



Science and Technology Organization
Collaboration Support Office

Neuilly-sur-Seine – France

NATO Science & Technology Organization (STO)
Collaboration Support Office (CSO)
Applied Vehicle Technology Panel (AVT)

Preliminary Meeting Announcement and

Call for Papers

For AVT-407 Research Workshop (RWS)

on

System Qualification and Certification by Analysis

organized by the Members of the
Applied Vehicle Technology Panel
AVT-407 Programme Committee

to be held in Riga, LATVIA

Date tbd October 2025

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

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

Deadline for submission of abstracts: 02 March, 2025



AVT 407 Research Workshop on System Qualification and Certification by Analysis

Framework of the Meeting

The Applied Vehicle Technology (AVT) Panel is one of the eight Scientific and Technical Committees of the NATO Science and Technology Organization (STO), and it is organizing a Research Workshop (RWS) on the subject of “System Qualification and Certification by Analysis” under its Technical Sub-Committee Performance, Stability & Control, Fluid Physics (PSF).

The meeting is open to NATO Nations and the STO Enhanced Opportunity Partner nations (Australia and Japan). The event is NATO Unclassified. The meeting will be held in Riga, Latvia, during the Fall 2025 AVT Panel Business Week (**date tbd**).

The three day Workshop is planned to have around 20 papers, several of which will be invited and 6 break-out sessions to discuss related themes and challenges. Full Workshop Proceedings will be published on the STO website: <https://www.sto.nato.int>.

General Scope and Meeting Objectives

The AVT-407 Technical Team has been set up to establish a community of interest amongst the NATO scientific community around the theme of System Qualification and Certification by Analysis. To support this ambition the Technical Team will host a research workshop. The workshop has been arranged to:

- Provide an opportunity to gather together experts, specialists and interested stakeholders with an interest in system qualification and certification by analysis;
- Provide a forum to share existing knowledge and practice;
- Identify and prioritize remaining challenges that require further research and development.

The scope of the workshop is broad, covering the use of modelling and simulation to support qualification and certification of land-, air- and sea-based systems. It encompasses all engineering disciplines across the full system lifecycle. The programme committee particularly seeks contributions addressing the following four key thematic areas:

- 1) The development and use of modelling and simulation capabilities in the context of system qualification and certification.



- 2) Model assurance. Tools, methods and processes for establishing stakeholder confidence and credibility in model predictions and the use of model predictions for high-consequence decision making.
- 3) Simulation management, governance and regulation.
- 4) Education and Training.

Workshop Topics

Papers are invited in the areas of:

Modelling and simulation capabilities in the context of system qualification and certification:

- physics based models
- data based models
- coupling of Physics and data based models
- machine learning and artificial intelligence
- digital twins
- model based engineering
- model based systems engineering
- use of physical test data in modelling and simulation
- coupling of physical test and computational modelling
- use of in-service data
- digital thread and digital fabric
- risk and rare event prediction

Model assurance:

- model credibility assurance
- verification and validation
- uncertainty quantification

Simulation governance:

- simulation process and data management
- model and simulation management and governance
- regulatory policy

And education, development and certification of suitably qualified and experienced personnel.



Background and Justification - Relevance to NATO

The threat to NATO and its interests is intensifying and diversifying. Consequently, there is a pressing need to deliver increasingly capable (and consequently complex) systems to the war fighter in shorter time and against a background of constrained budgets. To meet this challenge there is a need to challenge historical processes and explore alternative means of compliance, such as those offered by Digital Engineering in general and Certification by Analysis in particular.

OEMs expend significant effort in demonstrating compliance to governmental requirements that ensure safe operation of equipment for both the military operator and the general public. Currently, much of the compliance to certification regulations is demonstrated through physical experimentation, whether through tests of components and sub-systems in representative laboratory environments or trials of the full system in 'real-world' environments. Such experimentation takes significant time and is costly [1]. Moreover, such testing requires the availability of physical hardware before physical experimentation can begin.

