HUMAN FACTORS & MEDICINE (HFM) PANEL

CALL FOR PAPERS

HFM-RSY-377 Symposium on

Meaningful Human Control in Information Warfare

"Encompassing Control of Future Operations across Warfare Domains and the use of Advanced AI"

To be held in
Amsterdam, the Netherlands
21-22 October 2024

For information please contact:

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This Symposium is open to
NATO Nations, NATO Bodies, STOEOP, MD, PfP, GP and will
be conducted at a Public Releasable level

DEADLINE FOR RECEIPT OF ABSTRACTS:

15th April 2024
(1st April 2024 for USA Submitters)

THE NATO SCIENCE AND TECHNOLOGY ORGANIZATION

Science & Technology (S&T) in the NATO context is defined as the selective and rigorous generation and application of state-of-the-art, validated knowledge for defence and security purposes. S&T activities embrace scientific research, technology development, transition, application and field-testing, experimentation and a range of related scientific activities that include systems engineering, operational research and analysis, synthesis, integration and validation of knowledge derived through the scientific method.

In NATO, S&T is addressed using different business models, namely a collaborative business model where NATO provides a forum where NATO Nations and partner Nations elect to use their national resources to define, conduct and promote cooperative research and information exchange, and secondly an in-house delivery business model where S&T activities are conducted in a NATO dedicated executive body, having its own personnel, capabilities and infrastructure.

The mission of the NATO Science & Technology Organization (STO) is to help position the Nations' and NATO's S&T investments as a strategic enabler of the knowledge and technology advantage for the defence and security posture of NATO Nations and partner Nations, by conducting and promoting S&T activities that augment and leverage the capabilities and programs of the Alliance, of the NATO Nations and the partner Nations, in support of NATO's objectives, and contributing to NATO's ability to enable and influence security and defence related capability development and threat mitigation in NATO Nations and partner Nations, in accordance with NATO policies.

The total spectrum of this collaborative effort is addressed by six Technical Panels who manage a wide range of scientific research activities, a Group specializing in modelling and simulation, plus a Committee dedicated to supporting the information management needs of the organization:

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS System Analysis and Studies Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These Panels and Groups are the power-house of the collaborative model and are made up of national representatives as well as recognized world-class scientists, engineers and information specialists. In addition to providing critical technical oversight, they also provide a communication link to military users and other NATO bodies.

The scientific and technological work is carried out by Technical Teams, created under one or more of these eight bodies, for specific research activities which have a defined duration. These research activities can take a variety of forms, including Task Groups, Workshops, Symposia, Specialists' Meetings, Lecture Series and Technical Courses.

The Human Factors and Medicine Panel (HFM) is part of the Science & Technology Organization, Collaboration and Support Office (STO-CSO): Consult our STO/CSO website at http://www.sto.nato.int

The HFM Panel covers the fields of two complementary domains, which are represented in the two 'Area Committees':

STO Collaboration Support Office – HFM Panel - BP 25 - F-92201 Neuilly-sur-Seine Cedex - France
HFM Panel Executive: Tel: +33 1 55 61 22 60 - Email: siebren.wolf@cso.nato.int
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A) The **Health, Medicine and Protection (HMP) Area** provides the scientific basis for establishing an operationally fit and healthy force, restoring health, minimizing disease and injury, optimizing human protection, sustainability and survivability. This encompasses research in the field of military medicine, physiology, psychology and human protection technology. Areas of interest include, among others, medical diagnosis, prevention, treatment and evacuation. HMP also focuses on enhancing human protection research on physiological and physical influences, e.g. of cold, heat, air pressure, noise, vibration, ionizing and non-ionizing radiation, acceleration, motion, biological and chemical effects on the human body, and developing appropriate countermeasures.

B) The **Human Systems and Behaviour (HSB) Area** provides the scientific basis and explores new technology for optimizing the performance of individuals, teams and organizations and their interaction with socio-technical systems to achieve highly effective mission performance. This encompasses research in the fields of human factors, human systems integration as well as cognitive, psycho-social, organizational and cultural aspects in military action. Contributions on Human Systems Integration cover complexity, total life-cycle affordability, human error and fatigue management, intelligent agents, human cognitive and physical resources management, anthropometry, human-machine interfaces, communication and teamwork, performance assessment, enhancement and aiding, training and function allocation in (semi)automated systems. Contributions on individual and team readiness cover values and ethics, leadership, multi-national operations, human enhancement and coping with mental, cognitive and physical demands on the individual. Contributions on organizational effectiveness encompass human resource management, training, interoperability, shared decision-making, synchronized situational awareness, resilience, understanding terrorism, psychological operations and coping with new demands on military organizations.

