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SYNOPSIS

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INTRODUCTION

NATO's Allied Command Transformation (ACT) hosted the 24th International CD&E Conference from 29-31 October 2024 in Vilnius, Lithuania. The central theme of the Conference, 'Synchronizing activities between military and non-military entities in the context of Multi Domain Operations (MDO),' emphasized the importance of seamless coordination and collaboration across various domains to achieve strategic objectives and enhance overall mission effectiveness.

The theme reflected on NATO's 360-degree approach that ensures that all aspects of warfare, including land, sea, air, space, and cyber domains, are smoothly integrated. By fostering collaboration between military forces and civilian organizations, NATO can enhance its operational effectiveness, improve situational awareness, and respond more efficiently to complex security challenges. This synchronization not only strengthens defense capabilities but also supports humanitarian efforts, disaster response, and stability operations, making it a key objective for NATO conferences focused on MDO.

With 229 delegates from 27 NATO and 5 partner nations—including representatives from NATO Command Force Structure, NATO Centres of Excellence, Alliance nations, industry, and academia—the conference provided a unique platform for the CD&E community to reflect on contributions towards a future-oriented Alliance. CD&E combines methods and tools vital to NATO's transformation, driving the development of innovative ideas and turning them into viable solutions to contribute to capability development.

In his opening remarks, Major General Pepper emphasized the importance of the conference theme and the critical role of enhanced cooperation on multiple levels. Over the course of three days, the conference featured plenary sessions, engaging speakers, workshops, and networking opportunities. Beyond topic-focused discussions and panel sessions, the event fostered relationships, facilitated information-sharing, and identified common areas of interest for innovation. It also enabled engagement with partners, educated attendees on CD&E processes, and disseminated best practices and lessons learnt.

DAY 1

Opening and Keynote Sessions

The 2024 ICDE Conference opened with a warm welcome from Major General Pepper, Deputy Chief of Staff Strategic Plans and Policy (DCOS SPP) at NATO Headquarters, Supreme Allied Command Transformation in Norfolk, Virginia, who highlighted the significance of collaboration and encouraged active engagement. He framed the conference as a prime platform for learning, exchanging ideas, and fostering innovation.

This primary objective was to explore innovative ideas and methodologies that can drive forward the CD&E field, and in particular seeking to shape NATO's path to an MDO-enabled Alliance.

In framing the conference, Major General Pepper elaborated on the concept of MDO, emphasizing the critical need for *interoperability* among Allied nations and the strategic importance of *Digital Transformation* for NATO. He urged attendees to engage actively in discussions, share insights, and contribute to the collective advancement of MDO capabilities, as well as to the evolution of strategic thinking.

Representing the hosting country, Brigadier General Petrauskas, Commander of Training and Doctrine Command (TRADOC) of the Lithuanian Armed Forces, stressed the necessity for seamless cooperation between military and non-military entities and the shift towards agile, cross-domain warfare. In his opening remarks, he underscored the importance of unity and cohesion in strengthening defence against Russian aggression and encouraged attendees to engage actively, exchange ideas, and strengthen Alliance connections.

Both Major General Pepper and Brigadier General Petrauskas reiterated the pivotal role of collaboration, unity, active engagement, and enhanced interconnectivity in building a robust, MDO-enabled Alliance and advancing strategic thinking to strengthen MDO capabilities. By enhancing strategic foresight in this area, military and defense leaders can better anticipate and mitigate the multifaceted tactics employed by Russia. This approach ensures that all available resources and technologies are leveraged effectively, fostering resilience and adaptability in the face of evolving challenges. Ultimately, robust MDO strategies are essential for maintaining security, deterring aggression, and safeguarding national and allied interests.

DAY 1

SESSION 1: EXERCISE REVIEW

REPMUS 24 OUTCOMES

CAPTAIN (NAVY) ANTÓNIO MOURINHA, PORTUGUESE NAVY, DIRECTOR CENTRE OF EXPERIMENTAL OPERATIONS MARITIME

As the first keynote speaker of the Conference, Captain Mourinha discussed Robotic Experimentation and Prototyping with Unmanned Systems 2024 (REPMUS 24), a key operational experimentation exercise advancing NATO and national maritime interests through the development of unmanned systems. REPMUS 24 aimed to enhance operability, support defence projects, and promote emergent technologies in order to address capability gaps in maritime defence. REPMUS 24 was held around the Tróia Peninsula in Portugal from 9 to 27 September 2024. This year's iteration, the 14th of its kind, convened over 2,000 participants representing 30 different nations.

In 2024, the series of experimentation focused on multi-domain command and control, countering unmanned systems, and protecting critical underwater infrastructures. The event involved collaboration among entities such as the Portuguese Navy, NATO, EU agencies, academia, and industry, with notable international participation from Ukraine. Throughout the exercise, NATO conducted phased experimentation: asset integration, directed experimentation for operational problem-solving, and tactical experimentation to refine tactics, techniques, and procedures. Operating in Portugal's technology-free zone, this complex exercise enabled cutting-edge testing that informs regulatory advancements.

To showcase the relevance of REPMUS 24, Captain Mourinha broadcast a youtube video on the experiment that unveiled various aspects of this exercise, including the deployment of autonomous underwater vehicles, surface vessels, and aerial drones, as well as the integration of these systems into multi-domain operations.

Captain Mourinha addressed several questions on stage, including the challenges faced by autonomous platforms in multi-domain operations. He emphasized that the biggest challenge is effective C2 (command and control), which requires a deep understanding of MDO and the capabilities and deployment of unmanned systems—a highly complex issue. To address this, efforts are underway to establish a *maritime unmanned systems doctrine central to every operation*. This doctrine will be shaped by active participation in exercises that help refine standards and unlock new possibilities.

