MARESEC 2022

European Workshop on ***Maritime Systems Resilience and Security***

The second **European Workshop on Maritime Systems Resilience and Security** (MARESEC) was dedicated to the research on Resilience, Security, Technology and related Ethical, Legal, and Social Aspects (ELSA) in the context of Maritime Systems, including but not restricted to (Offshore/Onshore) Infrastructures, Navigation and Shipping and Autonomous Systems.

The event, which was organized by the Institute for the Protection of Maritime Infrastructures of the German Aerospace Center (DLR), occurred in a hybrid manner on June, 20th 2022. It counted on 79 participants online and onside at the Fischbahnhof, Bremerhaven, Germany. Out of all submitted extended abstracts, 24 submissions had been selected for presentation. Additionally, 2 works of undergraduate and graduate students have been presented (the final schedule can be found in the appendix). The authors are affiliated to institutions from Canada, Egypt, Finland, Germany, Greece, Norway, Poland, Switzerland, United Kingdom, United States.

From the **submitted full papers**, 17 works have been selected for publication. These works are as follows:

Alexandra Plein, Peter Danielis and Helge Parzyjegla
Networking Autonomous Underwater Vehicles to Automize Cooperative Missions

Enno Peters, Niklas Peinecke, Thomas Lüken and Maurice Stephan
Simulation of a Gated-Viewing instrument for helicopter deck-landing assistance and vision enhancement

Jan Löwenstrom, Edgardo Solano-Carrillo and Jannis Stoppe
Learning Representative Vessel Trajectories Using Behavioral Cloning

Filippo Giacomo Rizzi, Niklas Hehenkamp, Lars Grundhöfer and Stefan Gewies
Improving MF R-Mode ranging performance with measurements based ASF

Tuula Hakkarainen, Alexandra Viitanen, Timo Korhonen, Terhi Kling and Antti Korkealaakso
Fire Simulations of a Container Ship with FRP Structures

Felix Sattler, Sarah Barnes, Borja Carrillo-Perez, Karsten Stebner, Maurice Stephan and Gregor Lux
Real-time embedded reconstruction of dynamic objects for a 3D maritime situational awareness picture

Jason Halog, Michael Stadermann and Paul Margat
Legal Challenges for the Law of the Sea in the Light of Disruptive Technologies – Modular and Autonomous Submarines

Sven Bergmann, Matthias Brenner, Jennifer S. Strehse, Tobias Bünning, Edmund Maser, Philipp Grassel, David Heuskin, David Brandt, Marco Berger, Simon van der Wulp, Matthew Skelhorn, Polly Hill, Sven Van Haelst, Maarten De Rijcke, Uwe Wichert
North Sea Wrecks - An interdisciplinary approach towards understanding the risks posed by wrecks containing munitions in the North Sea

Victor Bolbot, Sunil Basnet, Hanning Zhao, Osiris Valdez Banda and Bilhanan Silverajan
Cybersecurity analysis of remote pilotage functions

Peter Danielis, Gunnar Kulat, Mohammad Salouh, Finn Ole Stadtaus, Lara Tauch and Helge Parzyjegla
Mission Planning and Motion Models for Autonomous Underwater Vehicles in OMNeT++

Nikolai Kulev and Frank Sill Torres
Investigation of high-impact low-probability disturbances in offshore wind farms

Habbo Cramer, Annika Fitz, Arto Niemi, Bartosz Skobiej and Frank Sill Torres
Estimating Hydrogen Usage of a Crew Transport Vessel Fleet for Offshore Windfarm Maintenance

Merlin von Rechenberg, Nina Rößler, Mari Schmidt, Florian Motz, Elmar Padilla and Jan Bauer
Guiding Ship Navigators through the Heavy Seas of Cyberattacks

Egbert Schwarz, Sergey Voinov and Detmar Krause
Usability of Medium Resolution Optical Remote Sensing Images for Anomaly Detection in Maritime Surveillance Applications

Babette Tecklenburg, Alexander Gabriel and Frank Sill Torres
Modeling unauthorized access to offshore platforms using a Bayesian network

David Freiknecht, Marc Lehmann and David Müller
Establishing Responsive Space: A Maritime Situational Awareness Experiment

Aud Marit Wahl, Trond Kongsvik and Gunnar M. Lamvik
Operational management of automated ships: A need for new competence and skills?

