is no better option
3.3.2. Free trade and movement is too valuable to lose
3.3.3. We are better together. The EU has so much combined potential.

Survey Result: YES EU will disintegrate 5, Don’t Know 5, NO EU will remain intact 13.

The question ‘who owns the moon?’ was easily to answer: no one – yet. Participants in the discussions agreed that claimed ‘ownership’ will become a concern in the future when actual exploration will start, whether by states or non-state actors who will likely be willing to defend their interest, investments and possible profits. This concern is not only applicable for the moon but also for other planets and for the use of space in general as well. The general feeling among the participants was that there is a lack of regulation. Exploration of the moon may start as soon as next year when a private company will conduct its first mission to the moon. Therefore a urgent need exist to start negotiating agreements.

5. Impacts of 3D/4D Printing (Dr. Timothy Povich)
There were several key ideas/discussion points that arose from the three unconference sessions on 3D/4D printing:

5.1. 3D printing is just one subset of the larger additive manufacturing area.

5.2. 3D Printing will play a key role in space exploration. Current research is ongoing on the Space Station for zero gravity 3D printing systems.
5.3. 3D Printing may have impacts on the logistics chain but it is still a long way off.
5.3.1. Could provide “On demand” spare parts in a deployed/field environment as well as personalized food and medicine soldiers.
5.3.2. Quality control remains an issue to be solved. With the production of single parts/items, there will be a need to verify the quality of a part that could be relied on for mission success.
5.3.3. In terms of viability to change deployed logistics, “printing” materials will still need to be resourced and transported to do the 3D printing. This may reduce the gains in reducing the logistics footprint.
5.4. There were several long term ideas discussed:
5.4.1. Convergence of AI/3D Printing/Robotics could allow for self-regenerative robotics
5.4.2. Societal implications will include personalization of nutrition and healthcare
5.4.3. Will provide the average person with the ability to conduct personalized research and a way to go quickly from virtual to physical prototyping.
5.4.4. Red Force Implications
5.4.5. Easy replication of weapons may lead to development of new threats; however the availability of weapons is greater than the availability of 3D printing.
5.4.6. Could lead to the availability of more “citizen soldiers” because of the ability to produce military equipment.
5.4.7. Transfer of ideas and designs for printing can be done easily using the global network – impact would be a greater ability to share and produce destructive technologies.

6. Can we save the world? – Climate change (Mr. Chris HOUGH)
6.1 Irrespective of the reasons that climate change is occurring or being observed, efforts are needed for humanity to respond to the changes.
6.2 Adaptation focus (i.e., how we can actively address climate change or severe weather) deemed to be as important as mitigation measures (i.e., how we can shape the climate in the long term with efforts such as reduction of greenhouse gas emissions)
6.3 Adaptation and mitigation measures may provide opportunities (e.g., through technology development) that could have positive effects on other aspects of society - economic, social, etc.
6.4 Unanimous agreement by all nations to collectively respond to climate or environmental change has proven to be difficult due to competing national interests, but progress is being made
6.5 Ultimately, we must strike a balance with our efforts to save the world and those to save ourselves (in the changing world)
6.6 This balance will vary by nation and, as such, it will be challenging for an alliance, such as NATO, to achieve a common, collective agreement on this balance that is equally observed by each alliance nation.

7. Will Polarization continue? Ideology & Religion – Fractured identities (CDR Gro Oeen)

7.1. The discussions where kicked off by a list off statements and questions. They were just listed, and the participants were asked to pick up on one of them and start the discussion. Some of the statements were a little bit provocative to make sure that the participants had something to discuss.

7.2. The statements and questions used:

7.2.1. Polarization = segregation?

7.2.2. A more interconnected world make people aware of the growing disparity of wealth -> more polarization?

7.2.3. Decline of national identity -> more polarization/fractured identities? -> radicalization

7.2.4. To some degree, we all have fractured identities (families, cultural backgrounds, where we live, type of work)

7.2.5. Traumatic events can affect fractured identities

7.2.6. Identity is a primary issue in most racial and ethnic conflicts

7.3. Discussion:

Polarization and segregation are two different things, still we cannot talk about polarization without talking about segregation. Segregation works two ways, someone are segregated others choose to segregate. Some argued that assimilation is the only alternative to segregations, others argued that integration is what we should aim for.