At the request of conference attendees, Captain Mourinha also discussed the legal obstacles in deploying autonomous systems. He noted significant legal concerns persist; hence multiple preparatory workshops were held before the exercise. This year, two workshops were conducted: one organized by the RAND Corporation, focusing on the ethical implications of deploying these technologies in combat, and another by the European Defence Agency (EDA), addressing the safe use of unmanned assets in civilian waters, particularly with respect to navigational rules. The goal of these workshops is to ensure these systems are used safely and responsibly, both in peacetime and in conflict.

CWIX – INTEROPERABILITY EXPERIMENTATION ACROSS THE BOARD – OPEN TO DE-RISKING OPEX AND NON-MILITARY ACTORS

LIEUTENANT COLONEL PETER HARTMANN, CWIX TRIALS COORDINATOR

Lieutenant Colonel Hartmann introduced Coalition Warrior Interoperability Exploration, Experimentation, Examination and Exercise (CWIX) as NATO's premier event for advancing multi-domain interoperability across the Alliance. CWIX promotes practical testing, experimentation, and collaboration by bringing together experts, innovators, and practitioners from military, government, industry, and academia to support NATO's evolving operational needs and improve multi-domain operational capabilities.

Lieutenant Colonel Hartmann explained that CWIX aims to enhance information exchange, heighten situational awareness, and mitigate C2 challenges by identifying and resolving interoperability shortfalls before deployment. CWIX operates under a four-part cycle: eXplore (scientific exploration of standards), eXperiment (engineers test interoperability), eXamine (capability assessment), and eXercise (field testing with operational use cases). Guided by NATO's Defence Policy Committee and executed by ACT, CWIX operates on a 10-month planning cycle.

Each year's programme addresses national priorities, integrates real-time fixes to identified shortfalls, and incorporates feedback for future cycles. Lieutenant Colonel Hartmann emphasized CWIX's role in NATO's digital transformation and technical innovation, positioning it as a vital tool for building interoperability across multiple domains and ensuring readiness for "Day Zero" deployment.

SESSION 2:

UNDERSTANDING INTERACTION BETWEEN MILITARY AND NON-MILITARY ENTITIES

ENABLING COORDINATED RESPONSES TO COMPLEX HYBRID MARITIME THREATS

DR. ROBBY RENNER, HEAD OF CENTRAL COMMAND FOR MARITIME EMERGENCIES – GERMANY

In his presentation, Dr. Renner discussed the crucial need for coordinated responses to complex maritime hybrid threats. Drawing on his experience in the German Military and his current position at Havariekommando, Central Command for Maritime Emergencies (CCME) in Germany, he outlined how the increasingly blurred lines between military and civilian responsibilities complicate responses to hybrid threats—actions that have military-like effects but are executed by non-military entities.

He emphasized the imperative for synchronization among diverse organizations, such as police, fire brigades, and military forces, to effectively tackle incidents that could potentially escalate into catastrophic situations. The presentation highlighted the challenge of responding to hybrid threats, which create complex operational scenarios where determining legal responsibility and who possesses

the most suitable capabilities becomes intricate. Effective communication and a shared understanding of capabilities are essential for making informed decisions and managing resources during emergencies.

In his talk, Dr. Renner underscored that the traditional dichotomy of peacetime and wartime operations is no longer adequate in the face of hybrid threats, which can materialize as intentional acts or accidents with substantial consequences. He illustrated this point with real-world examples, including the recent oil tanker fire onboard Anika in the Baltic Sea, showcasing the successful collaboration of multiple entities in mitigating the disaster.

In addition, he emphasized the importance of developing harmonized concepts and undertaking joint training exercises in advance to ensure preparedness for future incidents. Dr. Renner highlighted the blurred lines between peacetime and wartime, which need a more integrated approach to security. This new paradigm necessitates proactive planning to address potential threats before they escalate, highlighting the significance of preparedness in an increasingly complex operational environment.

THE ROLE OF CIVIL-MILITARY COOPERATION

COLONEL HANK PAAPE, DEPUTY DIRECTOR CIVIL-MILITARY COOPERATION CENTRE OF EXCELLENCE

Colonel Paape provided an overview of the Civil-Military Cooperation (CIMIC) Centre of Excellence (COE) and its capabilities in analysis, assessment, and advisory roles. The COE focuses on integrating military and non-military stakeholders, including academic, economic, and governmental entities, to enhance operational decision-making. CIMIC is vital in Multidomain Operations (MDO) by synchronizing military and civilian activities, ensuring NATO has access to necessary civil capabilities, and optimizing shared resources. The COE also organizes wargames to encourage participants to consider these diverse elements.

In his presentation, Colonel Paape emphasized the importance of integrating civilian considerations into military planning, with analysis conducted during peacetime to prepare for future crises and minimize operational challenges, such as protecting civilian infrastructure.

A notable example of effective coordination was seen in Ukraine, where a military-developed app allowed civilians to report drone sightings, improving interception times. Collaborations with academic institutions, like the University of Leiden, are also crucial in developing resilient defense strategies.

NATO SPECIAL OPERATIONS FORCES COMMAND SYNCHRONIZATION WITH NON-MILITARY ENTITIES

COLONEL LUIGI PULLI – SOFCOM WARFARE DEVELOPMENT DIVISION DEPUTY CHIEF OF STAFF

COLONEL BOZHIDAR BOYKOV – HEAD OF SOFCOM FUTURES DEVELOPMENT DIVISION

In their informative presentation, Colonel Pulli and Colonel Boykov explained that the Allied Special Operations Forces Command (SOFCOM) and its Warfare Development Directorate are dedicated to advancing NATO's SOF capabilities. SOFCOM's mission is to support NATO and allied partners through warfare development, ensuring interoperability, and developing strategic capabilities for NATO's SOF units. Originating from a 2006 NATO initiative, SOFCOM brings together personnel from NATO allies and partners. It serves as both a SOF Theatre Component Command and a SOF advisor, supporting allied SOF initiatives across NATO's operations and regional plans.

Key focuses for SOFCOM includes enhancing SOF interoperability, concept development, and adapting NATO's MDO concept. SOFCOM's four operational pillars for MDO include a dynamic operating environment, technological advancements, integration across domains, and adaptable SOF structures.

