NATO-INDUSTRY FORUM 2019 – BREAKOUT SESSION ONE
Tasking, Collecting, Processing, Exploitation, Dissemination

Introduction

With the planned arrival of the Alliance Ground Surveillance (AGS) capability this year, NATO commanders and staffs have rapidly shifted from a mind-set of taking whatever Intelligence the Nations offer, to ambitions for planning and managing organic, National and commercial Intelligence, Surveillance and Reconnaissance (ISR) collection and exploitation. NATO now has agreed doctrine for Joint ISR and Allied Command Operations (ACO) has established procedures and arrangements for managing Tasking, Collecting, Processing, Exploitation, and Disseminations (TCPED) - the phases of the JISR cycle.

While there are complicating factors associated with collection authority and rules of engagement, the capability requirements most often raised by the staffs are:

1. How to shift from using a trusted spreadsheet to something more automated and integrated for synchronising collection and exploitation management of best available assets;

2. How to more rapidly extract useful information from multiple sources that exceed the exploitation and fusion capacity of the existing organisations; and

3. How to more rapidly turn the information into understanding that directly supports decision-making of all kinds.

Generally, it is accepted that the Alliance must function as a coherent federation of ISR forces and agencies, most belonging to the Nations. The assumption is that the Nations are willingness to connect, collaborate, cooperate and contribute. The JISR community needs to share and utilise timely data for planning and dynamically re-tasking collection and exploitation. Collection and exploitation management tools will use near real time data about sensors and platforms (type/status/location) to optimise their use in the multidimensional battlespace. Then collected data needs to be processed on board or routed to the appropriate nodes in the network for processing, exploitation, fusion, assessment and decision-support. The fewer steps that require intervention by a human, the faster this can occur. For NATO-led missions, this data must pass without loss or delay between tactical, mission, National, and NATO networks, which is an interoperability challenge. Finally, decision-makers of all kinds, from the tactical to the political levels, must receive information at the earliest stage of processing that will be useful to them. It may be data for a fire control system, an image or symbol on a map, or a written report. Since there cannot be one analyst for every customer of collected data, automation must help make the existing capacity more effective.

Questions

The output from this breakout session will be answers to the following questions:

1. How can Industry help NATO to enhance the Federated ISR TCPED processes to support analysis and decision-making (DM) at every level of command?

2. How can ISR Collection Managers have near-real-time (NRT) knowledge of the most appropriate (type/status/location) sensors and platforms to support dynamic tasking?

3. How can the decision-maker know that the information derived from ISR is raw, fused, or validated and whether he/she can expect more or better information in a reasonable timeframe?

4. How can data be provided with confidence directly to analysts and decision-makers from the sensors and how will these systems ensure the provenance of the information?

5. In addition to automated target recognition for imagery, what automation is becoming available for all-source exploitation, fusion, and natural language products?

6. What Artificial Intelligence (AI) tools are available from industry that can help cue an alert to an intelligence analyst and to a collection manager which may lead to further intelligence collection?

7. With the growing use of publically available information coming from non-organic sensors and sources, what alarms are being built into exploitation tools to warn of data tampering; and are commercial imagery and signals reconnaissance product providers working to guarantee that products are not fooled by deceptive techniques?

8. How does industry fuse information from a variety of unclassified, open sources with sensitive sources (i.e. fuse Twitter feed with Imagery)?

9. What AI tools is industry using to help be more predictive in their DM?

10. Given the speed at which these types of systems are improving, how can NATO and industry work together to ensure acquisition programs enable the Alliance and Nations to field the most up-to-date or most capable systems?

Discussion outcomes

- NATO needs to harness the power of artificial intelligence and machine learning to increase productivity. Technology exists now that can help analyse vast amounts of data, which can allow people to focus their talents on more important work.

- NATO needs to change the way it procures capability and execute contracts. Contracts need to be adaptive and be awarded more quickly if NATO wants to harness technology that can be provided by smaller businesses and start-up companies. Further NATO also needs to re-look how it views technology. Technology should not be regarded as a "product" but as a "service" that is provided to increase effectiveness and productivity.

NATO-INDUSTRY FORUM 2019 – BREAKOUT SESSION TWO
Leveraging Big Data (Strategic)

Introduction

Data provides the foundation from which we will extract information, intelligence, and ultimately knowledge. Securing access to and being able to successfully analyse data will be fundamental to our future ability to understand the environment we face and take action.

The exponential, and in some fields over-exponential[1], growth of structured and unstructured data, from human and non-human sources, marks the transition from knowledge creation being an exclusively human endeavour to its future dimension: where artificial intelligence algorithms extract critical insights from vast amounts of data to support the decision-maker, enabling an overall capacity which is more capable than the sum of its parts.