It is natural for people to want to belong. Group mechanisms is essential for polarization. Are there other interests than ideology, like cooperation’s and religion that drive polarization today? For migrant it is not evident that liberalism is a good thing. This make assimilation more difficult. The combination of different cultures, values, ideologies, religion and the inability to integrate migrants effectively may perpetuate the fracturing of identities and the risk of conflict.

Polarization isn’t anything new, but is has become more difficult to manoeuvre because of the complexity and connectivity. The sensational media is part of the problem, they contribute to polarization by their sensational black and white news coverage. Polarization is the language of conflict.

A narrative is important to counter polarization. Is that something NATO needs to focus more on? Could new communication platforms be utilized to mitigate the problem (positive influence)? Or will the new communications platforms make it worse? The vast amount of information means that everyone have more to choose from. It makes it harder to distinct between bad and good information. It makes it more difficult to make informed decisions.
To influence identities is very difficult, and it needs to be handled as a risk. In mixed societies there are pockets where that is an issue. They nurture “us and them”. They have an attitude saying “I don’t win if you don’t lose”.

Families is often the main identity marker. Broken families due to conflicts and so on, will affect future generation’s identities. Fractured identities will become worse. Identities are “very personal”. It could become more difficult to handle all your different identities because of digitalization, and fractured identities could become even more problematic.

Fracturing identities isn’t just bad. There is opportunities as well.

8. What does happen when we run out of water?— Water Scarcity (Ms Swathi VEERAVALLI)

8.1. Distribution:
   8.1.1. We won’t run out of water – but the distribution of water will become of great concern;
   8.1.2. Therefore, main issue is exploitation of water (separating out surface water and ground water) in meeting the local, national, international requirements

8.2. Geostrategic Implications:
   8.2.1. Some countries/organizations can use water as a weapon (Syria/Iraq);
   8.2.2. Hydro-hegemony (Nile Basin);
   8.2.3. Because climate change impacts manifests itself through the hydrological cycle, we will see more “transition periods”;

8.3. Technological Advances:
   8.3.1. Desalinization extremely expensive but advances by Middle Eastern countries;
   8.3.2. Consider advances in water reuse—grey, green, black water for example;
   8.3.3. Innovation means more H2O can be available BUT there’s the cost of energy for water treatment to consider.

9. Changing demographics – Impacts of migration (LTC Sven SZABO)

The question that was posed to the three unconference sessions was revolving about the upcoming youth bulge in developing countries, especially in Africa where an increase of 900 million people is estimated by 2040, which creates an enormous youth bulge. Following the current trend of a mass migration of young people from Africa to Europe, there will be a high change that this youth bulge in Africa will find its way to Europe. According to major scientific research’s, this youth bulge will be more a benefit than a drawback even though there will be huge challenges to master within governance and society. So the participants were asked the question if they think that the upcoming youth bulge will either be a benefit for Europe or a drawback. Two of the sessions generated very similar discussions, definitely favouring the benefits of the upcoming youth bulge. On the opposite one session clearly stressed out the drawbacks of the upcoming youth bulge. Nevertheless the results were quiet similar.

9.1. The integration of the upcoming youth bulge into the job market is strongly connected to other trends like automatization.
The Future of the State (Dr. Kristi RAJK)

The following questions served as a starting point of the unconference discussions: Are states eroding or re-claiming power? What are the factors that challenge the power of states? The participants were divided over the question of whether state power is actually eroding.

10.1 NO: Although factors such as globalization, increased role of non-state actors, growing interdependencies and new technologies pose a challenge to states, states remain the main actors of the international system. It was argued that it is more appropriate to speak about change rather than erosion of state power. For example, states can make use of new technologies to strengthen their role, including control over their population and territory.

10.2 YES: Both external and internal factors are eroding state power. Due to redistribution of global power and erosion of the existing international order, major states may in future take over/regain control over sovereignty of smaller states. On the other hand, global forces (including financial) are narrowing the room for maneuver for all states.

Several participants raised specific challenges to democratic states such as erosion of trust in institutions, lack of leadership, crisis of democratic values and increased perception among citizens that states are not capable of providing security and public services.

The Future of Money- Blockchain & Bitcoin (Dr. Adrian KENDRY)

11.1 The international monetary system was established at Bretton Woods NH, USA in 1944 and created the dollar-based international monetary system that is embodied in the International Monetary Fund and World Bank. The system has withstood various OPEC energy, political and economic shocks since the 1970s including the global financial recession that began in the United States in 2008 and was marked by the collapse of several financial institutions including Lehmann Brothers and a loss of international confidence in banks and financial institutions.