The following table lists all **reviewers**:

Name	**Affiliation**	**Country**
Alexander Gabriel	German Aerospace Center (DLR)	GER
Aljoscha Windhorst	German Aerospace Center (DLR)	GER
Arto Niemi	German Aerospace Center (DLR)	GER
Babette Tecklenburg	German Aerospace Center (DLR)	GER
Bartosz Skobiej	German Aerospace Center (DLR)	GER
Bernhard Berger	Hamburg University of Technology	GER
Carl Wrede	German Aerospace Center (DLR)	GER
Colin von Negenborn	Kiel University (CAU)	GER
Daniel Lichte	German Aerospace Center (DLR)	GER

David Heuskin	German Aerospace Center (DLR)	GER
Dennis-Kenji Kipker	University of Bremen	GER
Dieter Kraus	Bremen University of Applied Sciences	GER
Edgardo Solano Carrillo	German Aerospace Center (DLR)	GER
Enno Peters	German Aerospace Center (DLR)	GER
Eva Schmitt	Federal Office of Civil Protection and Disaster Assistance (BBK)	GER
Frank Fiedrich	University of Wuppertal	GER
Frank Sill Torres	German Aerospace Center (DLR)	GER
James Imber	German Aerospace Center (DLR)	GER
Jannis Stoppe	German Aerospace Center (DLR)	GER
Josef Oehmen	Technical University of Denmark	DK
Kari Koskinen	Tampere University	FIN
Karin Bernsmed	SINTEF	NOR
Karsten Sohr	University of Bremen	GER
Maarten Schadd	TNO	NL
Maurice Stephan	German Aerospace Center (DLR)	GER
Michael Stadermann	German Aerospace Center (DLR)	GER
Nicola Wendt	German Aerospace Center (DLR)	GER
Nikolai Kulev	German Aerospace Center (DLR)	GER
Peter Danielis	University of Rostock	GER
Rikke Bjerg	University of London	UK
Roberto Galeazzi	Technical University of Denmark	DK
Rory Hopcraft	University of Plymouth	UK
Sarah Barnes	German Aerospace Center (DLR)	GER
Sergey Voinov	German Aerospace Center (DLR)	GER
Stanislaw Iwan	Maritime University of Szczecin	POL
Stefanie Schubert-Polzin	Magdeburg-Stendal University of Applied Sciences	GER
Sylvia Bach	University of Wuppertal	GER
Tobias Meisen	University of Wuppertal	GER
Yannik Steiniger	German Aerospace Center (DLR)	GER

In the name of the whole organizing team we thank all authors and reviewers for their effort and the technical team for their valuable support.

Arto **Niemi** – Publication chair
Verena **Nickel** – Local chair
Frank **Sill Torres** – General chair
Yannik **Steiniger** – Program chair

Schedule of the 2nd European Workshop on Maritime Systems Resilience and Security (MARESEC 2022)

Session 0 – Welcome

Time	09:00 – 09:10	
Room	MARESEC main	
Session Chair	Yannik Steiniger	

Session A1 – Maritime Security

Time	09:10 – 10:50		
Room	Ocean		
Session Chair		Bartosz Skobiej	
ID	**Start**	**Title**	**Authors**
A1-1	09:10	North Sea Wrecks - An interdisciplinary approach towards understanding the risks posed by wrecks containing munitions in the North Sea	Sven Bergmann, Matthias Brenner, Jennifer S. Strehse, Tobias Bünning, Edmund Maser, Philipp Grassel, David Heuskin, David Brandt, Marco Berger, Simon van der Wulp, Sven Van Haelst, Maarten De Rijcke and Uwe Wichert
A1-2	09:30	Qualitative effectiveness assessment and categorization of security measures in the offshore context	Alexander Gabriel, Babette Tecklenburg and Frank Sill Torres
A1-3	09:50	Regulating vessel-based armouries as a means to increase maritime security in high risks areas	Hugo Blom, Stavros Karamperidis, Fotios Moustakis, Konstantinos Tsetsos, Tim Tepel, Nicola Wendt and Carl Wrede
A1-4	10:10	Guiding Ship Navigators through the Heavy Seas of Cyberattacks	Merlin von Rechenberg, Nina Rößler, Mari Schmidt, Florian Motz, Elmar Padilla and Jan Bauer
A1-5	10:30	Usability of Medium Resolution Optical Remote Sensing Images for Anomaly Detection in Maritime Surveillance Applications	Egbert Schwarz, Sergey Voinov and Detmar Krause