Established in 2023, SOFCOM's Warfare Development Directorate leads initiatives on education, doctrine, and capability development. It has divisions dedicated to areas such as SOF maritime, air, and medical. Future goals include fostering CIMIC to maximize SOF impact. By involving military and civilian experts, SOFCOM seeks to enhance NATO's strategic advantage through updated doctrines and stronger interoperability across NATO allies.

In his turn on stage, Colonel Boykov emphasized the critical importance of synchronizing efforts with non-military entities to enhance operational effectiveness and resilience. By collaborating with governmental agencies, non-governmental organizations, academic institutions, and private sector partners, SOFCOM ensures a comprehensive approach to security challenges. This synchronization allows for the seamless integration of civilian expertise, resources, and infrastructure, which is essential for addressing complex, multidimensional threats. Such partnerships enhance situational awareness, improve resource allocation, and foster a unified response to crises, ultimately strengthening NATO's overall strategic capabilities and operational success.

PANEL DISCUSSION: UNDERSTANDING INTERACTION BETWEEN MILITARY AND NON-MILITARY ENTITIES

The panel delved into the complexities of implementing MDO within the alliance framework and across military and civilian sectors. Critical insights highlighted the necessity for synchronization within NATO to avoid duplication of efforts and resource competition. Panelists emphasized the pivotal role of NATO in coordinating these efforts, the importance of CIMIC in bridging NATO with civilian entities, and the emerging role of SOFCOM in an increasingly dynamic, complex, and contested operating environment.

Furthermore, the panel recognized that *MDO's effectiveness hinges on seamless integration between military and industry capabilities, facilitating improved decision-making and rapid responses to evolving security challenges*. These discussions underscored the significance of early relationship-building and sustained collaboration, emphasizing the key necessity to leverage advanced technologies and exchange information. For instance, fostering partnerships in transportation, logistics, and technology was highlighted. Recommendations included implementing Red Team exercises to stress-test systems and capacity while utilizing wargames and exercises to incorporate a wide variety of civilian entities to identify shortfalls and enhance coordination.

Panelists emphasized that relationships established during peacetime would yield enhanced civil-military integration during times of conflict and improve responses to complex security challenges.

SESSION 3:

IMPACT OF TECHNOLOGY

INTELLIGENCE RISING - USING NARRATIVE GAMING TO UNDERSTAND AND PLAN FOR THE IMPACT OF AI

MR. PAUL ELLIS, CHIEF EXECUTIVE OFFICER (CEO) I3 GEN

Mr. Ellis led a compelling discussion on the use of narrative gaming as a strategic tool to address complex, real-world challenges, particularly those posed by rapid advancements in artificial intelligence (AI). Under Mr. Ellis' leadership, i3 Gen has developed a novel approach to wargaming that transcends traditional military tactics by integrating multi-domain factors such as economic, diplomatic, and technological aspects.

In his presentation, Mr. Ellis explained that this narrative wargaming method, which is aimed at enhancing strategic foresight, utilizes competitive storytelling and expert insights instead of dice-based randomness, immersing participants in high-stakes scenarios. Through expert-led sessions, Mr. Ellis' team helped participants explore dynamic, realistic outcomes to better understand the implications of decisions, ultimately fostering collaboration across military and non-military sectors. Mr. Ellis elaborated that this process allows for a progressive strategy that unfolds iteratively, offering insights into the complexities of modern warfare and planning.

Interestingly, one of i3 Gen's recent projects, funded by philanthropists and not influenced by government or tech interests, focused on the societal impacts of AI through a series of narrative wargames. These exercises simulated scenarios such as cybersecurity threats, economic disruption, and the potential emergence of Artificial General Intelligence. As participants grappled with incidents like AI-driven disinformation and cyberattacks, they were challenged to create strategic responses that could be applied across both public and private sectors. The objective was to address the potential societal shifts AI might bring, highlighting the need for innovative regulations and collaborative safeguards.

Mr. Ellis shared that these exercises not only raised awareness but also led to discussions on how AI developments might be managed to balance benefits with significant risks. An upcoming documentary, "Intelligence Rising", will cover this project in detail, aiming to bring i3 Gen's thought-provoking methodology to a wider audience.

IMPLICATIONS OF AI MULTI-AGENT SYSTEMS ON MILITARY APPLICATIONS

MR. BLAGOJ DELIPETREV, NATO HQ – DATA SCIENCE AND AI ADVISOR

Dr. Delipetrev, in his session, addressed the advancing capabilities of AI, including emerging technologies, Multi-Agent AI for MDO, military implications, and future considerations. AI has surpassed human performance in several areas, including imaging, reasoning, and understanding. However, it still falls short in competitive-level mathematics, visual commonsense reasoning, and planning.

In the context of MDO, AI technology could be leveraged in military applications such as Unmanned Aerial Vehicles (UAVs), Unmanned Ground Vehicles (UGVs), Unmanned Surface Vehicles (USVs), and Unmanned Underwater Vehicles (UUVs). As developments show, these unmanned vehicles are capable of communicating with one another.

Dr. Delipetrev highlighted the benefits of AI in military applications, such as enhanced autonomy between platforms, improved intelligence, faster response times, and reduced costs. AI could be employed in training and exercises, cyber defence, and supply chain sectors. However, AI is currently constrained by gaps in data sharing and interoperability, certification processes, cybersecurity threats, adversarial vulnerabilities, and catastrophic forgetting.

These gaps in AI technology are being addressed by fostering partnerships with allied industry manufacturers and academia. In addition to utilizing products already available via open-source platforms, collaborating with manufacturers and establishing in-house resources could reduce costs. Dr. Delipetrev concluded by explaining that while AI can enhance human performance, it cannot replace it at the moment.

