NATO OTAN

Science and Technology Organization
Collaboration Support Office

Neuilly-sur-Seine – France

NATO Science & Technology Organization (STO)
Collaboration Support Office (CSO)

Scientific and Technical Committee (STC) Applied Vehicle Technology (AVT)

Preliminary Meeting Announcement and

Call for Papers

For AVT- 417 Research Specialists' Meeting

on

Platform Implications for Hybrid Space Architectures for NATO Missions

organised by the Members of the

AVT-417 Programme Committee

to be held in Riga, LATVIA

Date tbd October 2025

(in conjunction with the 56th AVT Panel Business Meeting)

Contributions and participation are open to citizens from NATO Nations, STO EOP Nations (Australia and Japan), and New Zealand

Final date for submission of abstracts: 14th February, 2025

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AVT 417 Platform Implications for Hybrid Space Architectures for NATO Missions

Framework of the Meeting

The Applied Vehicle Technology (AVT) Panel is one of eight Scientific and Technical Committees of the NATO Science and Technology Organization (STO) and is organising a Research Specialists' Meeting (RSM) on the subject of "Platform Implications for Hybrid Space Architectures for NATO Missions" under its Technical Sub-Committee Mechanical Systems, Structures and Materials (MSM).

The meeting is open to NATO Nations, STO Enhanced Opportunity Partner nations (Australia and Japan), and New Zealand; it is classified as NATO UNCLASSIFIED OPEN TO STO EOP and NEW ZEALAND. The meeting will be held in Riga, Latvia, during the Fall 2025 AVT Panel Business Week (Date tbd).

The three-day RSM is planned to have around 20 papers, several of which will be invited. Full RSM Proceedings will be published on the STO website: https://www.sto.nato.int.

A RSM is an event with a maximum of 100 participants. The aim of the meeting is to promote the exchange of state-of-the-art knowledge to an audience of experts and specialists on an important scientific or applied topic. The RSM will include presentations, roundtable discussions and/or a poster session. The Technical Programme Committee is responsible for selecting and inviting speakers. Observers are welcome to participate in the roundtable discussions. RSM results will be summarized for a STO Meeting Proceedings Publication.

General Scope and Meeting Objectives

This RSM will be held in conjunction with the 56th AVT Panel Business Meeting (PBM) with an objective to discuss and prioritize **Platform Implications for Hybrid Space Architectures for NATO Missions**, which is vital for NATO's defense capabilities.

NATO is critically dependent on space capabilities and services to conduct military missions and related responsibilities of the Alliance in a responsive and efficient manner. These missions include homeland and global security, out-of-area peace-keeping missions with rapid reaction forces, and asymmetric warfare. NATO STO (previously known as RTO) has been involved in space technology development and enhancing its usage since its early days. Most of the STO Scientific and Technical Committees

(particularly SCI, AVT, SET) have technical teams managing space related research work. As such, this cross-STC activity is encouraged and prioritized in the NATO STO context. With the establishment of space forces particularly in USA the topic received further interest to enhance the development of space capabilities and services. Recent success of constellations of small satellites and increased number of affordable access to space has further increased the need and value to be gained from collaborative space assets. The AVT STC has been engaged in advancements in small satellites (Smallsat) platforms, since early 2000s. A series of consecutive ETs, RWSs and RSMs have taken place, last one being the AVT-336 on Enabling Platform Technologies for Resilient Small Satellite Constellations for NATO Missions. Topic of Hybrid Space Architecture (HSA) is one of the most important topics emerged from discussions held during RSM of AVT-336 held in 2021, and the importance of this topic was validated by the AVT-ET-233 technical team. Furthermore, the current NATO ACT vision of cyber and space is also strongly supporting the need for HSAs for NATO missions.

