UNIVERSITY OF
PLYMOUTH

Cyber-SHIP Lab
SECURING MARITIME
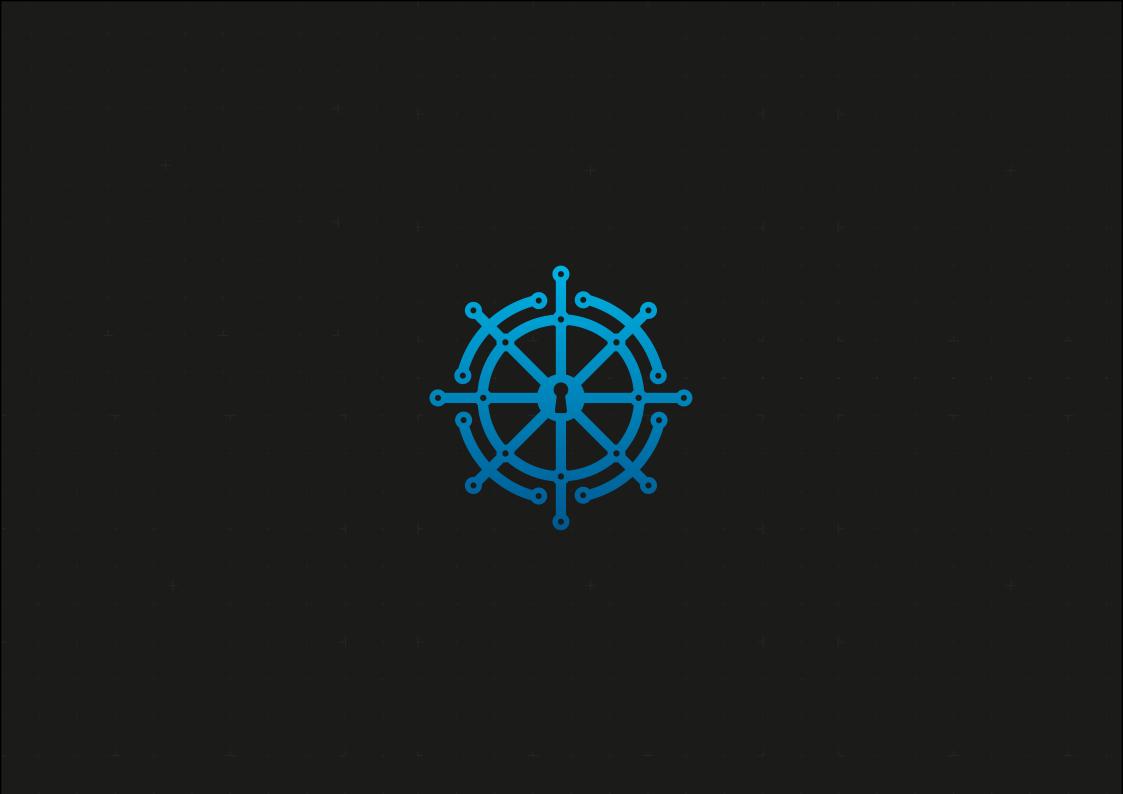
ANNUAL SYMPOSIUM
2021 PROGRAMME