11.2 Since 2008, the increasing economic and financial strength of the emerging economic powers, notably China whose Yuan is now officially an IMF reserve currency, has intensified the debate over the shape and composition of the historically Western-dominated international monetary system.

11.3 The unconference sessions on the future of money considered whether the digital financial technological revolution might transform and accelerate these trends. The underlying
complexity of encryption systems using public-key encryption explained the difficulty of discussion on the future of money but also signalled the potential for digital money having a considerable impact on the global economy and global security in the next 20 years.

11.4 In 2008 the mysterious Satoshi Nakamoto (presumably a pseudonym) announced the bitcoin principle online. He described his innovation as a revolutionary Bitcoin/Blockchain electronic cash system that was "fully peer-to-peer with no trusted third party". The production ("mining") of electric coins/money (bitcoins) is based on a chain of digital signatures and the use of a public-key encryption system where owners of bitcoins can transfer coins to other parties. This decentralised public-key encryption process has greatly excited those who see the future of money increasingly determined by financial technology. Bitcoin/blockchain technology offers the potential for transforming the global financial system by strengthening trust and reducing transaction costs through weakening the intermediation power of banks and financial institutions in global transactions.

11.5 The group discussions noted that the timing of this digital financial revolution has coincided with the crisis in public confidence over the vulnerability of banks and other financial institutions that was triggered by the mortgage debt-induced recession in the USA and the public debt generated economic austerity in the Eurozone (a crisis that continues to resonate with the recent global concerns over the stability of Deutsche Bank). While recognising that each of the approximately 160 million Bitcoin transactions that have taken place since 2009 will remain credited and debited (until the disappearance of the Bitcoin), and that there are other cryptocurrencies based on Blockchain technology, opinion in the groups was divided over the extent to which this financial technology would replace existing international financial arrangements and determine the future shape and organisation of money.

11.6 A good deal of discussion focused on the ability of the international banks, financial institutions and venture capital investment community to use blockchain technology to reduce their transaction costs and increase financial rents from intermediation. (The venture capital community invested more than $1.4 billion in blockchain applications 2013 to 2015 and more than $1 billion is anticipated in 2016). To escape from the continuing control and administration of ledgers and financial balance sheets that are regulated by the orthodox financial architecture and institutions, it was recognised that the existing international financial order would have to succumb to an even more devastating financial and economic crisis than that of 2008 if there was to be a widespread adoption and creation of financial savings from the trust embodied in fully decentralised blockchain technology.

11.7 Some lively debate centred on bitcoin production ("mining") being used as a long-term strategic weapon with countries (such as China) seeking to digitally strengthen its market share in all cryptocurrencies (analogous to the physical control of the production and market for rare earth elements). There was also a discussion expressing concern over the security implications of this technology.

11.8 Some members of the groups highlighted the use of this technology in "Bitcrime" and "Bitterror" (organised crime concealing its operations and intentions and terrorist organisations such as
Islamic State utilising cryptocurrencies to finance and support terrorist operations). Blockchain technology is already being used to verify that militias are not using rough-cut diamonds to fund conflicts. Equally, Estonia has strengthened its digital defences against cyber attacks by employing a keyless signature infrastructure to manage and protect the data of its citizens lodged with its many hundreds of online services.

12. Superman 2.0 - Is Human enhancement ethical (Dr. Stefan RESCHKE)

13. Income inequality—Growing War between the ‘Haves’ and ‘Have Nots’ (CDR Chuck CORDON)

13.1 Increased strain on governments and economy: The ability of national systems to adapt and flex (grow) to provide services that stimulate integration and appease the masses, as demand increases

13.2 The level of expectation of the poor has increased because their overall situation (quality of life), access to basic services has improved. Access, by awareness and observation as to what others have, by comparison, has been stimulated by general access to the internet. In context, “you don’t know what you don’t have if you’ve never had it...”

13.3 Make work pay, or make not working an undesirable situation. The working poor have become increasingly disenfranchised, as education norms have increased with associated cost and debt burden, while wages have stagnated. Overall (traditional) compensation packages have been significantly reduced (e.g., part time instead of full time employment, shift of healthcare expenses).

13.4 “Globalization has helped the few but not the many”. The very wealthy have had the biggest proportional increases in net wealth, the very poor have also realized improvements, but the middle class has been squeezed out.