Session A2 – Sensors

Time	11:10 – 12:30		
Room	Ocean		
Session Chair		Borja Jesus Carrillo Perez	
ID	**Start**	**Title**	**Authors**
A2-1	11:10	Simulation of a Gated-Viewing instrument for helicopter deck-landing assistance and vision enhancement	Enno Peters, Niklas Peinecke, Thomas Lüken and Maurice Stephan
A2-2	11:30	Validation of a probabilistic Model for the consideration of Rain and Target Reflection Effects within Maritime 3D LIDAR Simulations	Marvin Bathmann and Sebastian Feuerstack
A2-3	11:50	Improving MF R-Mode ranging performance with measurements based ASF	Filippo Giacomo Rizzi, Niklas Hehenkamp, Lars Grundhöfer and Stefan Gewies
A2-4	12:10	Integration of a flow optimized transmission sensor into an AUV	Max Anders, Jendrik Schmidt, Marco Berger and Enno Peters

Session B2 – Cyber Security

Time	11:10 – 12:30		
Room	Port		
Session Chair		Dieter Hutter	
ID	**Start**	**Title**	**Authors**
B2-1	11:10	Investigating the Security and Accessibility of Data in Voyage Data Recorder using a USB attack	Avanthika Vineetha Harish, Kimberly Tam and Kevin Jones
B2-2	11:30	Cybersecurity Threat Information Platform MISP Tailored for Maritime Environment	Jani Vanharanta, Jani Ekqvist and Jarkko Paavola
B2-3	11:50	Towards a Coherent Formal Model for Operational Cyber Security in Ship Operations	Aljoscha Windhorst and Jannis Stoppe
B2-S	12:10	Delegating Decision-Making to Machines – Moral Responsibility and Meaningful Human Control in Lethal Autonomous Weapon Systems (LAWS)	Lukas Albrecht (student presentation)

Lunch Break

Time	12:30 – 13:30

Session A3 – Autonomous Systems

Time	13:30– 15:10		
Room	Ocean		
Session Chair		Yannik Steiniger	
ID	**Start**	**Title**	**Authors**
A3-1	13:30	Networking Autonomous Underwater Vehicles to Automize Cooperative Missions	Alexandra Plein, Peter Danielis and Helge Parzyjegla
A3-2	13:50	Mission Planning and Motion Models for Autonomous Underwater Vehicles in OMNeT++	Peter Danielis, Gunnar Kulat, Mohammad Salouh, Finn Ole Stadtaus, Lara Tauch and Helge Parzyjegla
A3-3	14:10	Operational management of automated ships: A need for new competence and skills?	Aud Marit Wahl, Trond Kongsvik and Gunnar M. Lamvik
A3-4	14:30	Legal Challenges for the Law of the Sea in the Light of Disruptive Technologies – Modular and Autonomous Submarines	Jason Halog, Michael Stadermann and Paul Margat
A3-5	14:50	Cybersecurity analysis of remote pilotage functions	Victor Bolbot, Sunil Basnet, Hanning Zhao, Osiris Valdez Banda and Bilhanan Silverajan

Session A4 – Modeling and Simulation

Time	15:30 – 16:50		
Room	Ocean		
Session Chair		Arto Niemi	
ID	**Start**	**Title**	**Authors**
A4-1	15:30	Fire Simulations of a Container Ship with FRP Structures	Tuula Hakkarainen, Alexandra Viitanen, Timo Korhonen, Terhi Kling and Antti Korkealaakso
A4-2	15:50	Investigation of high-impact low-probability disturbances in offshore wind farms	Nikolai Kulev
A4-3	16:10	Estimating Hydrogen Usage of a Crew Transport Vessel Fleet for Offshore Windfarm Maintenance	Habbo Cramer, Annika Fitz, Arto Niemi and Bartosz Skobiej

A4-4	16:30	Modeling unauthorized access to offshore platforms using a Bayesian network	Babette Tecklenburg, Alexander Gabriel and Frank Sill Torres

Session B4 – Situational Awareness

Time	15:30 – 16:50		
Room	Port		
Session Chair		Edgardo Solano Carrillo	
ID	**Start**	**Title**	**Authors**
B4-1	15:30	Real-time embedded reconstruction of dynamic objects for a 3D maritime situational awareness picture	Felix Sattler, Sarah Barnes, Borja Carrillo-Perez, Karsten Stebner, Maurice Stephan and Gregor Lux
B4-2	15:50	Learning Representative Vessel Trajectories Using Behavioral Cloning	Jan Löwenstrom, Edgardo Solano-Carrillo and Jannis Stoppe
B4-3	16:10	Establishing Responsive Space: A Maritime Situational Awareness Experiment	David Freiknecht, Marc Lehmann and David Müller
B4-S	16:30	International Field Analysis on Use Cases for Autonomous Maritime Systems	Alena Schmitz (student presentation)

Session E – Closing

Time	16:50 – 17:00	
Room	MARESEC main	
Session Chair	Frank Sill Torres	