

iTrust Times

A Quarterly Newsletter

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Something's Brewin'

Dear Reader:

Greetings from iTrust!

The first quarter of this year kept iTrust faculty, staff, and researchers as busy as ever. The Global Young Scientists Summit

was held during the month of January. iTrust hosts guests from various parts of the world during this summit. This year, among others, we hosted a team of young scientists, senior officials from the Swedish and German defence, and the chairman of Singapore Maritime Institute. A summary of some of the visits is in this issue of the newsletter. In addition, together with CSA, Assistant Director Mark Goh visited the National Digital Exploitation Center in Ebbw Vale in South Wales, UK.

Leading R&D in maritime security, iTrust is organising a Maritime Cyber Security Webinar focusing on AI, ML, and IoT technologies and their impact on maritime autonomous surface ships. Leaders from Class NK, METSTA Ry, Alto University, and Wartsila will share their views on maritime security.

I take this opportunity to welcome Mr R. Anand and Ms Vanessa Lee to iTrust. Anand knows iTrust well as he has graduated from the MSSD graduate program at SUTD. Vanessa brings with her expertise in international events and outreach.

Two major announcements await our readers. Watch out for these in the next newsletter due sometime in July this year.

That is all for now. Happy reading and best wishes to all readers of iTrust Times for a productive and happy 2023!

Aditya Mathur
Centre Director, iTrust, SUTD
Director, National Satellite of Excellence DeST-SCI
Professor Emeritus, Computer Science, Purdue University

Keeping up the pace

iTrust kickstarts the year with a series of visits

The Global Young Scientists Summit is organised by the National Research Foundation (NRF) and brings together bright young researchers and top scientific minds from around the world to discuss science and technology trends, future game changers and how research could address major global challenges. The Summit is multi-disciplinary and covers topics including chemistry, physics, medicine, mathematics, computer science, and engineering. As a Summit partner, SUTD offered its campus as one of the site visits for the scientists on the first day of the programme on 14 Jan 2023. About 10 scientists were hosted by Cyber Tech Lead Francisco Furtado and postdoc researcher Dr Yan Lin Aung at iTrust's testbeds and learnt Singapore's efforts in defending critical infrastructures and IoT devices against cyber attacks.



Fig 1: Cyber Tech Lead Francisco introducing iTrust's Secure Water Treatment testbed to the scientists



Fig 2: Postdoc researcher Dr Aung at the IoT shielded room with the scientists

By Ronald Yeung, Research Associate, Digital Manufacturing and Design (DMandD) Centre



Mr Kenneth Lim, the Maritime and Port Authority (MPA) of Singapore's Assistant Chief Executive (Industry & Transformation), visited SUTD on 3 Feb 2023 to get an update on the progress of projects funded and supported by MPA.

The first showcase was a robotics project with an innovative soft gripper designed for container handling. The mobile unit consists of sensors for localisation, mapping, and autonomous navigation so that its manipulators can perform the coning and deconing of the fitting using the soft gripper based on real-time motion planning. During the tour of DMandD Centre, Mr Lim was introduced to a wide range of additive manufacturing (AM) technologies, such as Large-scale Robotic Arm FDM systems, Automated Fibre Placement for composite manufacturing and Wire Arc Additive Manufacturing. Ronald also shared on the National Additive Manufacturing Innovation Cluster's (NAMIC) collaborations with corporate partners. NAMIC is a national platform that seeds AM capabilities in corporate partners through translational R&D leading to commercial applications.

At iTrust, Co-centre director Prof Jianying Zhou briefed Mr Lim on iTrust's latest foray into maritime cyber security. This included the one-year study by Prof Zhou's team on cyber risk assessment and mitigation of shipboard OT systems, as well as iTrust's plans to design and construct a maritime OT testbed. Being his first visit to iTrust, Prof Zhou also presented an overview of the centre's activities.