The technical team will conduct a Research Specialists' Meeting (RSM) to assess platform implications to implement Hybrid Space Architectures for NATO Missions. The HSA is the integration of emergent Smallsat capabilities with traditional government large space systems. HSA links multiple satellites assets and satellite constellations, as well as ground communications systems using all available data links, including laser, radio frequency, military tactical data links and ground segment wired networks. HSA is to provide resilient system architecture that uses various networks for rapid and secure data exchange among large and small satellite systems operated by government and commercial from NATO member states; in various, diverse, and layered orbits. The architecture shifts from a platform-centric to an information-centric paradigm. HSA is expected to dramatically improve deterrence and resilience in space systems while providing access to new information that benefit NATO missions. HSA is to provide strength in numbers and diversity of usable space assets, mitigating the inherent vulnerability with small numbers of high value assets in the current architecture. Such system allows for more rapid collection and dissemination of vital information to the warfighter, as well as rapid insertion of new technologies. Furthermore, HSA is to improve decentralized interoperability among national military assets, civilian capabilities and commercial space systems. This RSM will provide participating nations the opportunity to share, evaluate and improve HSAs by reviewing the state-of-the-art, identifying technology gaps, discussing potential solutions for technical challenges. Knowledge transfer will support the direction of future research, technology development and reduce the duplication of effort, if any.

Roundtable discussions will focus on evaluating the stat-of-the-art and improving technical challenges that needs to be resolved for optimized implementation of HSA for NATO defence. These discussions will help nations understand how to optimize resources and build consensus on best management practices while providing credibility for engagement with environmental authorities and the public. This RSM will be of interest to all NATO members, as well as space systems manufacturers, procurement agencies and users, research/testing laboratories and environmental officers from Defence departments and law enforcement organisations. The expertise that will be shared will enhance our mutual understanding of HSA and strongly support participating nation's space capability sustainability.

Following the RSM the Technical Programme Committee will disseminate the results in a final summary report detailing the current state-of-the-art information with recommendations for modifications to current procedures or new approaches discussed.

RSM Topics

Interested speakers are invited to submit papers on the following topics:

- Multi-path, adaptive, secure communications, open mission systems, common standards
- Edge processing, autonomous command and control/tip and cue, artificial intelligence, distributed ledgers, and reliance of on-board computational architecture.
- Dynamic tasking algorithms allows adaptive mission planning using diverse asset capabilities
- Technologies that enable secure operations, prevent cyber-attacks, and ensure data integrity
- Rapid access to space, rocket payload integration strategies for hybrid space architecture
- Low-cost commercial bulk launch, responsive and resilient small launch
- Platform precision position and vector sharing requirements for hybrid missions.
- Platform – Sensor compatibility, Distributed operations, Fractioned sensors and data fusion solutions, reinforcement Learning in Orbital Servicing
- Commercial/Military constellation for on-board computational architecture
- Mission level autonomy for constellation and survivability of mission operations
- Intersatellite links for multi-orbit constellation
- Cloud-based systems to realize platform-centric to information-centric paradigm to improve resilience in space system

- Platform implications for HSA for hypersonic missile defence

In addition to above topics, the scope of this RSM could include any other relevant technical fields that may be discussed to realize the potential of HSA for military applications.

Background and Justification - Relevance to NATO

Space is considered a highly dynamic and rapidly evolving area essential to NATO's deterrence posture and defence capabilities. In 2019, NATO's Space Policy recognized space as a new operational domain, similar to the air, land, sea and cyber domains. This Space Policy provides guidelines for space systems to ensure that space assets are able to provide timely communications, navigation and intelligence for NATO missions. Through the use of advanced satellite systems, NATO is able to respond with greater speed, effectiveness, efficiency and precision, in addition to cost-effectiveness.
NATO Member and commercial space capabilities are vital and central to NATO operations and their economic security. They are increasingly threatened militarily by potential adversaries. To meet these challenges and retain NATO primacy in space, NATO bodies should partner with the space industry to rapidly transition to a Hybrid Space Architecture (HSA).