AI IN GLOBAL COMPETITION: DIGITAL SOVEREIGNTY VS. INTEROPERABILITY, CIVIL AND MILITARY PERSPECTIVES

MS. TSIPORAH FRIED, FRANCE MINISTRY OF DEFENCE, CIVILIAN EXPERT

Ms. Fried delved into the geopolitical impact of AI. She highlighted that AI's digital tools have primarily evolved within a civilian ecosystem driven by market demand, profitability, and international trade rather than direct national security concerns. This development spans various fields, intensifying competition for resources such as strategic materials, skilled labour, and energy for data centres.

AI embodies both "soft" and "hard" power, with China, the United States, and Europe holding unique positions and perspectives, which present operational and diplomatic challenges. In the current international landscape, global trade is undergoing significant changes, and the concept of digital sovereignty gains prominence. Ms. Fried highlighted that this concept encompasses four main objectives: Regulation of the internet and social networks; Protection of citizens' fundamental rights; Safeguarding commercial and national interests; and Achieving independence and autonomy in AI development.

Lastly, Ms. Fried raised that AI has the potential to influence the resurgence of warfare, the normalization of violence, and intensifying global competition, particularly in the context of Sino-American rivalry.

PANEL DISCUSSION: IMPACT OF TECHNOLOGY

The panel discussed several questions surrounding AI in the context of NATO's interoperability, regulation, and ethics. Panelists highlighted the challenges of monitoring and regulating AI proliferation, particularly through proprietary systems and open-source models, with the latter being harder to control. Effective regulation must be enforceable, and ethical considerations should focus on the creators and inputs shaping AI rather than the AI itself.

The discussion concluded the need to ensure AI serves as a beneficial tool while countering malicious uses. It is crucial to protect human creativity in an AI-dominated future by valuing AI-assisted art and accepting AI's supportive role in analysis, freeing humans for more advanced tasks. Although concerns exist about AI replacing jobs, particularly high-paying knowledge roles, history suggests job shifts during industrial revolutions rather than outright losses.

AI presents both opportunities and challenges for global development. It could balance opportunities for developing nations, but its effectiveness depends on access to high-quality, well-managed data. Quantum computing introduces further risks, as quantum algorithms can break current cryptographic methods, raising data protection concerns.

The social implications of Cognitive Warfare are profound with tools like TikTok highlighting the difficulties in countering unwanted influence. Disinformation should be met with factual countermeasures rather than bans, as youth easily bypass restrictions. Overall, embracing AI's capabilities and limitations while balancing security, ethics, and human values is paramount for a sustainable AI-integrated future.

SESSION 4:

CD&E FOCUS

MODELLING & SIMULATION SUPPORT TO CD&E

COLONEL STEVE BANKS, HQ SACT MULTI-DOMAIN FORCE DEVELOPMENT, MODELING & SIMULATION LEARNING TECHNOLOGY - BRANCH HEAD

Colonel Banks, in his talk, emphasized the crucial role of Modeling & Simulation (M&S) in NATO's CD&E process. He provided an informative overview of the M&S programme, including guiding doctrine, organizations, and methodologies, explaining how M&S supports capability development by providing scientific rigour and objectivity while reducing reliance on physical resources.
For instance, simulations allowed NATO pilots from across the Alliance to train together in a controlled virtual environment before deployment. This ensured they could develop familiarity before facing real-life operational scenarios, thereby enhancing mission preparedness and reducing risks.

Regarding current M&S projects, Colonel Banks highlighted three major initiatives: MDO in Urban Environments, Cognitive Warfare, and Dispersed Logistics. Each project demonstrates M&S's value in evaluating complex and diverse scenarios.

Colonel Banks also provided an update on NATO's efforts to implement the Next Generation (NexGen) M&S programme, designed to centralize and standardize NATO's M&S capabilities to ensure operational alignment across Allied forces. Scheduled for deployment by 2025, the NexGen programme aims to improve NATO's readiness and adaptability by making simulation tools more accessible, ultimately enhancing training, experimentation, and planning processes across the Alliance.

MULTINATIONAL CAPABILITY DEVELOPMENT CAMPAIGN (MCDC) OVERVIEW WITH ALLIES AND PARTNERS EXPERIMENTATION NETWORK (APEX-NET) PROJECT UPDATE

MR. KARL BOGGS, INTEGRATED LEARNING BRANCH CHIEF, JOINT STAFF J-7

Mr. Boggs briefed on the Multinational Capability Development Campaign (MCDC), a collaborative initiative involving NATO, the European Union Defence Force, and other allied nations, aimed at enhancing multinational military capabilities through joint research and experimentation. The programme is designed to address common challenges across member states, particularly focusing on areas not prioritized in individual force development efforts due to limited resources.

Through two-year project cycles, MCDC invites participation from civilian experts, private industry, and academia to contribute their expertise, especially for projects exploring advanced technologies like AI-enabled sensor fusion, directed energy weapons, and climate-driven security concerns. NATO and other sponsoring entities oversee project governance, enabling members to share resources and insights to collectively advance both non-material solutions (such as guidebooks) and material capabilities across multiple domains.

One key MCDC project, Allies and Partners Experimentation Network (APEX-NET), aims to resolve fragmented data and communication barriers within multi-national concept development and wargaming activities. Limited information-sharing capabilities across different nations and organizations have led to inconsistent data use, redundant efforts, and inefficiencies in collective knowledge. APEX-NET, now concluding its 2023-24 cycle, has developed a guidebook outlining best practices, policies, and commercially available solutions to address these gaps.

Mr. Boggs pointed out that this guidebook, intended for NATO review and wider use, emphasizes linking national and partner systems effectively to foster multinational collaboration. It provides a framework adaptable for public and private industry partners, with recommendations on navigating the policies, intellectual property considerations, and technical requirements necessary for a cohesive multinational information-sharing network.