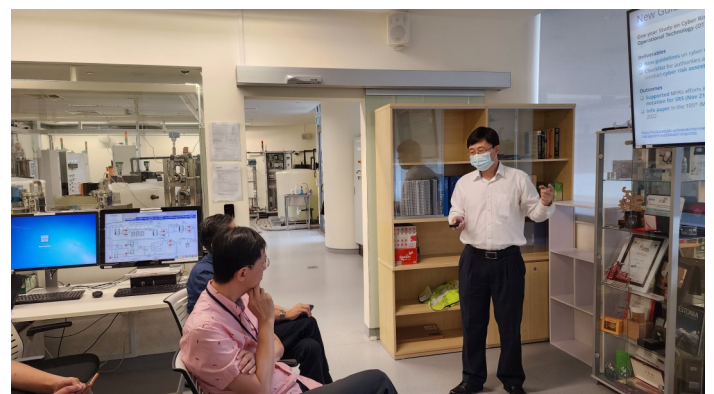


Fig 3: Prof Zhou briefing Mr Kenneth Lim (seated)

Text and photo courtesy of Singapore Maritime Institute

iTrust hosted SMI Chairman Professor Low Teck Seng and SMI R&D Team on 1 March 2023 to share about iTrust's aspirations and capabilities in cyber defence of critical infrastructure and their project for maritime cybersecurity, Maritime Testbed of Shipboard Operational Technology (MariOT). MariOT is expected to be the world's first industrial-grade cyber-physical platform for R&D and equipped with essential shipboard operational technology systems to offer a safe and realistic testing environment for cybersecurity technologies without disrupting actual vessel operations.



Fig 4: Francisco (standing) presenting iTrust's role in cyber exercises to (seated left to right) SMI's Executive Director Mr Tan Cheng Peng and Chairman Prof Low Teck Seng

iTrust Co-Centre Director Prof Zhou Jianying outlined the capabilities of various testbeds that are used for research, testing, exercises, and training for cybersecurity competencies, complemented with training programmes in the area of cyber-physical systems, helps position iTrust as a unique facility for research and training in the design of safe and secure large-scale cyber physical systems. iTrust is also a regular participant and contributor in international cybersecurity exercises such as Critical Infrastructure Security Showdown (CISS), Critical Infrastructure Defence Exercise (CIDE), and NATO's Locked Shields exercise.

Prof Low re-iterated the importance of an integrated development approach for iTrust in cyber-physical

capabilities in view of the exponential rise in maritime cyber-attacks and constantly evolving technology, particularly in today's highly inter-connected systems. The integration of IT, OT, and human factor elements in maritime assets will define the cyber physical systems necessary for efficient and safe operations. He advocated further deepening of collaborations between iTrust and other cyber expertise residing in SMI's Centres of Excellences and IHLs to sharpen their value proposition at the national strategic interests and maritime economic fronts.



By Francisco Furtado, Cyber Tech Lead

In March, iTrust hosted three visits from senior European officials, all of whom expressed a keen interest in our centre's research: BG Armin Fleischmann, Head of Division Cyber/IT-Governance, Germany (14 Mar), BG Johan Axelsson, Director of the FMV T&E Division, Sweden (22 Mar) and LG Michael Vetter, DG Cyber/IT & CIO, FMOD, Germany (22 Mar). The generals, accompanied by MINDEF personnel, were hosted by Centre Director Prof Aditya Mathur and Cyber Tech Lead, Francisco Furtado and had the opportunity to view our world-class testbeds SWaT, WaDi and EPIC. The visitors were particularly interested in iTrust's in-house technology - Digital Twins - that are used for cybersecurity research, training, and exercises. As iTrust continues to build capability in critical infrastructure security, it was important to showcase its work and engage in productive discussions around the impact of our R&D efforts to the world.



NYK SHIPMANAGEMENT

By Li Meixuan, Research Assistant, iTrust

At the invitation of the NYK Ship Management (NYKSM), iTrust Co-centre Director Prof Jianying Zhou together with a group of SUTD researchers visited its Training Centre on 16 Mar 2023. The visit was led by NYKSM's manager and the head of Training Centre

Captain Mitsuo Mori. Spanning nearly 2,000m², the Centre houses ship and cargo handling, main engine maneuvering and control, automation and control, hydraulic and LNG simulators. NYKSM is a Japanese in-house ship management company and its Training Centre provides theory- and practical-based training courses, including simulation and e-learning.