In this era – also known as the 'Cognitive Age[2]' – data are the dispersed, ever-present dust which are the invisible gold of today's markets and will be equally vital to tomorrow's operational theatres. Data is generated from events happening in either, or both, cyberspace and physical space, and their effects have ripples across all domains of operations[3].

NATO will only maintain its military superiority if it captures and exploits data faster and more efficiently than potential competitors, starting from today. The Alliance has therefore embarked upon a major new initiative to promote the use of data as a strategic resource. We need to take the right steps now to ensure we can successfully harness the data we have and derive value from it. Looking ahead, we must prepare ourselves for a new era of decision-making driven by insights derived by data. In the 2035-2040 timeframe, we can anticipate that artificial intelligence enabled by data exploitation will drive new ways of operating – such as human-machine teaming – and lead to an increase in the speed of decision-making.[4] Increases in the availability of data will also lead to greater complexity as we search for the key threads which need to underpin decision-making in a mass of information. Ensuring that we have the right data delivered to the right place at the right time will become a key operational necessity.

There are a number of Data Science-related issues to be tackled which require a mixture of policy and technical work. We have convened you here today to understand what major developments you foresee in this field as well as the challenges that lie ahead. Together, we need to transform the state of the possible into the state of art.

Questions

The output from this breakout session will be answers to the following questions:

1. What data can be collected or accessed today? How do we decide what is the most relevant data for NATO?

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[1] D. Sanchez, *Feeling overwhelmed by a deluge of IoT data?*, DVmobile, 2018, and analysis from IDC, 2009

 A. Kott, *Toward Universal Laws of Technology Evolution: Modeling Multi-Century Advances in Mobile Direct-Fire Systems*, Journal of Defense Modelling & Simulation, preprint.

 H. Neven, at Google Quantum Spring Symposium, May 2019.

 G. Rizzo, *The Global Environment of 2060*, Space Futures 2060 Workshop, United States Air Force Space Command, Mar 2019

 F. Arute , K. Arya, R. Babbush, et al. *Quantum supremacy using a programmable superconducting processor*, Nature 574**,** 505–510 (2019)

[2] J.E. Kelly III, *Computing, cognition, and the future of knowing – How humans and machines are forging a new age of understanding*, IBM White Paper, 2015.

[3] G. Rizzo, *What data, which data, what Futures*, Workshop of the Italian General Defense Staff "The Systemic Approach for Key Leaders in XXI Century", 2019

[4] Gen. J.R. Allen, USMC (ret.), A. Husain, *On Hyperwar*, Proceedings of the US Naval Institute, 2017

 G. Rizzo, *Perspectives on Deterrence and Assurance in Hyperbolic Warfare*. NATO Symposium on Deterrence & Assurance within an Alliance Framework, 2019.

2. What are the best practices employed by industry to successfully handle the 4 'V"s of big data management?

3. How does industry share data across within and across partnerships? What does it look like to "share to win"?

4. How can NATO leverage data to scan the environment and monitor effectiveness of actions? How can NATO use this information to enhance decision-making? How can NATO leverage data to anticipate the behavior of state or non-state actors?

5. How can NATO utilize data to assess strategic risks and better understand potential scenarios?

6. What concrete steps should NATO take to become a data-centric organization? What other changes would this imply for NATO?

7. How does industry use data to drive innovation and how can innovation drive better data exploitation?

8. Where is the right balance for the adoption of new technology and data science techniques?

9. How can we best present data and data insights to decision-makers? How can we educate and train leaders to use data science and technical tools in support of decision-making?

10. What are the most significant trends in data science and what is their impact likely to be?

Discussion outcomes

- NATO must understand the business problem and then decide data collection requirements. It was noted that data collection takes time, money, and effort; NATO must invest in the collection of relevant data based on the business problem, and leadership needs to drive this effort.

- If NATO wants to be a "data-centric" organization, NATO must adopt a data culture. Leadership needs to drive data culture from the top and perform actions to increase analytical maturity level. Areas of focus included human capital with analytics skillsets, treating data as a strategic asset, getting leadership more familiar and comfortable with AI/ML.

- NATO must adopt a federated learning approach. The BOS discussed the importance of breaking large problems into smaller ones and enlisting effort across a spectrum of stakeholders. This requires trust between nations, academia, and industry to facilitate data sharing. This also includes both classified and non-classified data access.

- The NATO acquisition process must change. We must adopt a "roadmap" where we accept failure and learn from it just like in Silicon Valley (fail fast, learn often); we don't have time to set requirements and wait. Similarly, rhetoric doesn't match resourcing. Leaders talk about investment in data science and analytical decision making, but they don't resource it quick enough.