IN PARTNERSHIP WITH

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# CYBER-SHIP LAB ANNUAL SYMPOSIUM 2021 PROGRAMME

## DAY ONE Thursday 21 October 2021

| TIME | EVENT |
|---|---|
| 08:30 | REGISTRATION |

### OPENING SESSION: MARITIME: UNIQUELY VALUABLE, UNIQUELY VULNERABLE?

| TIME | EVENT |
|---|---|
| 09:00 | **WELCOME**<br>**Prof Kevin Jones,** Principal Investigator, Cyber-SHIP Lab; Executive Dean, Faculty of Science and Engineering, University of Plymouth |
| 09:15 | **OPENING ADDRESS**<br>The Rt Hon Robert Courts MP, Minister for Aviation, Maritime and Security |
| 09:20 | **UNIVERSITY OF PLYMOUTH MARINE INSTITUTE**<br>**Dr Alex Nimmo Smith,** Associate Professor in Marine Science, University of Plymouth Marine Institute |
| 09:40 | **MARITIME: UNIQUELY VALUABLE. UNIQUELY VULNERABLE?**<br>**Prof Kevin Jones,** Principal Investigator, Cyber-SHIP Lab; Executive Dean, Faculty of Science and Engineering, University of Plymouth |
| 10:05 | **U.S COAST GUARD EFFORTS TO PROTECT THE MARINE TRANSPORTATION SYSTEM FROM CYBER ATTACKS AND VULNERABILITIES**<br>**Captain Adam B. Morrison,** Deputy, Coast Guard Cyber Commander, U.S Coast Guard |
| 10:30 | **MORNING TEA** |

### Session 2: Real and present hardware — cyber challenges around AIS, navigation systems, and maritime communications protocols
Chair: **Prof Kevin Jones,** Principal Investigator, Cyber-SHIP Lab and Executive Dean, Faculty of Science and Engineering, University of Plymouth

| TIME | EVENT |
|---|---|
| 11:00 | **CYBER CHALLENGES AROUND AIS, NAVIGATION SYSTEMS, AND MARITIME COMMUNICATIONS PROTOCOLS**<br>**Dr Gary Kessler,** Principal Consultant, Fathom5 |
| 11:20 | **REAL AND PRESENT HARDWARE — CYBER-SHIP LAB OVERVIEW AND UPDATE**<br>**Dr Kimberly Tam,** Cyber-SHIP Lab Academic Lead and Lecturer in Cyber Security, University of Plymouth |
| 11:40 | **CYBER ATTACK DEMOS**<br>**Cyber-SHIP Lab Research Team** |
| 12:00 | **UNDERSTANDING AND MITIGATING MARITIME CYBER RISKS**<br>**Joel Snape,** Senior Vulnerability Researcher, Nettitude |
| 12:20 | **WHAT DOES MARITIME CYBER RISK VIGILANCE LOOK LIKE? A DELIBERATELY RHETORICAL QUESTION**<br>**Richard North,** Head of Technical Support, Marine Accident Investigation Branch |
| 12:25 | **Panel discussion:** Speakers and audience Q&A |
| 12:50 | **LUNCH** |

# CYBER-SHIP LAB ANNUAL SYMPOSIUM 2021 PROGRAMME

## DAY ONE Thursday 21 October 2021

| TIME | EVENT |
|------|-------|

**SESSION 3: INTERNATIONAL PERSPECTIVES AND OPPORTUNITIES FOR MARITIME CYBER COLLABORATION**
**Chair, Ian Bramson,** Global Head - Cyber Security, ABS Group; Chair IMarEST Cyber Risk Special Interest Group

| TIME | EVENT |
|------|-------|
| 14:00 | **INTERNATIONAL SHIPPING'S CYBER RISK AND RESILIENCE PROFILE, POTENTIAL, PRESCRIPTION AND PROGNOSIS**<br>**Mr Jakob P. Larsen,** Head of our Maritime Safety and Security, BIMCO |
| 14:05 | **CHALLENGES AND DRIVERS OF MARITIME CYBER RISK AND RESILIENCE**<br>**Ian Bramson,** Global Head - Cyber Security, ABS Group; Chair IMarEST Cyber Risk Special Interest Group |
| 14:25 | **REAL WORLD CYBER SECURITY RESILIENCE MANAGEMENT**<br>**Dr Mate Csorba,** Global Service Line Leader, Security Architecture & Verification, DNV |
| 14:45 | **LACK OF TRANSPARENCY DULLS MARITIME CYBER SITUATIONAL AWARENESS. WHAT'S TO BE DONE?**<br>**Brian Worning,** Head of Commercial & Partnerships, OceanShield |
| 15:05 | **Panel discussion:** Speakers and audience Q&A |
| 15:25 | **AFTERNOON TEA** |