DAY 2

START OF DAY REMARKS

LONG RANGE FIRES AND RESILIENCE

MR. DE GAETANO, ACO INNOVATION BRANCH – SECTION HEAD WARGAMING

On the second day of the conference, Mr. De Gaetano presented an analysis of military and civilian resilience against long-range kinetic attacks, examining historical and contemporary conflicts. His analysis demonstrates that despite technological advancements, long-range kinetic strikes alone have rarely achieved decisive results in permanently disrupting logistics or breaking national morale.

Drawing from World War II, strategic bombing proved ineffective against population centres and only marginally successful against industrial targets. The Vietnam War further reinforced this pattern, where despite heavy bombing campaigns, logistical networks demonstrated remarkable resilience, and effects on national morale were negligible. The 1999 Allied Force operation in Serbia marked a shift, where concentrated precision-guided munitions successfully impacted civilian resilience and national morale, though military resilience remained largely intact.

In his presentation, Mr. De Gaetano referred to the current Ukraine armed conflict, where Russian attempts to disrupt Ukrainian logistics and war production have achieved only partial success, despite significant resource commitment. Mr. De Gaetano stressed that Strategic Communications and CIMIC have proven crucial in mitigating enemy actions and maintaining popular support.

Looking forward, the comprehensive analysis identifies several key developments: the declining impact of purely kinetic effects; the emergence of cyber warfare as a cost-effective tool; and the growing importance of influence operations. The proliferation of UAVs and loitering munitions may shift the balance of deep strikes. Additionally, the increased significance of civilian-owned infrastructure necessitates a broader approach that considers both military and civilian targets as part of an integrated system. Future planning must incorporate dispersal and redundancy in civilian infrastructure while considering both kinetic and non-kinetic approaches as part of a comprehensive strategy.

SESSIONS 1 & 2: WORKSHOPS

THE FUNDAMENTALS OF 'INTERACTION' WITH NON-MILITARY ENTITIES AND NATO SOFCOM (FULL DAY WORKSHOP)

LIEUTENANT COLONEL VUOCOLO, SOFCOM FDD DEPUTY AND CD BRANCH HEAD

The purpose of this working session was to exchange insights, discuss opportunities, and address challenges related to partnerships between non-military entities and SOFCOM. While many obstacles exist—particularly in fostering these relationships during both peacetime and conflict—we recognize that the benefits of collaboration far outweigh the risks.

The workshop covered a range of critical topics, including potential interactions between academia and the military. Featuring the HYDRA project as a case study, this 24-month initiative funded by Italy's Ministry of Research under the NexGen EU programme explores collaborations between academia and the military to address hybrid threats (HT). Key goals include producing research publications, podcasts, high-level courses, and guidelines while navigating challenges like accessing state-held documents and understanding the complex, multi-layered nature of HT.

The Latvian Ministry of Defence's Crisis Management and Resilience Department promotes a comprehensive national defence approach, focusing on individual, community, and state readiness to safeguard the country in crises. Initiatives include a mandatory national defence course in schools, legal requirements for critical infrastructure continuity, and a coordinated "whole-of-government" approach to clarify state and municipal roles during crises.

EUCAP Somalia supports Somali security institutions across maritime, police, and rule-of-law sectors to stabilize the region. Through coordination with EU and local entities, it addresses complex security challenges and enhances Somali capacity, as seen in the new Somaliland Coast Guard Command Centre, aligning with EU goals of countering illegal trafficking, migration, and piracy.

CIMIC in full-scale invasions focuses on maintaining resilience in essential sectors—such as governance, energy, food, and health—while managing vulnerabilities like uncontrolled population movement and communications breakdowns. Key priorities include ensuring stable energy and water supplies, fostering local cooperation, controlling NGO and IDP support, and integrating local knowledge into strategic operations to enhance defence capabilities.

Legal issues in MDO involve challenges around integrating military and non-military activities across multiple domains, with significant legal and ethical concerns surrounding AI use, autonomous systems, and compliance with international humanitarian law. Complexities arise due to varying national approaches, jurisdictional disputes, information-sharing barriers, and interagency collaboration, which necessitate a shared vision, robust communication frameworks, and early private sector engagement to foster effective coordination.

SOFCOM emphasizes the critical need for synchronized actions between military and civilian sectors in MDO, leveraging non-kinetic capabilities like information operations, PSYOPS, and CIMIC to address hybrid threats and build resilience in essential sectors. Despite challenges like communication barriers, cultural differences, and legal complexities, coordination across security domains aims to strengthen information environments, support governance, and counter misinformation effectively.

FOSTERING ALLIANCE INNOVATION – HOW DIANA CAN CONTRIBUTE TO THE CD&E EFFORTS

LIEUTENANT COLONEL MACIEJ MACENOWICZ, PhD, CHIEF COUNSEL RAPID ADOPTION SERVICE DIANA

The workshop opened with an overview of DIANA's charter and scope of authority, emphasizing its aim to connect start-ups and small to medium-sized innovators with end users. DIANA's Rapid Adoption Service operates in two six-month cycles to harness emerging technologies that address urgent problems. The focus is on answering two critical questions: what are the demands, and what are the procurement challenges? With over 200 test centres across the alliance, DIANA aims to advance the most promising proposals. DIANA is developing an operating system to facilitate information sharing and collaboration, aiming to avoid duplication of efforts with other entities like the Innovation Hub. To address ongoing intellectual property (IP) concerns, DIANA is working to create a taxonomy to effectively communicate about innovators and challenges without disclosing sensitive solution details, thus enabling information sharing while safeguarding IP. Another issue is the standardization and verification of testing practices across diverse testing centres; DIANA is exploring a vetting process to ensure the standards of its affiliated centres.

The workshop also addressed the challenge of translating innovation into practical solutions amid a lengthy procurement pipeline. DIANA encourages commercial success among its innovation partners to bridge the financial gap between prototype approval and defence procurement. However, a solution that is fully commercially viable may fall short of NATO's requirements, creating barriers for small and medium-sized enterprises. DIANA is focused on helping these companies meet NATO's stringent standards while maintaining commercial viability, which is crucial for collaboration on NATO's emerging needs. Further discussions on acquisition reform are necessary to accelerate peacetime acquisition processes to match the pace of emerging issues.