Introduction

As NATO celebrates 70 years of shared purpose and mission, there is a strong sense among Allies that our security situation has never been more complex and unpredictable. Russia's 2014 seizure of Crimea and interference in Eastern Ukraine, the Arab Spring, missions in Afghanistan and Iraq, the rise of ISIL/DAESH, civil war in Syria, Iranian regional aspirations and nuclear ambitions, as well as migration, cyber and hybrid threats have all underscored the need for operational awareness and anticipation. Furthermore, as the Alliance looks to the future, factors such as the rise of China, threats to critical infrastructure, and advances in emerging and disruptive technology are transforming the way NATO thinks about Allied security.

In this dynamic environment, both national and NATO leaders demand timely information and intelligence that will improve decision space and prevent surprise. NATO's June 2016 Warsaw Summit Declaration emphasized the importance of improved intelligence functions and Joint Intelligence, Surveillance, and Reconnaissance (JISR) capabilities as a means to anticipate the actions of potential adversaries and support "timely and informed" political and military decision making. Speaking in May 2019, NATO Secretary General Jens Stoltenberg noted that "Good intelligence is good deterrence… NATO's new Intelligence Division is already increasing our situational awareness."

Despite improvements, the task of providing leaders with decision space remains immense for several reasons. First, the number of operational areas and trouble spots strains even the most well-resourced organizations. Second, traditional tools for providing indications and warning are often ill-suited for anticipating cyber actions, terrorist threats, and hybrid actions. Third, improvements to intelligence collection outpace the capacity of human analysts to analyze and disseminate information. NGA Director Vice Admiral Robert Sharp highlighted the need to rethink collection and analytic processes as well as IT infrastructure and networks, in order to "keep up with the deluge of data."

In a multilateral environment such as NATO, the challenges are unique. Rather that suffering from a "deluge" of data, NATO organizations charged with awareness and anticipation must ensure they have timely access to relevant Allied information. Classification issues, systems constraints, and habits of information protection can create impediments to situational awareness.

As NATO looks to enhance operational awareness and anticipation, close linkages with Allies and industry partners are necessary. Breakthroughs in artificial intelligence, quantum computing, big data, biotech, and security technologies have the potential to transform how we provide planners and decision makers with awareness and anticipation. However, to be properly implemented, these tools need to be well understood by practitioners and leaders. Too often these technologies become buzz

words for well-intended, but poorly informed bureaucrats. It is essential that experts from both industry and government jointly consider the problems we face and the potential solutions, including those that challenge the limits of our imagination.

Questions

The output from this breakout session will be answers to the following questions:
1. How can NATO leverage a wide range of information and technologies to deliver more timely and accurate awareness and anticipation to decision makers?

2. To what extent can advanced tools and technology support, augment, or replace the traditional work of human analysts.
3. What are the most effective push or pull mechanisms to keep busy decision-makers aware of emerging and trending threats and opportunities in the security environment?
4. What types of technologies or tools might provide decision makers with greater predictive capacity or I&W?
5. How can modeling and simulation be integrated into the Common Operational Picture to provide the most likely future picture?
6. How can NATO leverage Advanced Analytics and AI to enhance Operational Risk Management?
7. Who gets to decide what data sources are important and what are not?
8. How can data visualization support the decision making process?
9. How can we use modeling and simulation/augmented reality tools to test strategic leaders' decision making?
10. What could be done to support situational awareness (i.e. the descriptive) and forecast future decisions (i.e. the predictive)?

Discussion outcomes

- We are in a great power competition today and NATO has 360-degree situational awareness responsibility. There are new challenges including hybrid threats that increases complexity. Military and non-military activities of the potential adversaries should be covered in data collection that support anticipation. NATO needs to be ahead of the news and timely information should be provided in support of the informed decision making. This strategic intelligence needs to include cyber domain and geo-int data that uses advanced data analysis tools.

- We are living in an increasingly uncertain environment. Policy makers are concerned what's coming and when it's coming. Right data, right structure, building the right model might help to answer these questions. NATO does not have the manpower to collect and process data which continues to grow geometrically. NATO should develop models in this big/large data environment, use machines to support analysis that gives credible answers to decision makers.

Introduction

As technologies continue to advance at an exponential pace, NATO will be operating in complex multinational operations where timely decision making is paramount to staying ahead of the adversary. Adversaries will strive to match or even out-pace the Alliance, using increasingly sophisticated tools to support and inform their own decision making. Technology can be a force enabler in the decision making process by processing large amounts of data and providing filtered and formatted information to the leaders. It can also serves as a great training aid in improving decision making performance and in evaluating decision making skills.