The HSA is the integration of emergent Smallsat capabilities with traditional government large space systems. HSA links multiple satellites assets and satellite constellations, as well as ground communications systems using all available data links, including laser, radio frequency, military tactical data links and ground segment wired networks. HSA is to provide resilient system architecture that uses various networks for rapid and secure data exchange among large and small satellite systems operated by government and commercial from NATO member states; in various, diverse, and layered orbits. The architecture shifts from a platform-centric to an information-centric paradigm. HSA is expected to dramatically improve deterrence and resilience in space systems while providing access to new information that benefit NATO missions. HSA is to provide strength in numbers and diversity of usable space assets, mitigating the inherent vulnerability with small numbers of high value assets in the current architecture. Such system allows for more rapid collection and dissemination of vital information to the war fighter, as well as rapid insertion of new technologies. Furthermore, HSA is to improve decentralized interoperability among national military assets, civilian capabilities and commercial space systems.

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AVT-417 Technical Programme Committee

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Deadlines and Preliminary Schedule

Nov 2024 — **Distribution of Call for Papers**
To solicit abstracts from NATO nations, Australia, Japan and New Zealand
After: authors to send their abstracts to the Programme Committee Co-Chairs.

14 Feb 2025 — **Deadline for Abstract Submission**
For U.S. Authors and non U.S. Authors Affiliated with U.S. Organizations: Special conditions apply (See Annex 3)
Deadline for all authors to submit abstracts to the Programme Committee
After: Programme Committee to select abstracts and to create the Meeting Programme from selected abstracts

04 Apr 2025 — **Authors Informed of Selection Decision**
Programme Committee to inform selected as well as rejected authors
AVT Executive Office to dispatch authors' information package to selected authors
After: selected authors to prepare their papers, presentation, and clearances

02 May 2025 — **Final Agenda Approved by the Programme Committee**
Programme Committee to finalize the Programme
After: AVT Executive Office to prepare and publish the official Meeting Announcement

20 Jun 2025 — **Submission of Advance Copy of U.S. Papers to U.S. National Coordinator**
Deadline for US authors to submit a copy of their advance paper to the US National Coordinator (special instructions to be issued with authors' information package)

11 Jul 2025 — **Deadline for Advance Copy of Paper Submission**
Deadline for all authors to send an electronic advance copy of their paper and presentations to AVT Executive Office and Technical Evaluator

After: Programme Committee to review all submitted papers and presentations

05 Sep 2025 **Submission of Final Version of all Papers**
Deadline for all authors to send final cleared short/full papers and other author submissions to AVT Executive Office.
After: AVT Executive Office to prerelease all short/full papers on the STO website to make them accessible to all registered participants of the RSM via the STO website

TBD Oct 2025 **Research Workshop to be held in Riga, Latvia**

Day Month 2025 **Submission of Corrected Manuscripts**
Deadline for all short/full papers to be submitted to AVT Executive Office in order to be included in the Meeting Proceedings, which will be made accessible through the STO website

Procedures

Invitation and Abstract Submission

The initial abstract should describe in 1000-1500 words the aim, results and conclusions of the work Abstracts that are longer than the requested 1500 words will not be considered. Inclusion of 1 to 2 figures and/or photographs to support the abstract is recommended. Authors' names, complete email addresses and other pertinent information must be included with the abstracts. For this purpose, please use the Abstract Submittal Form (Annex 1) and keep the size of files less than 2 MB. The full scientific paper (recommended limit of 12 pages) will be requested once the Programme Committee has selected the authors and developed the final agenda for the Meeting.

Please submit your abstract along with the Abstract Submittal Form by no later than 14 February 2025 via email to the Programme Committee Co-Chairs (For U.S. Authors and non U.S. Authors Affiliated with U.S. Organizations, please See Annex 3):

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Security Level, Clearance and Paper Preparation

This RSM is classified as NATO Unclassified – Releasable to Australia, Japan and New Zealand. For details please consult the attached section on NATO and Partner Nations Overview (Annex 2). It is the responsibility of each contributor to fulfil the publication release and clearance requirements of his/her organization/company/affiliation and country to obtain clearance of abstracts and papers as needed. **An official clearance is mandatory in the US (see Annex 3)** and there may also be a requirement in other countries. If in doubt, authors should contact a Programme Committee Member.

