SCIENCE AND TECHNOLOGY ORGANIZATION

CENTRE FOR MARITIME RESEARCH AND EXPERIMENTATION

# CALL FOR PAPERS

## NATO Science and Technology Organization
## Centre for Maritime Research and Experimentation

## 1st MARITIME SITUATIONAL AWARENESS WORKSHOP (MSAW 2019)
## *Science and technology meet operational needs*

MSAW 2019

**to be held in**

**Villa Marigola, Lerici (La Spezia), Italy**
**8–10 October 2019**

**DEADLINE FOR RECEIPT OF MANUSCRIPTS**
**31 MAY 2019**

This workshop is organized by the NATO STO **Centre for Maritime Research and Experimentation (CMRE)** with the support of the **EU Horizon 2020 programme**.
Participation is open to all the specialists from the maritime domain.

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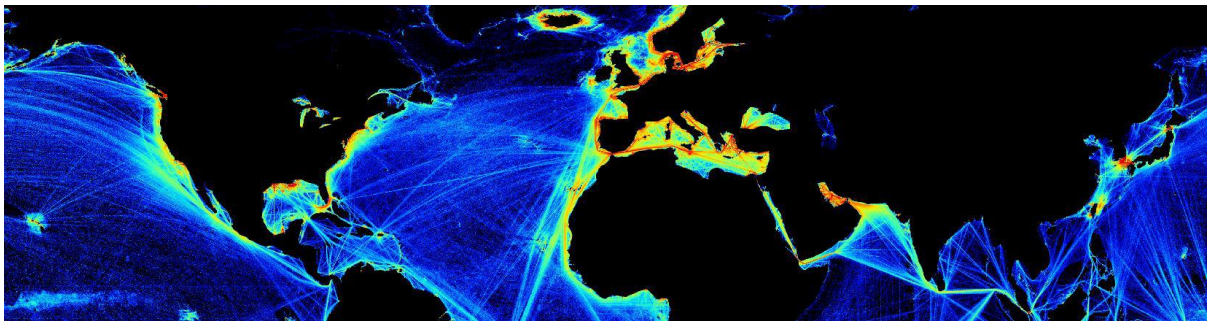
# MARITIME SITUATIONAL AWARENESS WORKSHOP (MSAW 2019)

The NATO Science and Technology Organization Centre for Maritime Research and Experimentation (STO-CMRE) is organizing a workshop to present and discuss advanced technologies, innovative concepts, and emerging scientific challenges with respect to current and future Maritime Situational Awareness (MSA) operational needs. MSAW 2019 foresees productive collaboration and synergistic discussion among MSA specialists from technical and non-technical areas.

With the theme ***"Science and technology meet operational needs"***, MSAW 2019 will encourage engagement with operational experts and scientists from national governments, military, academia and industry to discuss their respective challenges regarding MSA. The objective of MSAW 2019 is to foster the cross-fertilization of ideas from scientific and military domains, toward the design and implementation of future solutions tailored to MSA operational needs.



## THEME

***Science and technology meet operational needs***

MSA supports effective and efficient **decision making** and enables **maritime operations** to preemptively identify emerging safety, security or environmental issues so that a **timely** intervention is possible. MSA highly depends on the ability of sensing, collecting and processing technologies to handle the **big data challenges** brought by the ever increasing **volume, velocity and variety** of data, which often lack **veracity.**

Information **relevant** to the operation is collected from **networked sources** (sensors and non-sensors), and processed to provide an ideally robust, complete, and coherent **maritime picture**. Additionally, MSA tasks aim at establishing **patterns of life**, against which **anomalies** can be identified. The maritime picture correlated with other **background** information supports the detection, tracking, assessment, and prediction of **illicit activities** as well as **safety**-related events.

Understanding the maritime situation enables decision makers and emergency responders to focus on relevant events, to prevent malevolent acts, to minimize the impact of a possible threat, and/or to intervene in a timely manner. To reach a **common** and **comprehensive understanding** of the maritime operational environment, accurate, timely and **standardized** information need to be shared among nations, partners and civilian agencies, providing the required **information superiority** to successfully conduct maritime operations.