**Session 4: People in perspective — human factors in maritime cyber security**
**Chair: Tim Currass,** Programme Director at the Society of Maritime Industries

| TIME | EVENT |
|------|-------|
| 16:00 | **A REVERSE HISTORY OF MARITIME PIRACY — WHAT'S NEW AND NOT NEW ABOUT CYBER ATTACKS ON SHIPS AND THEIR CREWS**<br>**Dr Elaine Murphy,** Associate Professor in History, University of Plymouth |
| 16:20 | **EDUCATING AND DESIGNING FOR THE SO-CALLED "WEAKEST LINK" — HOW DIFFERENT IS THE SEAFARER CONTEXT? AND WHAT DOES THIS MEAN FOR MARITIME EDUCATION AND TECHNOLOGY DESIGN?**<br>**Prof Margareta Lutzhoft,** Professor of human-centred design and the effects of new technology; and<br>**Dr Joel Scanlan,** Associate Professor of Cyber Security, Western Norway University of Applied Sciences |
| 16:40 | **BRINGING MILITARY DECEPTION BACK INTO CYBER DEFENCE — THE OPPORTUNITY TO USE PSYCHOLOGY TO BETTER DEFEND YOUR MARITIME PLATFORMS AND SYSTEMS**<br>**Robert Black,** Deputy Director, National Cyber Deception Laboratory, Centre for Electronic Warfare, Information & Cyber, Cranfield University |
| 17:00 | **Panel discussion:** Speakers and audience Q&A |
| 17:30 | **NETWORKING RECEPTION** |

# CYBER-SHIP LAB ANNUAL SYMPOSIUM 2021 PROGRAMME

## DAY TWO Friday 22 October 2021

| TIME | EVENT |
|---|---|
| 08:00 | **BREAKFAST MEETINGS** |
| | Partner meetings by arrangement / Potential partner meetings by arrangement |

### Session 5: The science and practicalities of effective maritime cyber risk mitigation
**Chair: Mark Warner,** Head of Marketing - Maritime Performance Services, Lloyd's Register

| TIME | EVENT |
|---|---|
| 09:00 | **ADAPTIVE MARITIME CYBER RISK ASSESSMENT AND MITIGATION — INCLUDING MACRA**<br>**Dr Kimberly Tam,** Academic Lead, Cyber-SHIP Lab; Lecturer in Cyber Security; and<br>**Dr Kemedi Moara-Nkwe,** Research Fellow, University of Plymouth |
| 09:20 | **UNDERSTANDING TECHNOLOGY/LEGAL/INSURANCE INTERACTIONS TO INFORM FUTURE MARITIME CYBER RESILIENCE RESEARCH AND TOOLS**<br>**Peter Davis,** Director Security Concepts – Head of Cunning Plans, THALES |
| 09:40 | **CYBER INSURANCE IN THE MARINE SPACE: IS THERE A GLITCH IN THE MATRIX**<br>**Alex Kemp,** Partner, HFW |
| 10:00 | **LEGAL INSTRUMENTS AROUND CYBER SECURITY AND THEIR IMPACT ON SEAWORTHINESS**<br>**Päivi Brunou,** Head of cyber security, Technology, Wärtsilä Voyage |
| 10:20 | **CYBER SECURITY FOR AUTONOMOUS VESSELS**<br>**Marco Casassa Mont,** Principal Cyber Security Consultant , Defence & Security UK, BMT |
| 10:40 | **Panel discussion:** Speakers and audience Q&A |
| 11:00 | **MORNING TEA** |

### Session 6: Industry and research partnership
**Chair: Chloe Rowland,** Project and Knowledge Exchange Manager – Cyber-SHIP Lab, University of Plymouth

| TIME | EVENT |
|---|---|
| 11:40 | **MARITIME INDUSTRY'S CYBER SECURITY CHALLENGE**<br>**Tom Chant,** Chief Executive Officer, Society of Maritime Industries |
| 12:00 | **RESILIENCE THROUGH RESEARCH AND PARTNERSHIP**<br>**Kevin Forshaw,** Director of Industrial and Strategic Partnerships, Faculty of Science and Engineering, University of Plymouth |
| 12:15 | **Closing session — where to from here?** |
| | **OPEN DEBATE: MARITIME CYBER: WHERE TO FROM HERE?**  **CONFERENCE WRAP-UP**<br>Hosted by **Kevin Forshaw**  **Prof Kevin Jones** |
| 12:30 | **LUNCH** |
| 13:45 | Partner and interested parties meetings by arrangement |

# SPEAKERS

### Robert Courts MP
Minister for Aviation, Maritime and Security

Robert Courts was first elected as the Member of Parliament for Witney and West Oxfordshire in October 2016. In September 2020, he was appointed Parliamentary Under Secretary of State in the Department for Transport, with responsibility for aviation, maritime and security.