Authors of papers selected for presentation and publication will be notified by the Programme Committee by no later than **04 April 2025**. The AVT Executive Office will then send an Authors' Information Package containing templates, detailed instructions concerning the preparation of manuscripts, as well as information about the clearance process to all selected authors.

Eligibility and Participation

Authors are reminded to verify their eligibility based on their nationality before submitting their papers. Submissions from non-invited nations will not be considered, as specified in the Call for Papers and accompanying documentation. Authors are advised to consult the NATO and Partner Nations Overview (Annex 2) to confirm their eligibility.

Travel and Logistics

Authors of contributions selected for presentation will not be financially supported by NATO. Authors are responsible for their own accommodation and travel reservations based on suggestions given in the General Information Package, which will be provided typically 4 months ahead of the event. Expenses for travel and *per diem* costs are the responsibility of each author's organisation and nation.

Important Notice: Authors are highly encouraged to wait until they receive official confirmation of their registration before making any travel or accommodation arrangements. The AVT Executive Office is not liable for any expenses incurred by authors prior to receiving this confirmation.

Best Paper Award

Papers will be evaluated by the Technical Evaluator and Program Committee Members, based on their originality, technical quality, clarity of presentation, and significance of the research in context of NATO AVT. Based on these evaluations, the Co-Chairs will propose to the AVT Awards Sub-Committee the best full paper to receive the AVT-417 Best Paper Award. The Best Paper Award will be announced and awarded during the event.

Contact Information

Any questions about the technical aspects of the scientific programme or the contents of papers should be addressed to the Programme Committee Co-Chairs listed above.

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Questions on the administrative aspects of this Research Specialists' Meeting or requests for further information about STO activities should be addressed to:

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AVT Executive Assistance
NATO/STO Collaboration Support Office
Tel: + 33(0)1 55 61 22 88
Email: Isavela.kontolaimaki@cso.nato.int

Thank you for your contributions
which are very much appreciated by the NATO community.

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The NATO Science & Technology Organization

The NATO Science & Technology Organization (NATO STO) promotes and conducts cooperative scientific research and exchange of technical information amongst NATO nations and NATO partners. Being the largest such collaborative body in the world, the STO encompasses over 5000 scientists and engineers addressing the complete scope of defence technologies and operational domains. This effort is supported by the Collaboration Support Office (CSO), which facilitates the collaboration by organising a wide range of studies, workshops, symposia, and other fora in which researchers can meet and exchange knowledge.

For further information, please consult the STO web site: www.sto.nato.int

The STO website provides a wide variety of information and on-line services ranging from overview information on the organization's mission to news regarding upcoming events. You will find online access to more than 1800 scientific publications, as well as information about current activities.

Applied Vehicle Technology

The Applied Vehicle Technology (AVT) Panel is one of eight Scientific and Technical Committees of the NATO Science and Technology Organization (STO). The AVT Panel comprises of more than 1000 scientists and engineers, strives to improve the performance, reliability, affordability, and safety of vehicles through advancement of appropriate technologies. The AVT Panel addresses platform technologies for vehicles operating in all domains (land, sea, air, and space), for both new and ageing systems.

The members of the AVT community exploit and focus their joint expertise in the following fields:

- Mechanical Systems, Structures, and Materials
- Performance, Stability and Control, Fluid Physics
- Propulsion and Power Systems

For further information please consult the AVT web page.

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Annex 1

Abstract Submittal Form

AVT-417 Research Specialists' Meeting on Platform Implications for Hybrid Space Architectures for NATO Missions

Please attach a copy of this form to each abstract.

TITLE OF PAPER: _____

_____

1. Author Title **Name** **Nationality**

_____

Affiliation**:**

_____

Full Mailing Address:

_____

_____

Telephone / Email address:

_____

2. Author Title **Name** **Nationality**

_____

Affiliation**:**

_____

Full Mailing Address:

_____

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Telephone / Email address:

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3. Author Title **Name** **Nationality**

Affiliation**:**

Full Mailing Address:

Telephone / Email address:

3. Author Title **Name** **Nationality**

Affiliation**:**

Full Mailing Address:

Telephone / Email address:

Please copy as required – recommended not more than 5 authors.