From coastal radar to satellite imagery, developments in **Intelligence Surveillance and Reconnaissance (ISR)** technology promise complementary and possibly persistent surveillance capabilities to build the maritime picture. This includes sensor technology deployed onboard **Maritime Unmanned System (MUS)**, such as Unmanned Surface

Vehicles (USV) and Unmanned Underwater Vehicles (UUV). These have recently demonstrated high performance in terms of scalability, adaptability, robustness, persistence and reliability. Deployed within a monitoring region, MUSs can cooperatively form heterogeneous **intelligent networks** to detect, localize, and classify targets. Opening up to new operating scenarios, MUSs introduce also new scientific and technological challenges on autonomy, distributed and collective intelligence and sensing, data fusion, detection and tracking.

At the front-end of sensor systems (radar, sonar, camera, etc.) is **signal processing**, which builds mathematical models to investigate the principles of detection, localization, tracking and classification of targets. By associating and combining measurements of different sensors, **data fusion** techniques help to build a coherent and clear picture of a region of interest wherein multiple objects appear, move and disappear.

At the same time, in the **era of big data**, processing infrastructures provide an unprecedented capability to gather, store and process massive amounts of data in real-time. In the maritime domain, sources are heterogeneous and provide data in many formats (structured or unstructured); moreover, data are often intermittent, sparse and noisy. **Computational scalability** and **data models** allow cueing together all the available data, discovering (otherwise hard to find) patterns.

While humans can leverage from their experience to distinguish between normal and anomalous patterns, such interpretation and contextualization capabilities are everything but immediate for machines. **Artificial Intelligence (AI)** aims at mimicking some human cognitive abilities to automate routine tasks in an efficient way. **Machine learning** focuses on the learning process from large amounts of data, to further perform classification or prediction tasks. Supervised machine learning, such as **deep learning** techniques, together with unsupervised approaches, such as **clustering**, have recently demonstrated that significant improvements are possible in the maritime domain (e.g., ship classification, maritime traffic characterization and pattern recognition).

Other AI approaches can support **understanding** by bringing transparency, interpretation, or explanation to reasoning and decision making, addressing cognitive tasks such as vessels behaviour analysis or intent assessment. Additional to automated reasoning and **uncertainty** handling, **knowledge representation** can provide harmonized and rationalized terminology of the maritime domain, required for information sharing environments or integrating solutions toward **technical**, **procedural** and **human maritime interoperability**.

To improve **human-machine teaming, knowledge acquisition** techniques can bring the human “in the loop” in the early stages of the system design. Capturing knowledge and know-how in a structured and reproducible way helps in the understanding of specific aspects, such as procedures of maritime operations, information needs, and cognitive bias.

In this perspective, the achievement of MSA requires a **multi- and interdisciplinary approach**, spanning several fields including, but not limited to sensing technologies, signal processing, unmanned systems, data fusion, machine learning, big data, artificial intelligence, and applied human factors.

## OBJECTIVE

Focusing on **Maritime Situational Awareness**, the objective of MSAW 2019 is to bring together scientists, engineers, researchers from scientific communities with national and international authorities, end users and operators, and industrial representatives. MSA specialists will present and discuss scientific and operational challenges, advanced technologies and knowledge gaps, in order to facilitate future collaboration and research activities. MSAW 2019 encourages contributions from EU H2020 projects, as well as other research initiatives, to present on-going progress, results, and/or live demos.