LAYERED RESILIENCE

Mr. ICAYAN, HQ SACT – MILITARY RESILIENCE ANALYST

The Layered Resilience workshop presented NATO's Warfighting Capstone Concept (NWCC), emphasizing the importance of both civil preparedness and military capacity in maintaining the Alliance's ability to anticipate, withstand, and respond to strategic shocks. Key components discussed included Military Resilience, Civil Preparedness, and the interdependencies between these elements to enhance overall resilience. The NWCC details various lines of delivery, including the NATO Military Resilience Risk Assessment and stress-testing initiatives, aimed at reinforcing resilience in training and exercises. It highlighted the need for a continuous process that addresses both short-term shocks and long-term crises, advocating for a whole-of-society approach to ensure state stability and societal well-being.

The workshop further explored the necessity for military forces to deter and defend against adversaries while supporting civil environments during crises. It outlined the framework for military resilience, focusing on the ability to anticipate threats, recover from shocks, and adapt to changing situations. Layered resilience highlights the characteristics of resilient forces, including robustness, elasticity, and antifragility, which are essential for maintaining stability. Additionally, it calls for balancing capability and capacity in force development to enhance both military effectiveness and resilience. The overarching goal is to create a resilient military and civil infrastructure that can withstand and recover from strategic challenges while ensuring effective governance and societal stability.

MODELLING AND RESILIENCE

MR. ERRICO DE GAETANO, SECTION HEAD OF WARGAMING, DEPUTY BRANCH HEAD ACO INNOVATION MANAGEMENT, SHAPE

Mr. De Gaetano presented his wargaming model for measuring resilience. The workshop focused on gathering input from participants to identify the most effective methods for measuring the long-range kinetic and non-kinetic effects on a nation's resilience and morale. All participants agreed on the importance of this topic and emphasized its inclusion in future modelling and wargaming.

Discussions centred on how best to quantify resilience and morale in a measurable form suitable for modelling. The group examined key factors that drive morale, their importance levels, and how to assign numerical values to them. Identified key factors included basic health services, physical protection, energy, communication, and transportation.

A challenge highlighted was the variation in resilience and morale across NATO countries, influenced by factors such as geography, infrastructure, and political will. While assigning numerical values to these factors sparked productive discussions, achieving consensus on the best methods to capture and quantify resilience and morale proved difficult. AI was proposed as a tool to assist in quantifying resilience, but some members doubted its current effectiveness due to the non-data-driven nature of the issue.

Participants also explored ways to improve morale during wargaming, highlighting its importance in the modelling (e.g., STRATCOM). The group continued to discuss cause-and-effect scenarios that could significantly alter resilience and morale and how to measure these changes in the modelling. Examples included attacks on infrastructure and loss of territory, both of which would significantly affect civilian populations and influence resilience and morale.

UNDERSTANDING THE CIVIL ENVIRONMENT – A WARGAME SOLUTION

LIEUTENANT COLONEL PETER SCHAEFER, CIMIC COE, BRANCH CHIEF CONCEPTS, INTEROPERABILITY, CAPABILITIES

This interactive workshop challenged participants to explore civil-military dynamics through “Analysia," a new tabletop wargame developed by CIMIC to simulate and examine the dynamics of civil-military interaction. It positions players as different actors in a fictional conflict, requiring them to respond to evolving scenarios within a complex operational environment. Analysia’s objectives are to better understand the MDO environment and consider the civil-military relationship in CD&E and doctrine writing. Designed at an unclassified level, Analysia offers an opportunity to bring together civilian and military personnel, fostering relationships and improving understanding of the risks and challenges inherent in civil-military relations.

The workshop invited participants to play Analysia through two phases of the game sequence. The game unfolds where teams introduce "shocks" or events, such as attacks or diplomatic actions, to simulate an evolving civil-military landscape. Teams assess and respond to these events, considering their impacts on both military objectives and civilian conditions.

By simulating incidents, such as disruptions to critical infrastructure, the game underscored how various factors intertwine within civil-military operations. Analysia’s hands-on approach, which includes shifting roles and perspectives, deepens players' understanding of the mutual influence between military operations and civilian factors, the critical importance of improving civil-military integration, and demonstrates how gaming can challenge participants to explore the complexities of civil-military interactions. The workshop also highlighted the effectiveness of experiential learning through wargaming, where active involvement pushes participants to expand perspectives and enhance understanding.

M&S SUPPORT TO WARGAMING AND EXPERIMENTATION

MR. JAN HODICKY, HQ SACT – M&S TECHNICAL ADVISOR

The workshop led by Mr. Hodicky provided foundational insights into M&S, exploring its role in supporting NATO's experimentation, wargaming, and operational planning. Aimed at educating participants on M&S principles, the session highlighted its applications in training, operations support, capability development, mission rehearsal, and simulation-based procurement.

The first use case focused on validating MDO within Urban Environments (UE), showcasing M&S' capability to generate Common Operating Pictures, analysis of effectiveness across different operational approaches against a baseline, and supporting planners through detailed comparisons of Courses of Action.

The second use case explored M&S’s role in cognitive warfare, integrating Human Behaviour Models in simulations to strengthen defence against cognitive attacks, with a scenario set in Kosovo 2035.

This model included independent and dependent variables related to knowledge, values, motivation, and training levels, aiming to bolster defences in the cognitive dimension.

An additional exercise involved problem-solving around factory machine breakdowns and repair times, assessing impacts on profit and productivity through simulation-driven analysis and Design of Experiment methods.

FORECASTING THE IMPACT OF AI

MR PAUL ELLIS, CEO IGEN3

The workshop highlighted the evolving landscape of AI and its potential benefits and risks. Participants were encouraged to critically assess how AI could enhance daily life while being aware of its limitations, especially those stemming from historical technological constraints. With the advent of large language models, AI has become more accessible through user-friendly interfaces, prompting brainstorming on innovative applications and necessary safeguards against misuse. This exploration aims to foster a balanced understanding of AI's capabilities and the importance of integrating protective measures to prevent harmful outcomes.