He was previously Parliamentary Private Secretary (PPS) to the Secretary of State for Transport, having served as a PPS in the Foreign and Commonwealth Office from January to July 2018 and to the Secretary of State for Environment, Food and Rural Affairs from August 2019 until February 2020.

Robert served on the International Trade Select Committee before becoming a Minister, having previously been a member of the Transport, Justice and Backbench Business Committees.

### Professor Kevin Jones
University of Plymouth

Professor Kevin Jones is Executive Dean of the Faculty of Science and Engineering at the University of Plymouth. He is responsible for the Schools of Engineering, Computing and Mathematics; Biological and Marine Science; and Geography, Earth and Environmental Sciences. He holds a PhD in Computing Science from the University of Manchester, an MSc in Computation from Oxford University and a BSc in Computer Science from the University of Reading. He is a Fellow of the IMarEST, the IET and the BCS. Professor Jones leads the multidisciplinary Maritime Cyber Threats research group at the University of Plymouth, UK and is the Principal Investigator for the Cyber-SHIP Lab project.

### Dr Alex Nimmo Smith
University of Plymouth

Alex is Associate Professor in Marine Physics at the University of Plymouth School of Marine Science and Engineering, and Deputy Director of the University's Marine Institute, where he is a member of the Marine Physics Research Group and the Centre for Coastal and Ocean Science and Engineering.

Alex's research interests focus around suspended particle dynamics: how particles (plankton, sediment, bubbles, droplets) behave in a natural, turbulent environment, and in the use of particles as tracers of turbulent flows. He has developed several in situ optical systems to directly image particles for measurement and identification, and visualise 3D turbulence structure.

### Captain Adam B. Morrison
U.S. Coast Guard

Captain Morrison is Deputy, Coast Guard Cyber Commander. He relieved as Deputy, Coast Guard Cyber Command in Washington D.C in July 2021. He is responsible for supporting the Commander's ability to conduct operations and deliver effects in and through cyberspace domain.

Captain Morrison most recently served as the first Captain of Cutter STONE – the Coast Guard's ninth National Security Cutter.

Prior to STONE, he served as the first Coast Guard Attaché to the Tokyo Embassy. He had previously served in six cutters; assignments ashore included: Academy Instructor; Congressional Fellow to the Senate Appropriations Committee, and Budget Reviewer at Headquarters.

Captain Morrison is a 1995 Coast Guard Academy graduate and holds a master's degree from Princeton University.

## Dr Gary Kessler
### Fathom5

Gary is a principal consultant at Fathom5, a retired professor of cybersecurity, and co-author of Maritime Cybersecurity: A Guide for Leaders and Managers (2020). He is the Chief of the Cyber Augmentation Branch of the U.S. Coast Guard Auxiliary, guest faculty at the US Coast Guard Academy, and a Non-Resident Senior Fellow at the Atlantic Council. Gary has been in the information security field since the late-1970s; his current research efforts are related to maritime cybersecurity, with an emphasis on AIS and maritime communication protocol vulnerabilities. Gary is a Master SCUBA Diver Trainer and holds a 50 GT merchant mariner credential. More information can be found at https://www.garykessler.net.

## Dr Kimberly Tam
### University of Plymouth

Kimberly is a Cyber-Security lecturer at the University of Plymouth researching maritime cybersecurity and is a Co-I on Cyber-MAR and Co-I/Academic Lead on the Cyber-SHIP Lab projects. She has expertise in maritime cyber-vulnerabilities, risk assessment, and creating a lab environment to enable maritime-cyber research.

Kimberly's is PhD from Royal Holloway University of London, including a thesis on malware detection and classification for Android mobiles, and a B.S from Rensselaer Polytechnic Institute. Playing a leading role in the Cyber-SHIP Lab project, she is using her knowledge of hardware security, intrusion detection, malware, networking, and maritime cyber-security.