14. Challenges to the International Norms-South China Sea (LTC Darry GROSSNICKLE)

14.1 On 12 July 2016, the Permanent Court of Arbitration ruled against China’s claim to a vast majority of the South China Sea. China had based its claim on historical accounts that date back to the Ming Dynasty. To bolster its position in the South China Sea, China has created artificial islands on reefs and rocks, including the creation of military bases and airfields. Despite the United Nations Convention on the Law of the Sea (UNCLOS), as well as established norms for freedom of navigation, China has chosen a path of island reclamation that violates these laws and norms and threatens to escalate tensions in the region.

14.2 The unconference group unanimously felt that China’s reclamation efforts in the South China Sea is a precedent of confrontation that will be repeated elsewhere. Using vague language in international law, countries can deliberately challenge the international community. Using the threat of conflict as a deterrent, countries can use legal ambiguities to obtain policy objectives in the face of overwhelming international opposition. Russia’s incursion into Crimea is but another example. Furthermore, the unconference group felt that these political provocations will
increase in frequency and intensity until a non-violent solution is found by which the international community can respond.

Office of Primary Responsibility (OPR). The OPR for this document is Strategic Analysis Branch, Strategic Plans and Policy Division, Headquarters, Supreme Allied Commander – Transformation. Points of contact are Colonel Tibor Szabo, tibor.szabo@act.nato.int, Mr Mehmet Kinaci, Mehmet.kinaci@act.nato.int and LTC Aaron Bazin, aaron.bazin@act.nato.int. Conference slides and supporting documentation is available at: http://www.act.nato.int/futures-work.
Framework for Future Alliance Operations (FFAO) Workshop Report

Framework for Future Alliance Operations (FFAO) 2018
Workshop - II
28-30 September 2016
Bydgoszcz, Poland
1. Background.

1.1 The FFAO workshop focused on the following problem statement. Based on current trends, what are the challenges and opportunities for NATO in the security environment of 2035 and beyond? To develop a prudent and suitable answer to this question the workshop divided into four syndicate groups each focused on one of the following sub-questions:

1.1.1 Understanding that war has an enduring nature, what are the anticipated characteristics of future armed conflict in 2035 and beyond?

1.1.2 Based on the current trends in the security environment, what are the potential ethical questions NATO leaders may have to face in 2035 and beyond?

1.1.3 Based on the current trends in the security environment, what are possible instability situations which would present challenges to NATO's military forces in 2035 and beyond?

1.1.4 Based on the current trends in the security environment, what are the opportunities for NATO's military forces in 2035 and beyond?

1.2 FFAO Workshop – Participants.

<table>
<thead>
<tr>
<th>Attendees</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Attendees:</td>
<td>76</td>
</tr>
<tr>
<td>ACT (including SEE &amp; STRE)</td>
<td>19</td>
</tr>
<tr>
<td>ACO (including LCC, MCC)</td>
<td>4</td>
</tr>
<tr>
<td>16 COEs</td>
<td></td>
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<tr>
<td>24 Nationalities</td>
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<tr>
<td>Member Nations</td>
<td>BEL, BGR, CAN, CZE, DEU, ESP, EST, FRA, GBR, GRC, HUN, ITA, LTU, NLD, NOR, POL, ROU, SVK, SVN, TUR, USA</td>
</tr>
<tr>
<td>Partner Nations</td>
<td>AUT, CHE, FIN</td>
</tr>
<tr>
<td>COEs</td>
<td>C2, Joint CBRN, CCD, CIMIC, CIOS, CSW, DAT, ENSEC, EOD, JAPCC, MilEng, MILMED, MP, MW, SP, STRATCOM</td>
</tr>
<tr>
<td>Academia/Industry</td>
<td>Austrian Institute of Technology, Fraunhofer Society, Peace Research Institute Oslo, Czech University of Defence, Finnish Defence Research Agency, Northwestern University, Reporting and Analysis Centre for Information Assurance, Canadian Defence Research and Development Centre, UK Development Concepts and Doctrine Centre, European Defence Agency</td>
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</table>
2. General Workshop Findings.

2.1 Characteristics of Future Armed Conflict. Our discussions future flushed out how we think the battlefield will likely look like in the future (e.g., increased speed of information, use of Artificial Intelligence to assist commanders in decision making, and activities in the cyber domain impacting the physical domain).

2.2 Potential Ethical Questions. The discussion surfaced many ethical questions NATO leaders may have to address in the future (e.g., human augmentation, distinguishing between combatants and non-combatants, use of AI and robotics, and cyber).

2.3 Instability Situations. The discussions examined the current instability situations for validity. The groups developed a refined list that they felt better represented the possible instability situations in the future. Of note, one of our key take-aways is that we should re-look our model and possible distinguish between instability drivers and instability situations.