Over the past two decades there has been a transformation of our ability to represent and simulate the full physical behavior of complex systems driven by advances in Digital Engineering. The use of digital engineering technology to support certification has gained increasing attention from both industry and government. Today, sophisticated analytical capabilities, such as computational fluid dynamics (CFD), computational solid mechanics (CSM) and computational electromagnetics (CEM), are routinely used in design offices. Indeed, in many disciplines computational analysis has either replaced or drastically reduced the use of physical test in the early stages of the product development process. Digital transformation has not been limited to computational physics. Recent developments in model-based systems engineering (MBSE) have transformed our ability to represent and experiment with logical and functional architectures. End-to-end digital threads allow for certification artifacts from requirements, planning, simulation analysis and physical testing, to certification/airworthiness reports to be actively managed and configuration controlled for traceability and consistency throughout the product lifecycle. Virtual and augmented reality allow exploration of human factors before the production of physical hardware.

The ubiquitous presence of computational analysis in the early stage of the product lifecycle naturally begs the question 'Could these analytical tools be used to provide compliance evidence during the certification process?'. Despite the potential of analytical tools to address time and cost constraints, and even the ability to start digital testing ahead



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of the delivery of physical hardware, there has been a general reluctance to adopt this approach due to a lack of trust in the accuracy of modeling and simulation. This lack of trust exists in both the modeling community itself, where modelers lack the confidence to make high-consequence decisions based on simulation alone, and within the regulatory community, where accepting the credibility of claims made on modeling and simulation evidence alone is challenging.

Given the continued pressures on time and cost in the acquisition process, the rapid increase in complexity as systems become more and more interconnected and the emergence of numerous novel technologies for which there is no existing historical certification experience there is a need to understand how modeling and simulation can play a greater role in the certification process through Certification by Analysis (CbA). How can we overcome the low trust for high-consequence safety related decision making? What further developments in in engineering simulation Verification, Validation and Uncertainty Quantification (VVUQ) as well as modeling and simulation capabilities are needed? What more should be done to develop confidence in the use of modeling and simulation results as evidence for high-consequence decisions? What additional processes, digital infrastructure and training are required for modeling and simulation generated evidence to be credible in the eyes of the regulator.

[1] R. D. Gregg, "AIAA Forum 360 Panel Discussion on Certification by Analysis," in AIAA Aviation Forum, Atlanta, GA, 2018.



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Deadlines and Preliminary Schedule

November 2024	<p>Distribution of Call for Papers To solicit abstracts from NATO nations, Australia and Japan After: authors to send their abstracts to the Programme Committee Co-Chairs.</p>
02 Mar 2025	<p>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</p>
04 Apr 2025	<p>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</p>
02 May 2025	<p>Final Agenda Approved by the Programme Committee Programme Committee to finalize the Meeting Agenda After: AVT Executive Office to prepare and publish the official Meeting Announcement</p>
20 Jun 2025	<p>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)</p>
18 Jul 2025	<p>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</p>



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- 05 Sep 2025** **Submission of Final Version of all Papers**
Deadline for all authors to send final cleared papers and all other author submissions to AVT Executive Office.
- TBD Oct 2025** **Research Workshop to be held in Riga, Latvia**
- TBD Nov 2025** **Submission of Corrected Manuscripts**
Deadline of 4 weeks for all papers to be submitted to AVT office in order to be included in the Meeting Proceedings, which will be made accessible through the STO website



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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 **02 March 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 Workshop is classified as NATO Unclassified – Releasable to Australia and Japan. 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.



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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.

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.

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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***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, comprising more than 1000 scientists and engineers, strives to improve the performance, reliability, affordability, and safety of vehicles through advancement of appropriate technologies. The 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 site](#).



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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.

**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



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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 usually referred to as “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.:

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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 office within the authors' information package.