As the conversation shifted to future possibilities, Mr. Ellis underscored the emergence of AI agents capable of independent decision-making and real-world interaction, using examples like AlphaGo and advanced robotics. This raises critical discussions about the balance between traditional knowledge-based AI and more autonomous systems that learn through experience. The implications of AI in drug creation, cultural influence, and the potential for ethical dilemmas were also examined.

Concerns regarding disinformation, intellectual property, and emotional connections with AI were addressed, underscoring the need for resilience and proactive engagement across various sectors. Ultimately, the message advocates for careful navigation of AI's complexities and its societal impacts.

EXPERIMENTING THE ARCTIC KILL CHAIN

DR. VALTTERI TUOMINEN AND DR VILLE HIETIKKO, DIGITAL DEFENCE ECOSYSTEM

The workshop laid a foundation to educate participants on Finland’s dual-use and total defence concepts, emphasizing the role of civil organizations and the need for private-sector partnerships to address the Arctic’s challenging environment. As a “small Arctic superpower”, Finland leverages its total defence model, where “every man is a soldier”, to integrate civilian and military resources effectively.

Key insights included Finland’s conscription and civil organizations, which support rapid mobilization and essential wartime logistics, releasing military resources for frontline tasks. Additionally, strong cybersecurity and resilient digital infrastructure ensure connectivity and defence capability in the Arctic, enhanced by partnerships with tech firms and NATO allies. The private sector aids in developing cold-weather technology, efficient power, and navigation tools. The Arctic Kill Chain initiative focuses on early threat detection and real-time data sharing, bolstering Arctic situational awareness.

With limited satellite coverage, Finland explores alternatives for communication and uses modular logistics depots and drones to adapt to remote, rugged terrain. Finland treats crises as innovation opportunities, continuously adapting and training to improve readiness across sectors. Pre-staging essential supplies and training units for self-sustainability also improves Arctic operational readiness. This cross-sector collaboration fosters a scalable, adaptable defence strategy, positioning Finland to respond effectively to Arctic challenges.

SESSION 3: KEYNOTE ADDRESS

NEGOTIATIONS AS A KEY ENABLER IN MDO

PROF. PEDRO DE ÁGUA, DEPUTY DIRECTOR NAVY RESEARCH CENTRE, PORTUGUESE NAVAL ACADEMY

Prof. De Água, Associate Professor of project management, defence systems acquisition, general management, and negotiation at the Portuguese Naval Academy, accentuated the critical yet often overlooked role of negotiations in MDO. The discussion highlighted the need for traditional command and control structures to evolve to accommodate both military and civilian actors.

His key findings underscore that the future operating environment will be too complex for human comprehension alone, with humans being abductive and machines inductive in decision-making. Several critical challenges were identified, including different interpretations of core concepts (MDO, Systems-of-Systems), the integration of civilian behaviour into NATO decision-making, the need for new command approaches, as well as cultural, policy, and legal issues that may affect cross-domain operations.

In his speech, Prof. De Água suggested that MDO is characterized as a system-of-systems approach, classified into four types: Collaborative, Acknowledged, Virtual, and Directed. Each type presents unique challenges, particularly in moving from engineering to negotiation-based solutions. The complexity increases due to multiple stakeholders with competing interests, contradictory objectives and purposes, different operational priorities, and multiple lifecycles and resource decision-makers.

To address the complexity of systems-of-systems, negotiation needs to become an organizational capability rather than just an individual skill. This requires increased negotiation training in military and civilian contexts, an understanding of intercultural dimensions, a focus on human dimensions alongside technological solutions, and the development of agreement mechanisms between military and civilian entities.

Prof. De Água concluded that technological challenges will eventually be solved. The human aspects of coordination and negotiation are more critical for MDO's success, necessitating the systematic development of these capabilities across organizations.

DAY 3

START OF DAY REMARKS

TRANSPARENT BATTLEFIELD – UAS AND ELECTRONIC WARFARE ACCELERATED EVOLUTION IMPACT ON MULTI-DOMAIN BATTLEFIELD

MR PAULIS RIBAKOVAS, NT SERVICE COMPANY, PROJECT MANAGER

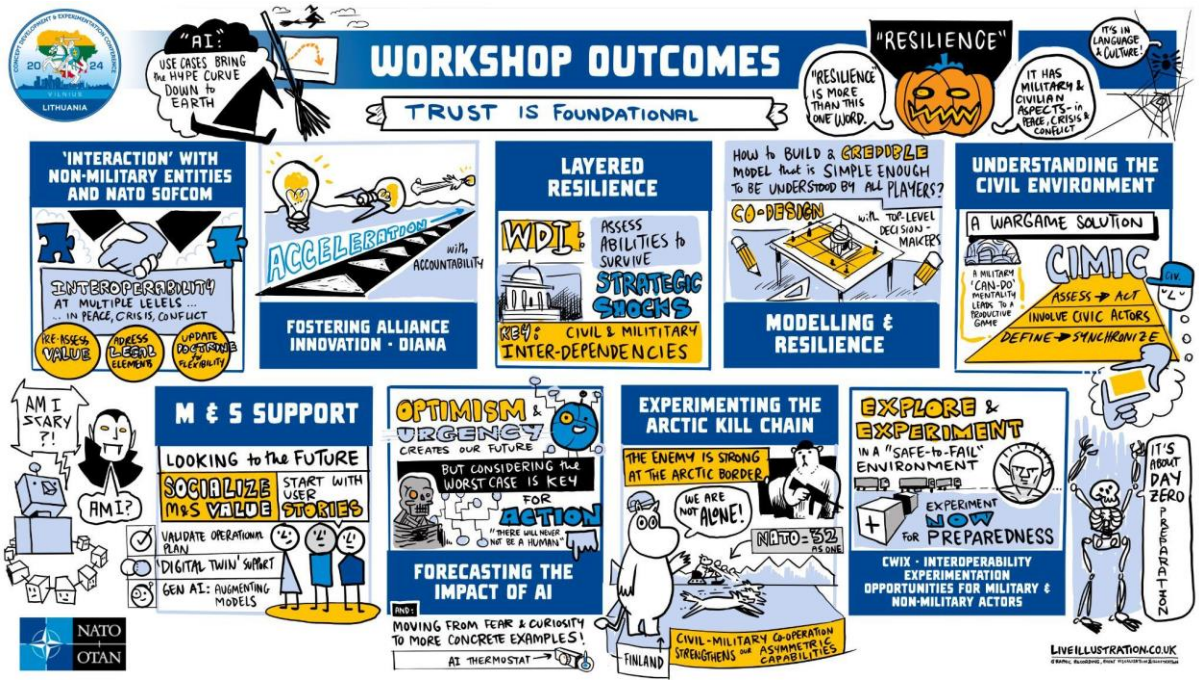
In his presentation, Mr. Ribakovas shared insights from the Ukraine war, highlighting Lithuania's support through initiatives like the Blue/Yellow Programme. He elaborated on how UAS and electronic warfare have reshaped the battlefield, facilitating real-time adaptability and accelerating tactical evolution. He noted a significant shift in warfare with affordable, attritable drones—especially First Person View (FPV) drones—that have matured into effective, scalable tools for reconnaissance and combat, now deployed in massive volumes. His telecommunications company has transitioned to counter-drone production, exemplified by portable jammers and anti-drone systems used at the Siege of Mariupol.