## Joel Snape
### Nettitude

Joel is a Senior Security Researcher at Nettitude, a Lloyds Register company. He started out working in telecommunications securing large scale UK and global networks, before moving to Nettitude to focus on maritime technologies. This includes threat intelligence for the marine and offshore community as well as vulnerability research on common equipment and protocols. Joel also develop tools and techniques for Nettitude's Red-Team and Threat-Intelligence Team.

## Richard North
### Marine Accident Investigation Branch (MAIB)

Richard is Head of Technical Support at the UK's Marine Accident Investigation Branch (MAIB), where he leads a team of technical specialists supporting the identification, preservation, recovery and analysis of all forms of electronic and technical evidence related to marine accidents. Previously, Richard worked at AMI-Marine, a leading Voyage Data Recorder (VDR) manufacturer, and he served as a Seaman Navigator in the British Army.

# SPEAKERS

## Jakob P. Larsen
### BIMCO

Jakob is Head of Maritime Safety & Security at BIMCO, including cyber security. His career began in the Danish Navy as a navigator and surface warfare officer, and later ashore in the Ministry of Defence, rising to the Commander rank. In 2010, he joined BIMCO as Maritime Security Officer. After three successful years in BIMCO, he moved to Nordic Tankers to become Head of HSSEQ. In 2015, he moved to Maersk Line as Global Security & Marine QA Manager. In parallel, he served as Chairman of the Security Working Group of the European Community Shipowners' Associations. In 2018, Jakob returned to BIMCO, to lead the Maritime Safety & Security department. His qualifications include: Master Mariner, Principal Warfare Officer, Joint Command & Staff Course graduate, Company Security Officer/Ship Security Officer, and ISO 9001 lead auditor.

## Ian Bramson
### ABS Group

Ian heads the global cyber security organisation at ABS Group, where he works closely with senior executives across the energy, industrial and maritime sectors to help minimize their cyber security risks. For over 20 years, Ian has helped organisations adapt to their digital environments and solve business challenges related to industrial cyber security, risk management and digital transformation. He has built successful companies, global sales organisations and cyber security programs across multiple industries.

Ian is a recognised thought leader and market developer in the emerging threat landscape of attacks on industrial operations and critical infrastructure. He has a bachelor's degree in Economics and English from Cornell University.

## Alex Kemp
### Partner, HFW

A Partner at HFW, Alex predominantly advises clients on the legal issues arising from casualty management and crisis response including salvage, wreck removal, groundings, collisions, fires and piracy with a particular interest in container ship casualties and war risk claims. He has extensive experience in marine insurance advising insurers, brokers and assureds in relation to H&M, war, kidnap & ransom, increased value, cargo, builder's risks, yacht and ports & terminals insurance policies.

Alex has been involved in a number of reported High Court cases including Osmium Shipping Corporation v Cargill International SA (The Captain Stefanos) [2012] 2 Lloyd's Rep. 46, Taokas Navigation SA v Solym Carriers Ltd (the Paiwan Wisdom) [2012] EWHC 1888 (Comm), The Owners of the Ship "Theresa Libra" v The Owners of the Ship "MSC Pamela" [2013] EWHC 2792 (Admlty), The Owners of the Ship "Stolt Kestrel" v The Owners of the Ship "Niyazi S" [2014] 2 Lloyd's Rep. 483, and The Atlantik Confidence [2016] EWCA 2412 (Admlty).

## Tim Currass
### Society of Maritime Industries

Tim is the Programme Director at the Society of Maritime Industries. He is also Director of the Maritime Defence and Security Group and Digital Technology Group. He joined SMI in November 2019.

Prior to joining SMI Tim enjoyed a 33-year career as an Engineer Officer in the Royal Navy, which at times included responsibilities for Information Security. His last job in the Service was as a Captain in Navy Command responsible for Above Water capability development and was the Royal Navy lead for the National Shipbuilding Strategy.

## Dr Elaine Murphy
### University of Plymouth

Elaine is Associate Professor of Maritime and Naval History at the University of Plymouth, where she has developed a number of maritime history modules, including Royal Navy in the Age of Sail, and Piracy and Privateering.