2.4 Opportunities for Military Forces. In group work we developed an expanded list of opportunities NATO may have in the future to include items such as: 1) ability to increase the dispersion on forces, 2) rebalancing of military capabilities away from being only expeditionary or only article 5 oriented, and 3) developing better intelligence by using open source information.

3. Way-ahead. The conference achieved the overall objective of getting the raw material needed for Chapter 1 of the FFAO. Moving forward, the FFAO team will incorporate recommended changes into the draft chapter 1 of the document. In November, this document will be submitted to tasker tool for abbreviated staffing and review for redlines. Additionally, the Joint Forces Staff College will conduct and independent red team review of the document. Following that review the FFAO will conduct the next workshop in March 2017 to discuss chapter 2 of the FFAO, Characteristics of the Future Force.

4. Office of Primary Responsibility (OPR). The OPR for this document is Strategic Analysis Branch, Strategic Plans and Policy Division, Headquarters, Supreme Allied Commander – Transformation. Points of contact are Colonel Tibor Szabo, tibor.szabo@act.nato.int and LTC Aaron Bazin, aaron.bazin@act.nato.int. Conference slides and supporting documentation is available at: http://www.act.nato.int/futures-work.

Attachments.

1. Group 1 Findings
2. Group 2 Findings
3. Group 3 Findings
4. Group 4 Findings
Group 1 Findings

1. Nature and Character of Warfare:
   a. Past
      i. Cold war (people involved / home, tailored forces, ideology, POLMIL):
         1. Near peer
         2. Strategic deterrence
         3. Conflict by proxy
         4. Mutually assured destruction
         5. Known enemy (state)
         6. Predictable / status quo
         7. Conventional
      ii. Terrorism (people involved / homeland, LAWFARE, ideology):
         1. Limited war
         2. Asymmetric
         3. Non state
         4. No treaties / non-compliance to international law
         5. Unconventional
         6. Difficult to identify / deter
         7. Transnational
      iii. Hybrid (Narrative, POLMIL, LAWFARE):
         1. Conventional + unconventional
         2. Below the legal threshold for ‘war’
         3. Strategy of competition
         4. Conflict of intent – confusion is goal
      iv. Crisis response (POLMIL, Capacity Building):
         1. Home populations not as involved
2. Expeditionary

3. Conflicts of choice

4. Nation building

5. Lack of clear end state

6. Long-term engagement (civil dimension)

7. Combined approach

8. Rogue states

9. Vacuum

b. Present

i. Quasi-State:

1. Across Borders / Transnational / Expansionism

2. Governance, Rule of Law / Proto State / Illegitimate

3. Domestic Threat

4. Sophisticated Influence

5. Ideology based

6. Foreign Fighters

7. Leverage Technology

8. Mission command – intent/cell structure, disenfranchised – lone wolf

9. Tech sharing

10. Direct challenge to state

11. Global recruitment policy

12. Everyone can be involved or everyone can be a target

13. Severity

14. Virtual Environment

15. Desire for a Theocratic state, provide alternate vision of governance

16. Long Term View – incremental approach
17. Lawfare

ii. State actors:
   1. Direct competition
   2. Power politics
   3. Force density is down
   4. In contested areas proxies used
   5. A2AD
   6. Conventional capability development,
   7. Using more cyber capabilities – Stratcom and social media,
   8. Erosion of international structures – new rules
   9. Changing nature of the state, / legitimacy erosion
   10. Clash of meanings / narratives
   11. WMD/E and cyber / space WMD proliferation
   12. Private military/hybrid / deniability
   13. Economic interdependence

c. Future
   i. More automation / counter automation
   ii. Decreased force density / increased distribution
   iii. Less likelihood of state on state war?
   iv. Increased expense per platform
   v. Power politics
   vi. Virtual battlefield
   vii. Subterranean Domain
   viii. Dense populated areas – urban (not megacities per se)
   ix. Multi-domain
   x. Confusion friend / foe over time
xi. Importance of international organisations
xii. Increased precision munitions / increase in direct targeting and counter precision
xiii. Decrease in total tech advantage can lead to an increase in near peer advantage
xiv. Gap closing, Technology proliferation, Search for new advantage
xv. More automation / counter automation
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xxviii. Gap closing, Technology proliferation, Search for new advantage