He highlighted a layered defence strategy, noting the limitations of both aerial and land forces against rapidly advancing drone technology, which operates at low altitudes and high speeds. A key challenge lies in balancing innovation and responsiveness within structured military processes. In addition, he stressed that bureaucracy and supply chain issues impede real-time adjustments to drone technology advancements.

Mr. Ribakovas urged NATO to foster agile communication channels with warfighting forces, enabling iterative feedback and prompt innovation. He concluded that battlefield transparency demands faster solutions and a collaborative approach between the military, industry, and society to outpace adversaries' technological gains.

WORKSHOPS RESULTS

Each workshop leader presented key points and highlights to the plenary, which are contained in an illustration by Peter Morey below.



The following points highlight the key takeaways from each workshop:

The Fundamentals of "Interaction" with non-Military Entities and NATO SOFCOM

1. SOF Doctrine needs to be updated to ensure more flexibility in civilian-military cooperation.
2. There are many barriers and obstacles (legal, judicial, bureaucratic, and educational) that need to be taken into consideration.
3. Interoperability is fundamental.

Layered Resilience

1. The stability of states is key. Civil preparedness will improve the resilience of the population.
2. It was emphasized that the interdependencies between civil and military resilience are extremely important.
3. The validation of the Layered Resilience concept was supported by consistent feedback from multiple NATO workshops, indicating that their findings align with the thoughts of other NATO entities.

Forecasting the impact of AI

1. Narrative Gaming as a Strategic Tool: The discussion highlighted the use of narrative gaming to tackle complex, real-world challenges, especially those related to rapid AI advancements.
2. Progressive Strategy Development: The iterative nature of the process allows for evolving strategies that provide insights into the complexities of modern warfare and planning.

3. Focus on Societal Impacts of AI: Recent projects simulated scenarios like cybersecurity threats and AI-driven disinformation, prompting participants to develop strategic responses relevant to both public and private sectors.

Modelling Resilience

1. Importance of Measuring Resilience and Morale: The workshop highlighted the critical need to effectively measure the long-range kinetic and non-kinetic effects on a nation's resilience and morale, emphasizing its inclusion in future modelling and wargaming.
2. Challenges in Quantifying Resilience and Morale: The group faced difficulties in reaching a consensus on how to quantify resilience and morale due to the variation across NATO countries influenced by geography, infrastructure, and political will.
3. AI as a Potential Tool with Limitations: Although AI was suggested as a tool to help quantify resilience, some participants were skeptical of its current effectiveness because the issue is not predominantly data-driven.

Understanding the Civil Environment - A Wargame Solution

The key takeaways from the desktop wargame Analysia underscored the military principles:

1. Assess before acting.
2. Define before synchronize.
3. Must make credible assessments.

In a more complex environment incorporating a civilian entities, these factors provide a crucial baseline.

M&S Support to Wargaming and Experimentation

1. Available M&S tools must be used more often to support activities.
2. M&S tools must be used in conjunction with AI.
3. Determine use cases to validate the use of AI in M&S Tools.

Experimenting the Arctic Kill Chain

1. The workshop suggested that the Finnish strategic approach could be adopted for NATO.
2. Finland needs quick, agile innovation cycles (about three months) using affordable, adaptable tech—like consumer drones and open-source software—to counter larger, well-funded adversaries.
3. Strengthening Finland's defence requires closing the gap between military and business sectors, fostering collaboration to integrate commercial technology and insights for national security.

CWIX - Interoperability Experimentation Opportunity for Military and Non-Military Actors

1. Never mind how mature your system is, you can experiment @ CWIX.
2. "Be Relaxed" in a safe to fail environment.
3. Fail to prepare, prepare to fail - Prepare NOW.

WRAP UP AND CONFERENCE CLOSE

Conference Summary and Closing Remarks

Overall, the conference fostered an environment of collaboration, knowledge sharing, and innovation, setting the stage for future advancements in NATO's operational capabilities. The conference concluded with gratitude to Lithuania and all participants, organizers, and contributors who made it a success.

Branch Head Concept Development elaborated on the way ahead in the CD&E work and emphasized the criticality in deriving the development of capabilities for future forces. He encouraged all participants to follow NATO on the path towards an MDO-enabled Alliance.

In formally closing, Major General Pepper urged participants to embrace fresh thinking, consider future outcomes, and explore opportunities in the CD&E environment.

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