Her research interests include early modern maritime history, the British Civil Wars of the 1640s and 1650s, and the writings and speeches of Oliver Cromwell. In 2018, with Dr Richard Blakemore she co-authored *The British Civil Wars at Sea, 1638-53* (Boydell, 2018), which was nominated for the Military History Matters Book of the Year award in 2019.

Elaine's latest research focuses on the experiences of women with the Royal Navy in the 17th Century.

## Prof Margareta Lützhöft
### Western Norway University of Applied Sciences

Margareta is Professor of human-centred design and the effects of new technology at Western Norway University of Applied Sciences. She is a Master Mariner, trained at Kalmar Maritime Academy in Sweden.

After leaving the sea, she studied for a Bachelor's degree in Cognitive science and a Master's in Computer Science. In 2004, she received a PhD in Human-Machine Interaction. She holds a position as Professor in the MarSafe group at the Western Norway University of Applied Sciences. Her research interests include human-centered design and the effects of new technology.

## Dr Joel Scanlan
### Western Norway University of Applied Sciences

Joel is Associate Professor of Cyber Security at Western Norway University of Applied Sciences. He has a PhD in the dual areas of cyber security and data mining. His primary interest for the past ten years has been cyber security, focusing on cryptography, penetration testing, risk analysis and e-forensics. He has a teaching career going back to 2004 across a wide range of IT subject areas. He has taught beginner through to expert levels of programming, web design, database development, web services and software design methodologies.

## Robert Black
### Centre for Electronic Warfare, Information & Cyber, Cranfield University

Robert Black is the Deputy Director of the National Cyber Deception Laboratory and a Lecturer in Information Activities at Cranfield University, based within the Defence Academy of the UK. He leads on a series of modules in the UK MoD's classified Cyberspace Operations MSc and supports the UK Defence Cyber School in educating senior MoD personnel about Warfare in the Information Age. Rob is also a Director at Artifice (www.artifice.co.uk), a specialised training and consultancy company, which trains Deception, Influence and Behaviour Change to specialist teams across Defence, Security, Law Enforcement and cyber security.

# SPEAKERS

## Mark Warner
### Lloyd's Register

Mark is Head of Marketing for Lloyd's Register's (LR) Maritime Performance Services (MPS) business, which brings together LR's professional services including cyber, fleet management, fleet optimisation, and its Maritime Training Academy.

Mark joined LR from Inmarsat, where he spent five years as Senior Director of Marketing and Public Relations. Over the last 20 years, he has amassed a wealth of experience in the maritime industry working for companies such as ShipServ and Informa. He also holds an MSc in International Shipping & Logistics and a BSc in Maritime Business & Law from the University of Plymouth and is a former chairman of their nautical Alumni, Pynda.

## Peter Davis
### THALES

Peter Davies is Director Security Concepts at THALES. He is a Security Expert operating at the convergence of Safety and Security. An honorary Fellow with Imperial College's Institute for Security Science & Technology and chair of the AESIN Security Workstream. He is a leading expert on Countering Cyber Attacks targeted Supply Chain Infiltration and Cyber Physical Attacks.

Peter has lead the Cyber Security aspects of 3 C-CAV research activities and has 30+ years of verifying security systems in hardware and software. Peter likes to say that he does security where it can't afford to fail. Peter is sought after by organisations for his advice on their legal position with respect to Cyber attacks.

## Brian Worning
### OceanShield

Based in Singapore, Brian is Head of Commercial & Partnerships at OceanShield. He is an oil & gas and maritime industry professional with 15+ years of global experience in executing commercial efforts and strategic initiatives within traditional maritime operators and offshore oil & gas vessel owners. Brian has worked across Asia, in Europe, Australia and West Africa. He marries traditional commercial maritime knowledge and experience with appreciation for and insight into digitalization and cyber-related challenges.

## Päivi Brunou
### Wärtsilä Voyage

Päivi is Head of Cyber Security Technology at Wärtsilä Voyage where she brings a pragmatic and holistic approach, ensuring cyber resilience for IT and OT are built into solutions. She helps development teams to reduce risk and leverage opportunities by coaching people, adjusting tools, processes, and methods for context-fit solutions. She works closely with internal and external stakeholders in creating a collective understanding.