2. Ethical Questions:

a. Overall
   i. How will NATO maintain ethical cohesion? Are NATO’s legal teams prepared to deal with conflicts of the future? – Training Needed
   ii. In the future how can NATO address proportionality during intervention?
   iii. How does NATO apply existing principles for LOAC during future armed conflict?
   iv. How do we define conflicts? (war, combat, etc) This contributes to legitimacy

b. Human Augmentation
i. Does NATO want to be a follower or leader in human augmentation (both mechanical and biological)?

ii. What long-term effects does the augmentation have on the individual (physical/psychological)? What are the behaviour changes?

iii. What values are challenged when humans are augmented (against their will)?

iv. What new standards should NATO adopt?

v. Does human augmentation matter strategically?

vi. Do we do this in the first place?

vii. How will people choose to enhance themselves (cyborg convergence)?

c. Combatants/Non-Combatants

i. How does NATO differentiate between combatants and non-combatants? (hybrid and non-state emphasized)

ii. How do we attribute actions?

iii. What is the acceptable level of non-combatant casualties? (limited and non-limited war)

iv. When do non-state actors cross the threshold and become combatants? (legal question – but extension)

v. Will we conduct pre-emptive action if big data indicates threat?

d. Cyber

i. How would NATO legitimatize offensive cyber action and proportionality? Is a new legal framework needed?

ii. What is war and conflict in the cyber realm?

iii. How do we respond proportionally to cyber-attack, limitations of just war?

iv. How will attribution for cyber-attacks evolve in the future?

v. How do NATO leaders deal with ambiguity in the cyber domain?

e. Autonomous Systems/Artificial Intelligence

i. In response to automation how does NATO respond?

ii. In the light of legal frameworks, do we keep humans in the loop?

iii. How do we teach AI to exercise good judgement in the application of force?
iv. What standards should NATO adopt? (New policies???) Does NATO maintain interoperability of AI/traditional forces if there is disparity (manned/unmanned hybrid response)?

v. How do we deal with AI/robotics used in a hybrid approach?
Group 2 Findings

1. Nature and Character of Warfare:
   a. Future Character of Warfare
      i. Uncertainty/complexity
         1. The battlespace will become even more confusing
         2. The “fog of war” makes it difficult to know who you are fighting against and what you are fighting for
         3. Where and when does the conflict start and end?
         4. Cascade of instability because of globalization (spillover effect from the conflict or/and the effect of the conflict)
      ii. Personal vs impersonal conflicts
         1. From propaganda to “brain to brain” targeting, leading to a cognitive dimension to the battlespace
         2. Conflict becoming more personal (precision targeting/discriminant) and impersonal (technology) at the same time
         3. Will war become more violent because of technology (including nanotechnology and biotechnology)?
         4. “Behind the human” we will see the internet of things (connectivity/networked), consequently “everyone” would like to/try to tap into that
         5. The technological development will make detection, accuracy and collecting intelligence easier (more visibility, but more difficult to understand?)
         6. If machine vs machine in a war, it will be logical and fast = total destruction (unlikely scenario?)
      iii. “Change of world order”
         1. A cataclysmic moment needs to happen to change a world order (systemic change)
         2. What if we what we are observing is a cataclysmic moment in the Middle East? Will that change the world order?
         3. Is a short brutal war be more desirable than a long bloody war? “Give war a chance”
4. Will allies in different parts of the world develop even tighter relationships and making the divide towards other parts of the world more solid (blocks), and focus on stability within the block?

5. The nature of state is changing. There is signs of less state control, will that lead to a more firm state to retain control? Will such a state become more internally focused (for self-preservation)? Will this reduce the possibility for state-to-state conflict? Could it have a weakening effect on the Alliance?

6. Is it more likely that we will see more local conflicts?

   iv. WMD
      1. If what we know as WMDs today gets more discriminant are they still WMDs?
      2. Will weak national states be more likely to use WMD?

   v. Other
      1. Rate of capability development will erode the qualitative advantages of established militaries
      2. Will the appetite for use of the military decline because of a more complexity? Do we, as NATO, have the correct “other tool” at hand? It seems like the PMESII/DIME toolbox is not enough

