



NORTH ATLANTIC TREATY ORGANISATION

SCIENCE AND TECHNOLOGY ORGANISATION

SET-319/RSM SPECIALISTS' MEETING

on

## New Mathematics for Multi-Dimensional Radar Systems

organized by the

**Sensors and Electronics Technology (SET) Panel**



to be held in

**ICMS, EDINBURGH, GBR on 21-23 February 2023**

This Specialists' Meeting is

**NATO UNCLASSIFIED**

**open to STO EOP nations (AUS, FIN, JPN, SWE)**

**plus IRL, KOR, CHE, and ZAF**

**Latest Enrolment Date**

**NATO Nations 20 JANUARY 2023**

**NON-NATO Nations 20 JANUARY 2023**

Enrol on-line at <http://www.sto.nato.int>

**All presentations and discussions will be in English**

**No conference fee for presenters and participants**

## INTRODUCTION

### General Information

A Specialists' Meeting aims at promoting an exchange of state-of-the-art knowledge among an audience of specialists on an important scientific topic to enhance the capability of the NATO S&T community to respond adequately to the NATO requirements.

Attendance at STO Specialists' Meetings is by invitation only from STO National Delegates and from SET Panel Members and will be restricted to citizens from NATO Member Nations, unless otherwise stated.

The Authors will be invited by the Programme Committee that will select Papers, based on submitted Abstracts that are considered suitable for presentation at the Meeting. The Papers and presentations will be delivered only in English. All selected Papers will have to be submitted in their final form.

The audience will include experts from NATO countries and the participation will be validated by the respective National Coordinators.

### S&T Organization in NATO

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.

The mission of the NATO 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 programmes of the Alliance, of the NATO Nations and the partner Nations, in support of NATO's objectives;
- 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;
- Supporting decision-making in the NATO Nations and NATO.

### The Sensors & Electronics Technology Panel

The Sensors and Electronics Technology (SET) Panel is one of the seven Panels under the STB.

The mission of the SET Panel is to foster co-operative research, the exchange of information and the advancement of science and technology among the NATO Nations in the field of sensors and electronics for defence and security. The SET Panel addresses electronic technologies as well as active sensors as they pertain to Reconnaissance Surveillance and Target Acquisition (RSTA),

Electronic Warfare (EW), communications and navigation, and the enhancement of sensor capabilities through multi-sensor integration and fusion.

### SET-319/RSM INFORMATION

#### Background

Nations within NATO and outside are engaged with a long-term and ongoing development of multi-dimensional radar systems: multi-polar, multi-static, multi-channel, multiple frequency bands, and interferometric. The diversity of novel radar systems each has potential advantages in the detection, tracking, recognition, and identification (DTRI) of different threats, including difficult targets, under different circumstances.

With the increased complexity of multi-dimensional radar data, comes new fundamental mathematical challenges – how it is modelled, what information it contains, and how to process or share the resulting new large quantities of data.

#### Objectives

*In conjunction with the Isaac Newton Institute for Mathematical Sciences (INI), the Newton Gateway to Mathematics, and the International Centre for Mathematical Sciences (ICMS), this RSM and Knowledge Transfer workshop seeks to understand the new and cutting-edge mathematics research required to enable, exploit and enhance advanced multi-dimensional radar systems. It will bring together specialists in multi-dimensional radar systems with leading mathematicians across a wide range of applicable disciplines. This will bring about new dialogue between disciplines, breaking down communication barriers to help a greater understanding, and provide the foundations of a new community of practice. It will inform future research and planning within NATO, ongoing mathematics research at the INI, as well as future collaborative and interdisciplinary activities.*

#### Topics to be covered:

The aim of this Specialists' Meeting is to include all relevant aspects of Multi-Dimensional Radar Systems. In particular, radar specialists will brief on challenges and objectives of ongoing research to mathematicians.

A non-exhaustive list of relevant radar topics is as follows:

- SAR/ISAR image formation and feature extraction, including bistatic, multi-static, multi-frequency and fully polarimetric, as well as passive
- Airborne and ground-based multi-dimensional radar systems, including passive and multi-static
- Non-cooperative target recognition theory and algorithms
- Optimal deployment of multi-dimensional, multi-sensor, and multi-platform systems
- Advanced exploitation of multi-dimensional radar, such as imaging and detection through obscurants

A broad range of relevant mathematical topics will be included to meet the radar challenges identified.