Note bene:
Authors should be listed in the order they will appear on the programme and in the final manuscript. Unless specified otherwise, the first listed author is presumed to be the lead author having the major responsibility regarding content of the paper.

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Annex 2

NATO and Partner Nations Overview with Geographical Abbreviations

NATO NATIONS			
ALBANIA	ALB	LITHUANIA	LTU
BELGIUM	BEL	LUXEMBOURG	LUX
BULGARIA	BGR	MONTENEGRO	MNE
CANADA	CAN	NORTH MACEDONIA	MKD
CROATIA	HRV	NORWAY	NOR
CZECH REPUBLIC	CZE	POLAND	POL
DENMARK	DNK	PORTUGAL	PRT
ESTONIA	EST	ROMANIA	ROU
FINLAND	FIN	SLOVAKIA	SVK
FRANCE	FRA	SLOVENIA	SVN
GERMANY	DEU	SPAIN	ESP
GREECE	GRC	SWEDEN	SWE
HUNGARY	HUN	THE NETHERLANDS	NLD
ICELAND	ISL	TURKEY	TUR
ITALY	ITA	UNITED KINGDOM	GBR
LATVIA	LVA	UNITED STATES	USA

EAPC/PARTNERSHIP for PEACE NATION (PfP)			
ARMENIA	ARM	KYRGYZSTAN	KGZ
AUSTRIA	AUT	MALTA	MLT
AZERBAIJAN	AZE	MOLDOVA	MDA
BELARUS	BLR	SERBIA	SRB
BOSNIA & HERZEGOVINA	BIH	SWITZERLAND	CHE
MACEDONIA	MKD	TAJIKISTAN	TJK
GEORGIA	GEO	TURKMENISTAN	TKM
IRELAND	IRL	UKRAINE	UKR
KAZAKHSTAN	KAZ	UZBEKISTAN	UZB

MEDITERRANEAN DIALOGUE NATION (MD)			
ALGERIA	DZA	MAURITANIA	MRT
EGYPT	EGY	MOROCCO	MAR
ISRAEL	ISR	TUNISIA	TUN
JORDAN	JOR		
ISTANBUL COOPERATION INITIATIVE (ICI) NATION LIST			
BAHRAIN	BHR	SAUDI ARABIA	SAU
KUWAIT	KWT	UNITED ARAB EMIRATES	ARE
QATAR	QAT		

GLOBAL PARTNERS (GP)			
AFGHANISTAN	AFG	KOREA (Republic Of)	KOR
AUSTRALIA*	AUS	NEW ZEALAND	NZL
IRAQ	IRQ	PAKISTAN	PAK
JAPAN*	JPN		

OTHER NATIONS (including CONTACT COUNTRIES)			
ARGENTINA	ARG	CHINA	CHN
BRAZIL	BRA	INDIA	IND
CHILE	CHL	SINGAPORE	SGP

*** Australia and Japan are also referred to as "STO Enhanced Opportunity Partner" Nations (STO EOP Nations)**.

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Annex 3

Special Notice for U.S. Authors and non U.S. Authors Affiliated with U.S. Organizations

When submitting abstracts to the Programme Committee, all U.S. Authors and non U.S. Authors Affiliated with U.S. Organizations must *CC* the following P.O.C.:

NATO S&T Organization US National Coordinator
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All U.S. authors are encouraged to address questions and concerns to the PoC as early as possible to the US Member of the Programme Committee. Delays in meeting deadlines will impact the timely submission of your abstract.

Nota bene: **For selected U.S. and U.S. affiliated Authors**

Regarding the Submission of their Copy of US Paper to US National Coordinator

Selected US authors will receive special instructions on how to submit a copy of their paper to the US National Coordinator. Instructions will to be issued via email by AVT Executive Office within the authors' information package.