MARITIME SITUATIONAL AWARENESS WORKSHOP (MSAW'19), OCTOBER 7–9, 2019, LERICI, ITALY

Maritime Situational Awareness (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. To reach a common and comprehensive understanding of the maritime operational environment, accurate, timely, and standardized information needs to be shared among nations, partners, and civilian agencies, providing the required information superiority to successfully conduct maritime operations. 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. 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. 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, data fusion, unmanned systems, machine learning, big data, artificial intelligence, and applied human factors.

Between October 7–10, 2019, the North Atlantic Treaty Organization (NATO) Science and Technology Organization-Centre for Maritime Research and Experimentation (STO-CMRE) hosted the Maritime Situational Awareness Workshop 2019 (MSAW'19) at the Villa Marigola in Lerici, La Spezia (Italy). The aim of this workshop was to present and discuss advanced technologies, innovative concepts, and emerging scientific challenges with respect to current and future MSA operational needs. Under the theme *Science and technology meet operational needs*, the MSAW'19 thus aimed at encouraging engagement with operational experts and scientists from national governments, military, academia, and industry to discuss their respective challenges regarding MSA. The objective of MSAW'19 was then 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.

The MSAW'19 brought together about 170 participants from 23 countries, including 18 NATO nations and 14 nations from the European Union (EU). All five continents were represented and brought together scientists, engineers, researchers from scientific communities with national and international authorities, end users, operators, and industrial representatives: 14% from academia, 39% from applied research institutes, 31% from industry, and 16% from the operational community. The technical program mixed highly technical scientific contributions with implementation perspectives from industry and standpoints from operations, offered as 42 oral presentations, 12 posters, and six technical booths.

MSAW'19 kicked off with both a welcome and opening session chaired by Dr. Catherine Warner, Director of CMRE. Four keynote talks were provided by distinguished experts of radar signal processing, information fusion, target tracking, and data fusion: Dr. Alfonso Farina and Sergio Gallone, Leonardo S.p.A., and Massimo Comparini, e-GEOS Chief Executive Officer, Telespazio Head of Line of Business Geoinformation, shared the floor for opening the workshop with the presentation entitled "Maritime Surveillance: Radar Technologies and Scenario Characteristics". Dr. James Llinas, Emeritus Professor at the State University of New York at Buffalo, in Buffalo, NY, presented remotely in the afternoon of the first day about "Re-Examining Fusion-Sensemaking-Decision-Making Interdependencies Again". Dr. Felix Govaers, Deputy Head of Department Sensor Data and Information Fusion at Fraunhofer In-

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Villa Marigola in Lerici.

Workshop participants at MSAW'19.

stitute FKIE, in Bonn, Germany, keynote speaker of the second day, talked about "Push and Pull in Digitalization: Technology Drivers for Sensor Data Fusion". Mr. John Waterston, Program Manager in the Strategic Technology Office at the Defense Advance Research Program Agency, US, concluded the keynote talks on the last day, presenting "Ocean of Things". Four projects funded by the European Commission were presented: "RAdars LoNG Distance Maritime SurveillancE and SaR Operations" (RANGER), cosponsor of this workshop, "MARitime

Alfonso Farina (center), Sergio Gallone, and Massimo Comparini, who presented on "Maritime Surveillance: Radar Technologies and Scenario Characteristics".

Integrated Surveillance Awareness" (MARISA), "Coordination of Maritime Assets for Persistent and Systematic Surveillance" (COMPASS2020), and Arctic and North Atlantic Security and Preparedness Network (ARCSAR), presented remotely from Iceland.

On the second day of the workshop, Fabio Marziani of the NATO Communications and Information Agency (NCIA) chaired a session on NCIA's 2019 Defence Innovation Challenge that focused on challenges of the High North including improvements to MSA capability. The winning entry was "Dual-use of AIS Data, Combining AIS Tracking with Social Network Analysis for Increased Maritime Network Awareness" submitted by the US Navy Post Graduate School and Norway's defense research agency Defence Research Establishment (FFI). A brief on the project was presented by Dagfinn Vatne of FFI. The concept presented was to combine historical and live automatic identification system (AIS) data with social network analysis (SNA), in order to identify and geolocate suspicious actors. Other NCIA Defense Innovation Challenge winners were also present at the workshop and presented several posters on their work.

The workshop closed with an expert panel animated by Dr. Sandro Carniel (Head of Research, CMRE) with interventions of Cpt. Jehan-Christophe Charles (Ret., French Navy), Cdr. Jorge Martinez (Spanish Navy, NATO Combined Joint Operations from the Sea Centre of Excellence), Lt. Cdr. Ivo Musulin (HRV Navy, NATO Shipping Centre, MARCOM), and Guy Thomas (DCSA, MBA, Advisor for Maritime Situational Awareness, Multinational Maritime Security Centre of Excellence). Experts provided their views on the most promising technologies to support MSA, the topics where more research effort should be allocated, and the main challenges for MSA.

The MSAW'19 was cosponsored by the EU Horizon 2020 project RANGER and NATO Allied Command Transformation (ACT) as part of the CMRE Data Knowledge Operational Effectiveness (DKOE) project.

Papers and presentations are available at www.cmre.nato.int/msaw-2019-home.