## SET-319/RSM Chairs

### Dr. Francis WATSON (GBR)

University of Manchester  
[francis.watson@manchester.ac.uk](mailto:francis.watson@manchester.ac.uk)

### SET- 319/RSM Co-Chair

### Prof. Marco MARTORELLA (ITA)

University of Pisa and CNIT  
[m.martorella@iet.unipi.it](mailto:m.martorella@iet.unipi.it)

### SET-319/RSM Local Host Coordinator

### Ms. Gillian KERR

ICMS  
[Gillian.Kerr@icms.org.uk](mailto:Gillian.Kerr@icms.org.uk)

### Keynote Speakers

### Prof. Alfonso FARINA, (ITA)

### Dr. Elisa GIUSTI, CNIT (ITA)

### Prof. William PARNELL, University of Manchester (GBR)

#### Deadlines:

- US Abstracts submission: **16 NOVEMBER 2022**
- Abstracts submission: **30 NOVEMBER 2022**
- Acceptance notification: **12 DECEMBER 2022**
- US Paper submission: **13 JANUARY 2023**
- Final paper submission: **20 JANUARY 2023**

#### Submissions:

Abstracts and Final Papers should be submitted to:

[francis.watson@manchester.ac.uk](mailto:francis.watson@manchester.ac.uk)  
[m.martorella@iet.unipi.it](mailto:m.martorella@iet.unipi.it)

copied to the SET Panel Assistant:

[SET@csso.nato.int](mailto:SET@csso.nato.int)

This RSM is organised in conjunction with the following Isaac Newton Institute Research Programme:

<https://www.newton.ac.uk/event/rnt/>

Two awards will be given to the overall best paper and to the best young scientist paper. A certificate will be presented to the winners either in person at the NATO SET Panel Business Meeting dinner or sent via mail.

## PRELIMINARY INFORMATION TO PARTICIPANTS

All Authors that wish to be invited to present at the Meeting should send an Abstract as described below. Authors are strongly encouraged to consider open and ongoing challenges and efforts which might benefit from mathematical collaboration, so submitted abstracts do not need to be restricted to completed research.

The Gateway and Chairs will use submitted abstracts to understand mathematical topics needed to be represented. Some authors may be contacted for further details and discussion to help this. This RSM will also involve panel discussion and breakout sessions, increasing involvement of non-presenting participants.

The Authors selected by the Programme Committee will receive the Instruction for Authors Package from SET Panel office concerning the details of the Paper/presentation, publication, etc.

Please note that the Authors of Papers selected for presentation will not be financially supported by this Organization. However, some support for travel and accommodation is available from the INI and ICMS. This may need to be prioritised e.g. to authors, early career researchers, INI programme participants etc. Please contact the Local Host Coordinator and Chairs to enquire.

### ABSTRACTS

All Abstracts of Papers must be submitted by the deadline stated in the Preliminary Schedule.

Non-US Authors must send the Abstract by e-mail as PDF to both:  
SET-319/RSM Chair: Dr Francis Watson (GBR):

[francis.watson@manchester.ac.uk](mailto:francis.watson@manchester.ac.uk)

[m.martorella@iet.unipi.it](mailto:m.martorella@iet.unipi.it)

SET Panel Executive Assistant: [SET@csso.nato.int](mailto:SET@csso.nato.int)

US Authors and Non-US Citizens affiliated with US organizations please see the Note below.

The Abstracts (length: 200-500 words) should contain the following information:

- SET-319 Specialists' Meeting on **"New Mathematics for Multi-Dimensional Radar Systems"**
- TITLE OF ABSTRACT/PAPER
- Name of Author/Co-Author(s) Company/Affiliation, complete mailing addresses, telephone, Fax and e-mail addresses
- CONTENT - scope of the contribution, relevance to the Meeting, rationale, conclusions

### NOTE:

SPECIAL NOTICE FOR US AUTHORS AND NON US CITIZENS AFFILIATED WITH US ORGANIZATIONS

Abstracts of Papers from the US must be sent **ONLY** to the following POC:

NATO CSO US National Coordinator

Country: United States

Phone: +1 703 614-2938 or + 1 703 639 1578

Email: [osd.pentagon.ousd-atl.mbx.usnatcor@mail.mil](mailto:osd.pentagon.ousd-atl.mbx.usnatcor@mail.mil)

All US Authors must include the following statement in a covering letter:

- The work described in this Abstract is cleared for presentation to NATO audiences
- The Abstract is technically correct
- If work is sponsored by a government agency, identify the organization and attest that the organization is aware of submission
- The Abstract is NATO Unclassified; and
- The Abstract does not violate any proprietary rights. requirements, US Authors are encouraged to contact the US POC as early as possible. Delays in meeting POC deadlines will impact the timely submission of your Abstract.

NOTE: 1. Only complete packages (Abstract plus all items listed above) will be accepted by the US POC.

2. After review and approval, the US POC will forward all US Abstracts with the Details of Authors Form to the SET Panel Executive Assistant. All US Abstracts must be received directly from the US POC. US Abstracts will not be accepted directly from Authors.

**Enrolment must be made via internet only at**

<https://events.sto.nato.int>

**Note: if you enrolled for other RTO-STO activities in the past, please use the same e-mail address as previously. If your e-mail address has changed, please inform the CSO contact before enrolling.**

**Enrolment Deadline – 20 January 2023**

**If you are unable to enrol via the internet, please contact the SET PANEL Executive Assistant: [SET@csso.nato.int](mailto:SET@csso.nato.int)**



**NATO Collaboration Support Office (CSO) – SET Panel Office**

**Lt.Col. Isidoro MARCONE (ITA)**

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