## TOPICS

### Big data in the maritime domain

- Infrastructure and management
- Data modelling and visualization
- ICT and cyber security
- All-source integration and interoperability
- Scalable and computational methods

### Machine learning in the maritime domain

- Pattern recognition and prediction
- Anomaly detection
- Knowledge discovery and clustering
- Deep learning
- Benchmarks and testbeds

### Signal processing and data fusion

- Space-based/airborne radar
- Passive and multistatic radar and sonar
- High-resolution radar imaging
- Image and video processing
- Target detection, tracking, and classification
- Remote sensing

### Maritime Unmanned Systems

- Unmanned Underwater/Surface/Aerial Vehicle technologies
- Applied robotic and autonomy
- Cooperative multi-agent systems
- Networked intelligence
- Distributed signal processing and fusion

### Artificial Intelligence in the maritime domain

- Knowledge acquisition, representation and reasoning
- Uncertainty modelling and management
- Semantic analysis and MSA vocabularies
- Human and open-source intelligence processing
- Decision making under uncertainty

### Support to maritime operations

- Intelligence Surveillance and Reconnaissance
- Search and rescue mission support
- Threat assessment
- Critical infrastructure protection (e.g. underwater cables)
- Border control and anti-piracy

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## STRUCTURE OF THE WORKSHOP

MSAW 2019 will be organized around a spectrum of scientific presentations, keynote talks, plenary sessions with a large room for discussions and questions. The event will close with a panel discussion of (scientific, operational, industrial) experts summarizing the main outcomes of the three days and identifying the way ahead for MSA research.

| | |
|---|---|
| **Day 1:** | Opening keynote and first presentations of invited/ submitted papers. |
| **Day 2 - Morning:** | Second keynote and presentations of invited/submitted papers. |
| **Day 2 - Afternoon:** | Presentations of invited/submitted papers. |
| **Day 3 - Morning:** | Third keynote, fourth keynote on EU H2020 RANGER Project and presentations of invited/submitted papers. |
| **Day 3 - Afternoon:** | EU H2020 RANGER and other EU Projects booth session, panel and closing event. |

## KEYNOTE SPEAKERS

MSAW 2019 will host keynote speeches from some of the most authoritative and renowned scientific experts in the fields of data fusion, surveillance, and radar.

| **Prof. James Llinas** | **Prof. Dr. Wolfgang Koch** | **Dr. Alfonso Farina** |
|---|---|---|
| University at Buffalo | Fraunhofer FKIE | Consultant, Leonardo S.p.A. |

| *Day 1* | *Day 2* | *Day 3* |
|---|---|---|
| *Registration* | *Registration* | *Registration* |
| | *Keynote 2* | *Keynote 3* |
| | *Plenary:* *Presentations* | *Keynote 4 :* **EU H2020 RANGER Project** |
| | | *Plenary : Presentations* |
| | *Lunch* | *Lunch* |
| *Opening keynote* *Presentations* | *Plenary:* *Presentations* | **EU H2020 RANGER and other EU projects booth session** |
| | | *Experts panel* *Closure* |
| *Icebreaker* | *Reception* | |

## INSTRUCTIONS FOR AUTHORS

The Programme Committee invites scientists, engineers, managers and operators from governments, military, academia and industry to submit manuscripts to be considered for the MSAW. The papers should describe the scope of the contribution, the relevance to the meeting in line with (but not limited to) the MSA topics outlined in this announcement for paper, aim, method, results and conclusions of the work. Inclusion of figures and/or photographs to support the work is encouraged.

Submissions content:

- Title of the abstract
- Authors names, affiliation and email address
- Manuscript between 2 and 5 pages, including figures and bibliography.

Authors of selected papers will be invited to send a final version of their work together with the copyright form, following the instructions available at https://www.cmre.nato.int/msaw. Accepted papers will be presented at the MSAW and published in the MSAW proceedings.

## CLEARANCE OF PAPERS/ABSTRACTS

It is the responsibility of each contributor to fulfil the publication release requirements of his/her organization/company and country and to obtain the mandatory clearance of abstracts, papers and presentations.

## PRELIMINARY SCHEDULE

| | | |
|---|---|---|
| **31 May** | 2019 | Paper Submission |
| **30 June** | 2019 | Rejection/Acceptance Notification |
| **30 June** | 2019 | Registration Open |
| **15 July** | 2019 | Final Version and Copyright Transfer |
| **08 Sep** | 2019 | Registration Closed |