2. Ethical Questions:
   a. Overall
      i. How will NATO maintain ethical cohesion? Laws and political decisions needs to keep pace with developing capabilities and new conflicts.
      ii. “Grey Zone” conflict and the blurring of the political/military means of power needs to be discussed.
      iii. Will brutality or “give war a chance” be more acceptable than a long bloody war in the future?
   b. Human Augmentation
      i. Does NATO want to be a follower or leader in human augmentation (both mechanical and biological)?
      ii. What long-term effects does the augmentation have on the individual (physical/psychological)? What are the behaviour changes?
      iii. Government directed augmentation as a condition for service (mandatory vs compulsory).
iv. What about social and battlefield norms? Captured augmented soldiers, do they need special medical treatment? What about research on captured augmented soldiers? What about ownership rights to own medical records? What will happen when soldiers have completed their service?

c. Combatants/Non-Combatants
   i. Blurring in ability to distinguish because of “new domains” that develops faster than the legal framework.

d. Cyber
   i. How do we distinguish between hostile acts/hostile intent, deception and deceit, constrains and restrains in this domain?
   ii. Reciprocity and proportionality
   iii. Sovereignty (vs rouge actor)

e. Autonomous Systems/Artificial Intelligence
   i. In response to automation, how does NATO respond?
   ii. In the light of legal frameworks, do we keep humans in the loop?
   iii. How do we teach AI to exercise good judgement in the application of force?
Group 3 Findings

1. 21 individuals participated in Syndicate 3. The findings from the group survey are described below:

   a. The Instability Situations are:

      i. Anti-access/area denial
      ii. Cyber Conflict
      iii. Disruption of Space Capability
      iv. Disruptive Migration
      v. Hybrid Conflict
      vi. Natural Disasters
      vii. Non-state Actor Conflict
      viii. State Actor Conflict
      ix. Weapons of Mass Destruction/Effect Use/Threat

   b. From the list above, what instability situation(s) is/are missing?

      i. Unconventional/Irregular Warfare.
      ii. Financial system failure (similar with 2009 crisis or Greece crisis but more serious)
      iii. New kind of diseases; financial system instability; disrupted global supply chains; urban and suburban conflicts.
      iv. Disruption of sea lines of communication; intentions to change existing borders by force.
      v. Failing states.
      vi. Failed states; religious wars or clash of religions; resource scarcity (water, gas oil) conflicts.
      vii. Financial or political crisis; unpredictable or cascading effects of different areas.
      viii. Critical infrastructure collapse/hijacks; combination of hybrid and non-state actor and A2/AD and natural disaster.
      ix. Meltdown of the economic/financial system; global disappearance or meltdown of governance, governing institutions.
      x. Pandemics; global/regional financial disorder.
      xi. Widespread AI.
xii. Religion or racial hatred; economic collapse; climate change, natural resource scarcity.

xiii. Natural resource conflict; breakdown of nation states.

xiv. Increased competition for natural resources, failing states.

xv. Artificial Intelligence, economic crisis, NATO member state inside crisis.

c. What instability situation is the most important?

   i. Hybrid conflict, disruptive migration, non-state actor conflict.

   ii. State actor conflict when powerful state is involved.

   iii. Cyber 3D (cyber democracy, cyber development, and cyber defence); disruptive migration; supply chain network disruption; non-state actor conflict.

   iv. Disruptive migration.

   v. Weapons of mass destruction use on urban area.

   vi. Natural disaster; disruptive migration; WMD.

   vii. Cyber conflict and state actor conflict; disruptive migration.

   viii. Disruptive migration; mass migration combined with refugees and asylum seekers.

   ix. Hybrid conflict.

   x. State actor conflict (if it's related to collective defence).

   xi. Non-state actor conflict.

   xii. Cyber conflict.

   xiii. A2/AD.

   xiv. Combined instability situations.

   xv. State versus state conflict.

   xvi. Natural disasters.

d. What world event, that if it occurred, would result in instability that might cause NATO to perform military operations?

   i. Wide range malicious cyber-attack on critical infrastructure.

   ii. Major attack (terrorist) against a NATO member/partner.

   iii. Global supply chain network disruption; state actor conflict.
iv. Proliferation of armed conflicts.

v. WMD.

vi. State actor conflict or a hybrid conflict near border of NATO; massive disruptive migration caused by increasing failed states (MENA) at or near the border of NATO.

vii. Hybrid conflict is the most difficult situation for a single country to deal with so NATO might have to respond.

viii. State actor conflict; tangible nation support needed for deploying armed forces.

ix. State actor conflict; non-state actor conflict.

x. Cyber conflict (large scale).

xi. Non-state actor conflict.

xii. Attack on a NATO member.

xiii. Melting of the Arctic Ocean which opens up a northern passageway to be exploited by Russia and China.

xiv. Intrusion into a NATO partner's territory.