Päivi is contributing to the creation of industry standards and studying for a Masters in Autonomous Maritime Operations. She is a member of The Operational Technology Cyber Security Alliance, ENISA Ad Hoc Expert group on Awareness Raising, and is serving her second term as a member of Singapore Shipping Association Cyber Security Subcommittee.

## Dr Kemedi Moara-Nkwe
### University of Plymouth

Kemedi is a Research Fellow within the University of Plymouth's Maritime Cyber Threats Research Group. His research interests include maritime cyber security, network and information security, maritime communication networks, computer networking, and wireless communications.

Kemedi's Doctoral research addressed physical layer security in wireless communications, focussing in particular on resource constrained (IoT) wireless networks. Previously, he was a Research Associate in Computer Networking involved in the Liverpool 5G mmWave Testbed Project at Liverpool John Moores University. His qualifications include a PhD in Network Security and a MEng (First Class) in Electronics with Wireless Communications.

## Marco Casassa Mont
### BMT

Marco is Principal Cyber Security Consultant, Defence & Security, UK at BMT. He has over 20-years' experience in cyber security, enterprise and cloud solutions, strategic consulting, trusted advisory and innovation. Previously, he was a Principal Cyber Security Architect and Lead Scientist at HP Labs. His focus is on cyber security for cloud, enterprise and deployed platforms; advanced threat detection; risk assessment; security strategies and roadmaps.

He holds MSc and BSc degrees in Computer Science. He is a (ISC)2 CISSP and CCSP certified cyber professional and a senior IEEE member.

## Chloe Rowland
### University of Plymouth

Chloe is the Project and Knowledge Exchange Manager for the Cyber-SHIP Lab at the University of Plymouth. She is an experienced Project Manager specialising in delivery, industry engagement, relationship management and economic growth activities in the maritime sector. She focuses on cyber security in vessels, smart ports and floating offshore wind developments.

Chloe works to engage industry with research by creating and managing relationships with regional, national and international stakeholders to help build resilience in the sector as a whole. Chloe is also the Marine & Maritime Solutions Consultant for the South West Centre of Excellence for Satellite Applications and maintains links with the Satellite Applications Catapult network.

## Tom Chant
### Society of Maritime Industries

CEO at the Society for Maritime Industries, Tom has a long association with the marine industry having been an active sailor and student of boatbuilding. His career encompasses a wide range of market sectors, including business development, and marketing and distribution internationally. At the trade body for the leisure and super yachts he developed the members' export business. He has managed UK pavilions at major international trade shows and managed inward and outward missions. He has overseen numerous market reports and participated on government committees. His recent experience includes distributor management for a marine equipment company before joining SMI in February 2017. He was appointed as SMI Chief Executive Officer in August 2020.

## Kevin Forshaw
### University of Plymouth

Kevin Forshaw is Director of Industrial and Strategic Partnerships at the University of Plymouth's Faculty of Science and Engineering. His focus is on creating high-value strategic partnerships with private and public sector organisations, translating the University's research outputs for positive socio-economic impact.

Kevin has been instrumental in securing funding and industry support for the new, £3.2m University of Plymouth Cyber-SHIP Lab.

He is Co-Chair of the South Coast Marine Cluster - comprising South Coast Universities, Research Organisations, Local Authorities and LEPs to raise importance of the sector, and increase engagement with high-growth marine business. He is also a member of the Maritime UK Technology and Innovation Marine Autonomous Systems Groups.

## Dr Mate Csorba
### DNV

Mate is Global Service Line Leader, Security Architecture & Verification at DNV where he combines academic research experience with his engineering background to deliver systematic verification and improve cyber-resilience in industrial cyber security projects. He leads cross-disciplinary and international teams, working with asset owners, vendors, and system integrators to improve cyber resilience in critical infrastructure. His work includes vulnerability and cyber risk assessments, as well as verification by penetration testing and purple teaming exercises for maritime, oil & gas, energy, and utility companies – offshore and on-shore. He is co-author of several DNV standards and recommended practices, and variety of publications and conference articles on cyber security and other topics.

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