Technology tools like model and simulation and augmented reality provide key leaders the ability to forecast the outcomes of their decisions. These tools can also be used by operational planners to assist in developing multiple courses of action for the strategic leader to consider. Technology also brings the added benefit of forecasting 2nd and 3rd order effects on decisions like the political implications of a military decision. Implementing new technological process and approach to an organization poses additional challenges such as apprehension and pre-conceived bias by individuals who may not understand the advantages these technological advancements offer.

NATO continuously seeks education and training solutions that will best prepare its leaders to incorporate modern technologies to support the human in the decision making process. Simulation can provide a risk-free environment where decision-makers can develop and improve their skills without regard to real-world consequences. NATO would like to understand how industry is leveraging simulation to improve the skills of decision-makers in their organizations.

Questions

The output from this breakout session will be answers to the following questions:

1. The amount of information available to decision makers has reached critical mass. How can NATO leverage advances in modelling and simulation as well as training technologies to support and enhance decision-making performance? What technology exist today and how can we leverage it to enhance Human decision-making?
2. What are the biggest challenges for NATO regarding the adoption of technology to assist humans in decision-making?
3. How can Modelling, Simulation, and Training Technologies be leveraged to create training and exercise opportunities for both political and military leaders?
4. What degree of technical understanding does the decision maker require in order to have confidence in actionable insights derived from simulation and AI methodologies? How can we mitigate the decision maker's comprehension and confidence barrier or bias towards AI?
5. The use of augmented and virtual reality have proven effective in training soldiers and first responders. How can NATO leverage these technologies at senior levels to provide a comprehensive overview of the situation and enable educated choices?
6. How can technologies be used to understand the second and third order effects to decision-making?

Discussion outcomes

NATO should continue to innovate. Creativity is our main asset. However we need to avoid the trap of complete dependency. NATO should use AI to predict emerging crises.

NATO should always keep the human on top of the decision making (if time permits—hypersonics will make this problem increasingly difficult). However we need to keep in mind that others will use AI to seek dominance which will only compound NATO's problem.

NATO must consider the trustworthiness of data before using the data to train algorithms. The data could be biased or manipulated. The risks of this should be considered when the human makes the decision.

NATO must remove obstacles by ensuring personnel are adequately educated and trained to implement technologies like AI into exercises and operations, overcoming bias, and learning to trust the information (education and training helps) and the barrier to information sharing between Nations due to security concerns.

NATO-INDUSTRY FORUM 2019 – Actionable Discussion Items

- NATO must invest in capabilities focused on deterrence and defence; Invest in the sharpest minds, best equipment, and latest technologies.

- Nations must continue to strive for 2% GDP on defence, and invest smarter by allocating 20% on research and development. Invest in new equipment and new technologies.

- Interoperability requires common standards across the alliance and coordination with the EU to harmonize capability requirements; we must not assume interoperability and must practice it through training and exercises.

- NATO must help militaries become more self-efficient, more effective, and reduce their impact on the environment.

- Today, the civilian sector assumes the role of lead innovator in critical areas of military relevance such as computation, robotics, advanced manufacturing, energy, and others.

- Consequently, our armed forces are increasingly reliant on technologies which development is driven purely by the market and that are widely available.

- This proliferation of technology also offers our adversaries greater capabilities to challenge the Alliance technologically, militarily, and therefore politically.

- In order to out-think and out-pace our potential adversaries, we need to approach our decision-making processes differently. Our vision is that the decision makers at all levels are presented with the richest information available on a situation that are presented through visualization techniques, so that is easy to digest, and allow for the exploration of a wide field of possible courses of actions and assumptions and their consequences through modelling and simulation

- What is important for the Alliance to understand is that these Technologies are available, leveraging them requires the appropriate human capital. Specifically, our leaders need to become more familiar and comfortable with Artificial Intelligence; our operators need the appropriate skillsets; and NATO must adopt a federated learning approach, and consider exercises and operations as venues to train our personnel to use new technologies and build trust in the insights they deliver

- Nations must consider risks of investing in new technologies from China like 5G, and giving them access to valuable information.

- NATO needs to exploit new technologies and deliver programmes on time and on budget to maintain the technological edge over potential opponents. This can be done through collective investment between allies to fund research projects in AI, big data, and cryptology. We need to work with companies to improve decision making during the NDPP.

- At the same time, our procurement processes struggle to engage with the ecosystem that is behind these technologies, moving at a pace which challenges our capability development processes. We, therefore, collectively, must radically change our methods and our mindsets.

- Harnessing solutions from the new tech ecosystem requires a real overhaul of our procurement processes: we need to speed up dramatically our contracting; we must acknowledge that to freeze requirements and to stick to them is not adapted to software development; we need to be more agile and to move from a fixed project to a living product approach; and we also need to accept failure and learn from it just like in Silicon Valley (fail fast, learn often).