THE HUMAN FACTOR AND MEDICINE (HFM) RESEARCH SYMPOSIUM – 377

The HFM-377 Research Symposium will explore ways to achieve responsible use and Meaningful Human Control (MHC) over AI-based systems across all warfare domains including Multi-Domain Operations (MDO), cognitive warfare, and cyber operations. The symposium will bring together scientists from all over the world to present and discuss their work and ideas on controllability challenges, concerns, and solutions for future NATO operations across the full spectrum of competition. This forum offers the opportunity to obtain new insights, tools, solutions, and research directions to better inform MHC in future applications and with emerging AI methods including generative and general-purpose AI.

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SYMPOSIUM INFORMATION

A. BACKGROUND

A clear trend within the safety and security domains is that there is an ever-increasing availability of and reliance on information. An example is **Multi Domain Operations (MDO)** (also termed **Joint All-Domain Operations (JADO)**) which aims to integrate platforms, sensors, and weapons with distributed Command and Control systems for improved decision making and mission effectiveness. Other examples are the use of information in (offensive and/or defensive) **cognitive warfare,** where manipulating opinion and creating decision uncertainty lies central, and **cyber warfare** where digital infrastructures are targeted, as well as shaped, protected and defended based upon information related to operational goals or mission requirements. A consequence of this is an ever-increasing need for Intelligent Systems that collect, process, and share large amounts of information. The requirement for greater speed and efficiency (overall improved performance compared to today) will necessitate these systems have a high degree of autonomy. In warfare, this processed information will contribute to decision-making for both offensive and defensive operations. As described in the NATO principles of responsible AI, such high-risk AI applications must operate under “human control”. War is, at its core, a human endeavor and therefore a key question for these highly autonomous information systems is how should this “human control” be achieved?

It remains unclear how this might play out across the information environment, where the speed of machine-driven decision-making leaves little or no time for the human to intervene. Alternatively, where the number of (networked) information processing entities is beyond the cognitive capability of human(s) alone to maintain any meaningful oversight, not least control. At the same time, many near-future applications of AI across the alliance are expected to take place in the information environment. Examples are **Information agents,** that convert data from sensors, social media, or intelligence sources into actionable information that can be used by other systems in the decision-making chain, such as (hypersonic) weapons, or command and control decision support systems. Another example is **generative AI,** where algorithms, such as chatGPT, generate content to be used in information warfare.
To date, discussions around responsible use of military AI has heavily focused on maintaining Meaningful Human Control (MHC) over Lethal Autonomous Weapon Systems (LAWS) associated with conventional warfare, i.e. ensuring that the human is always involved in legal and moral decisions about target selection. Whereas some lessons from the LAWS debate apply to information agents and generative AI, they also create new and novel challenges. The goal of this symposium is to identify and explore these issues, and to conceptualize promising new research directions in order to successfully establish and maintain MHC in the information environment. This symposium is organized as part of the overall research objective of NATO to maintain MHC over future AI-based systems. It is related to several other NATO groups, such as HFM ET-215, HFM ET-216, HFM RTG-330, HFM-IST RWS-366 and HFM RWS-322.

B. MILITARY RELEVANCE

NATO military operations (including support to *resilience and civilian preparedness* of member states) must increasingly leverage the ability to reliably forecast, command, and control activities in the information environment. Doing so will enable desired positive effects and minimize the potential for negative outcomes. This is clear from current and emerging military priorities in the areas of multi-domain information integration (aka, Joint All-Domain Operations), cognitive warfare, and cyber operations. In addition, how we address and align legal and moral decisions with ethical issues of AI, while not slowing down innovation and mission effectiveness, is of high importance. This challenge was specifically expressed in the NATO principles of responsible use of AI and the NATO’s DARB. However, operationalizing these principles is highly context specific and far from understood. Whereas significant progress has been made in the area of AWS, the information environment contains some

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specific and unique [converging] challenges which must be solved by combining expert perspectives from fields such as: legal, ethical, AI, cyber security, human factors, and information operations.

The operational and moral stakes are high in the rapidly developing field of AI-assisted information warfare and information agents. While information agents do not directly cause physical impacts, the systems that rely on them will (for example, AI-assisted Command and Control centers which may lead to the use of (hypersonic) weapons). Furthermore, applications of generative AI and other emerging AI methods are expected to have an immense impact on both mission effectiveness and ethical concerns. Appropriate control of these systems is critical to successful future military operations. Human warfighters must be able to reliably understand, assess, predict, synchronize, and 'control' the operation and effects of these complex, AI-enabled, and networked cross-domain systems. This symposium will focus on how MHC can best be established, sustained, and maintained for future military operations and indeed across the entire competition spectrum.