xv. Disruptive migration.

xvi. Article 5 events.

e. What instability situation listed above could be discarded or combined with another? Why?

i. Hybrid and Cyber.

ii. Disruption of space capability - low rate of development; A2/AD - limited so fare and unlikely to have a major impact due to NATO's inability to counter it; Disruption of space capabilities can be merged with A2/AD.

iii. Large scale natural disasters and migration; Hybrid conflict with cyber conflict and state action too.

iv. Hybrid conflict.

v. Disruption of space capability.

vi. A cyber conflict could combine with a hybrid conflict or state actor conflict; could be started by a cyber-attack.

vii. Anti-access/area denial.

viii. Hybrid conflict with non-state actor and anti-access area denial; natural disaster and disruptive migration.
ix. None. X3

x. Combination of instability situations turning them into hyper instability.

xi. WMD conflict.

xii. A2/AD, cyber, disruption of space, hybrid conflict, non-state actor conflict, and state actor conflict may not be the cause of the instability situation.

xiii. Disruptive migration.

f. What is the MOST LIKELY instability situation?

i. Non-state actor conflict. X4

ii. Cyber conflict. X2

iii. Disruptive migration together with non-state actor conflict/terrorism; natural disasters with toxic industrial, radiological contamination of large area.

iv. Disruptive migration. X7

v. Natural disaster. X4

vi. Co-occurrence of hybrid conflict and natural disaster combined with A2/AD.

g. What is the most dangerous instability situation?

i. Cyber Conflict.

ii. WMD Threat/Effect/Use – but also most unlikely. X7

iii. Disruption of global supply chain and/or destruction of critical infrastructure.

iv. State actor conflict X4

v. Hybrid conflict.

vi. Disruptive migration.

vii. Failed state.
Group 4 Findings

1. Instability Situations
   a. The group identified the following instability situations
   b. State vs. State
   c. Global Commons Disruption
   d. Major non-state actor conflict
   e. Disruption of critical infrastructure
   f. AI out of human control
   g. Conflict inside NATO
   h. NATO vs. peer state competitor (failed deterrence)
   i. Natural disaster – manmade disaster
   j. Competition for resources
   k. Disruptive migration
   l. Failed state or changing statehood
   m. 2015 instability situations as WMD, Cyber and Space disruption were dismissed either because they are means or strategies or were covered in the Global Commons Disruption.

2. Opportunities
   a. Increased chances to move forward to a working comprehensive approach
   b. Most of the future challenges can only be addressed in the context of the comprehensive approach. The future challenges will demand a border crossing, multinational comprehensive approach, which we don’t see today. As political structures act only out of necessity, there is a chance to get to a real NATO wide comprehensive approach in the future.
   c. Rebalancing of military capabilities away from two extremes: being only expeditionary or only article 5 oriented
   d. Contribution of the military to border-crossing resilience
   e. The principle of subsidiarity in emergencies and natural or manmade disasters will not survive the challenges of the future. Resilience costs demand for NATO wide solutions.
   f. Chances for a better outreach and better quality of NATO STRATCOM
g. New media has huge opportunities for NATO STRATCOM. It will call for changes in speed, outreach and quality and therefore for new flexible structures and younger professionals.

h. Better interoperability and standardization

i. Procurement costs and the size of national armed forces will call for closer cooperation. Therefore a much higher level of interoperability and standardization will be seen, as national armaments programs will become the exception.

j. More effective procurement processes

k. Better M&S capabilities, internationalization, a more structured planning process and the leading role of civilian production in technology will make procurement processes more effective.

l. Better intelligence via open source information, better security via open source architecture of networks

m. The role of open source architectures in networks needs to be addressed in the future. The benefits for situational awareness and security might be huge.

3. Ethical questions

a. Future responsibility for casualties fight with robots - AI intelligence issues

b. Collateral damage

c. Lethal capabilities of autonomous systems

d. Engagement of NATO countries of outside NATO territory

e. Human enhancement, AI, gene manipulation

f. Discrimination of combatants and non-combatants in megacities, cyberspace, as proxies and in the case of biological attacks

g. Freedom vs. security

h. Future responsibility for casualties fight with robots - AI intelligence issues

i. Collateral damage

j. Lethal capabilities of autonomous systems

k. Engagement of NATO countries of outside NATO territory

l. Human enhancement, AI, gene manipulation

m. Discrimination of combatants and non-combatants in megacities, cyberspace, as proxies and in the case of biological attacks

n. Freedom vs. security