C. SCIENTIFIC OBJECTIVES AND EXPECTED ACHIEVEMENTS

This symposium addresses ways to achieve responsible use and MHC over automated and AI-based systems, with a particular focus on operations in the information environment including Multi-Domain Operations (MDO), cognitive warfare, and cyber operations. This forum offers the opportunity to obtain new insights, tools, solutions, and knowledge transfer from the physical domain where controllability has been investigated for years. It thereby follows a system-of-systems approach in which multiple actors, such as policy makers, designers, and end-users are assumed to play a role in maintaining MHC. Of particular interest are the human factors design considerations such as transparency, explainability, directability and situation awareness support to ensure that the human is involved in a *meaningful* way. Also, a better understanding is required of measurement and prediction of effects in the information environment– without an ability to reliably predict and assess effects and influence in virtual, physical, and cognitive dimensions, there really is no MHC.

There are four main topics for this symposium. Topic 1 focuses on characterizing the state-of-the-art understanding of MHC, including key applications in physical warfighting domains (Land, Sea, Air, Space). Topic 2 considers the emerging challenges associated with the migration of MHC to information operations (where for example cyber-enabled operations target human and non-human cognition). Topic 3 essentially combines Topics 1 & 2 by considering the additional challenges associated with effectively integrating information across multi-domains for joint all-domain operations. This includes the added complexity of managing distributed teams of humans and machines under conditions of variable communications. Finally, Topic 4 considers MHC challenges associated with novel AI technology that will likely be an increasing part of future warfighting systems, such as LLM and generative AI. This symposium will chart the state of the art and especially map future directions while balancing risks and opportunities associated with this exciting challenge of MHC in future warfighting environments.

D. TOPICS

The symposium will cover, but is not limited to, the following topics:

Understanding MHC in physical warfare domains

- Characterizing MHC from ethical, legal, and moral societal perspectives.
- Remaining mission effective while conforming with ethical norms.
- Methods and processes to promote MHC across the mission/system lifecycle.
- Accounting for shifting public opinions.
- MHC of modern lethal autonomy (e.g., loitering munitions).

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MHC applied to information operations

- MHC in cognitive warfare, cyber operations, influence operations, ISTAR system, intel analysis.
- Measurement and prediction of influence and effects in the information environment.
- Challenges associated with MHC over large-scale socio-cultural influence operations.
- Defensive versus offensive operations.
- Information assessment: discerning between intentional mal/mis/disinformation and valid counter hypotheses/arguments/evidence.
- Analysis of ethical, legal, and societal risks associated with information operations.
- Employing generative AI for influence operations.
- Human mental models associated with the information environment (e.g. understanding effects of information actions, offensive cyber, spreading misinformation).
- The role of information provenance to MHC and accountability.

Multi-domain operations: multi-domain information integration and networked teams

- Human-centric challenges associated with MDO/ JADC2.
- Use cases of critical AI applications within MDO/ JADC2 systems.
- Cross-domain information integration: understanding, transparency, provenance.
- MHC considerations across distributed teams with limited/variable communications.
- Generating and assessing policy/ethics-compliant, multi-domain courses of action (COAs).

MHC considerations with emerging, advanced AI capabilities

- MHC issues with generative and general-purpose AI: (LLMs, Foundation models, GAN's, unsupervised ML)
  - Observability, Predictability and Directability (OPD) of AI systems
- Challenges with human-AI goal setting, computational ethics, value- and intent alignment.
- Consequences of model bias and model drift on MHC.
- Opportunities and limitations of Reinforcement Learning by Human Feedback (RLHF).
- Detecting, understanding, and responding to adversarial attacks on next-gen AI (e.g., Deep Fakes, synthetic media, etc.)

E. PARTICIPATION

Nations/organizations willing to join this activity are all NATO Nations, NATO Bodies, EOP, MD, PfP, GP in accordance with Public Releasable level.

F. PROGRAMME COMMITTEE

Chairpersons

Dr. Mark H. Draper (USA, Chair) Principal Engineering Research Psychologist 711th Human Performance Wing Air Force Research Laboratory Dayton, Ohio mark.draper.2@us.af.mil	**Dr. Jurriaan van Diggelen (Netherlands, Chair)** Senior Research Scientist TNO Defence, Security and Safety PostBox 23, 3769 ZG / Kampweg 55, 3769 DE, Soesterberg, the Netherlands jurriaan.vandiggelen@tno.nl

Organising Committee Members

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NATO-STO-CSO / HFM Panel

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G. ABSTRACTS, PAPERS AND MEETING PROCEEDINGS INFORMATION

Papers are solicited that draw from historical perspectives, leadership experience, and research insights, and should contribute to a clearer, shared understanding of how national contributions to alliance activities can be linked to collective military objectives.

Authors are invited to submit abstract that should provide an explicit statement of the content of the paper and its relevance to the symposium. Abstracts should be around 500 words in English, excluding diagrams, figures (with short captions), and references, adopting the following format:

- Title
- Authors and affiliations
- Abstract (500 words)
- References
- One figure with caption (optional)

Abstract shall be Public Releasable.

Contributions from military operations and industry communities are welcome. An indication of symposium topic(s) into which the paper would most logically fit would be of assistance to the Programme Committee who will adjudicate the submitted papers.
Abstracts should be submitted electronically in PDF or MS Word format to the Programme Committee Chair, Dr. Mark Draper, mark.draper.2@us.af.mil and Dr. Jurriaan van Diggelen jurriaan.vandiggelen@tno.nl and to the HFM Panel Assistant, Ms. Marie Linet marie.linet@cso.nato.int **no later than 15 April 2024 and no later than 1 April 2024 for US Authors and U.S. affiliated.**

Authors will be notified of the Programme Committee decision by **13th May 2024**. Authors of accepted abstracts should submit a full paper version by 15th/28th September in accordance with the paper template which will provided upon acceptance.

Accepted Papers should be accompanied by a signed **Publication Release Form** available at the NATO STO website**. Without this form signed no material will be published on the NATO STO website https://www.sto.nato.int/Pages/support-for-authors.aspx**.

H. CLASSIFICATION

The symposium will be conducted at a **Public Release** level.

I. PARTICIPATION

Participation is open to NATO Nations, NATO Bodies, EOP, MD, PfP, and GP

J. PRELIMINARY SCHEDULE

- U.S. Abstract submission: **1st April 2024**
- Abstracts submission: **15th April 2024**
- Abstracts acceptance notification: **13th May 2024**
- Opening registration: **1st July 2024**
- US Paper submission + Form-13 + Bio: **15th September 2024**
- Final paper submission + Form-13 + Bio **28th September 2024**
- Closing registration: **06th October 2024**
- PPT Presentation submission: **11th October 2024**
- Symposium **21st – 22nd October 2024**

If you have any questions, please contact any of the undersigned.

Sincerely,

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ANNEX 1

SPECIAL NOTICE FOR U.S. AUTHORS AND NON-U.S. AUTHORS AFFILIATED WITH U.S. ORGANIZATIONS

Abstracts of Papers, Papers and Publication Release Forms from the U.S. must be sent ONLY to the following P.O.C.:

NATO S&T Organization U.S. National Coordinator

OASD(R&E)/International Technology Programs

4800 Mark Center Drive, Suite 17D08

Alexandria, VA 22350-3600

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E-MAIL: OSD.PENTAGON.OUSD-ATL.MBX.USNATCOR@MAIL.MIL

1. All U.S. Authors must submit one electronic copy to this P.O.C. by **1st April 2024**.

The P.O.C. will forward all U.S. abstracts to the Programme Committee.

2. All U.S. Authors must include the following statement in a covering letter to the P.O.C.:

- The work described in this abstract is cleared for presentation to NATO audiences;
- If work is sponsored by a government agency, identify the organization and attest that the organization is aware of the submission;
- The abstract is technically correct;
- The classification of the abstract is Public Release
- The abstract does not violate any proprietary rights.

In addition to their abstract, all U.S. Authors must provide the P.O.C. with:

a) A certification (can be signed by the author) that there are no proprietary or copyright limitations;

b) Internal documentation from their local public affairs or foreign disclosure office (or equivalent) that clearly shows:

- Title of the paper or presentation
- Level of clearance (i.e. “Approved for public release”)
- Name, title, and organization of the approval authority

c) Full details of authors

Note that only complete packages (abstracts + items listed above) will be accepted by the US P.O.C. After review and approval, the US P.O.C. will forward all U.S. abstracts to the HFM Panel Office, who will send them to the Programme Committee.

U.S. authors are encouraged to address questions and concerns to the P.O.C. as early as possible. Delays in meeting P.O.C. deadlines will impact the timely submission of your abstract.

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