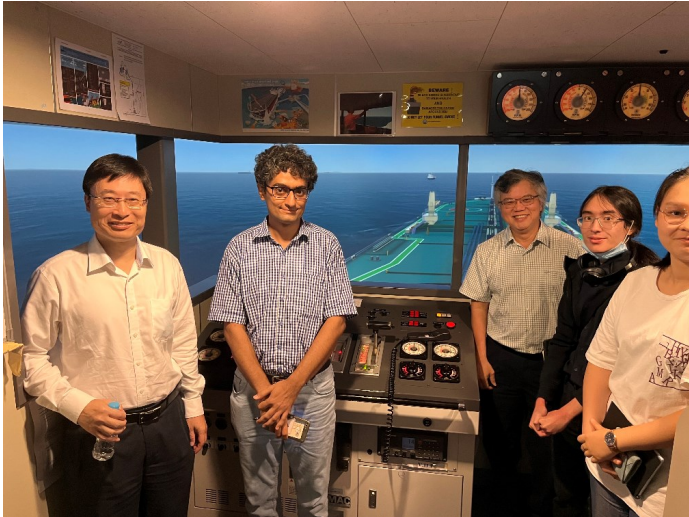


Fig 5: Prof Zhou (first from left) with his team of researchers— postdoctoral researcher Dr Awais Yousaf, MSSD student Philip Kwa and research assistants Sean Gunawan and Meixuan Li at NYKSM's ship simulator

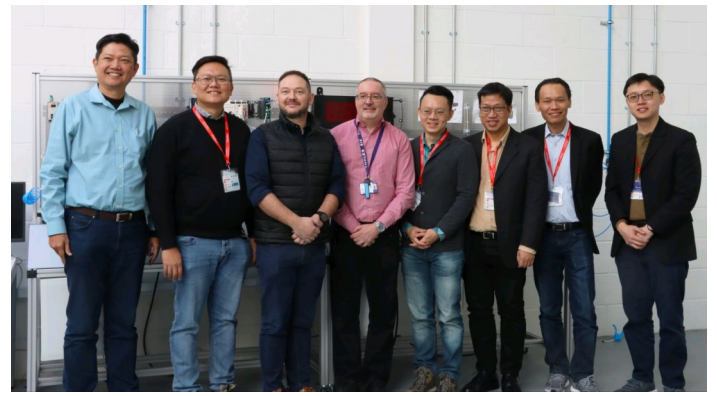


Fig 6: CSA, NCL and iTrust were hosted by the Thales team Mr Ahsanul Kalam, APAC Regional Director, Cyber Defence (first from left), Mr Neil McElhinney, Regional Manager (third from left) and Mr Dene Yandle, Engineering Manager (fourth from left); CSA was represented by Mr Neo Say Beng, Deputy Director, National Cyber R&D Directorate (second from left), Mr Chan Hoong Maeng, Assistant Director, National Cybersecurity R&D (third from right) and Dr Victor Sim, Senior Consultant (first from right); NCL was represented by Mr Seah Choon Meng, Program Director (second from right). Photo courtesy of Thales

Operational Technology Cyber Security

Working with like-minded organisations to keep critical infrastructure safe

At the invitation of CSA, representatives from iTrust and the National Cybersecurity R&D Laboratories (NCL) visited the National Digital Exploitation Centre (NDEC) the town of Ebbw Vale in South Wales. The NDEC is a collaborative project by Thales and the University of South Wales in partnership with the Welsh Government. NDEC is Thales' Centre of Excellence for Cyber Security, recognising the current and future challenges of, and building specific capability in relation to, OT in critical national infrastructure.

During the full day visit, we were introduced to Thales' delivery of OT security transformation as well as the resources put into R&D in OT cyber security. The NDEC also houses a range of OT testing platforms to test and develop cyber solutions for the protection of critical infrastructure. In its demo, it recreated possible

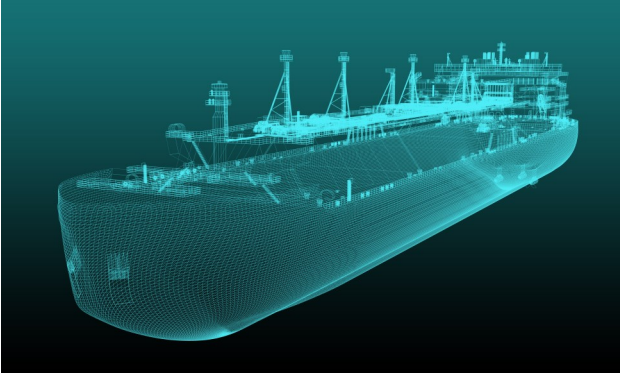
scenarios of how a water treatment facility Oldsmar, Florida was compromised, leading to brief but significant spike in the amount of sodium hydroxide being released into the water.

In addition to research, NDEC runs an education and outreach project that works with schools, the community, and SMEs to promote the cyber industry and upskill individuals in cyber hygiene. It also demonstrates the importance of cyber best practice through its digital education centre, and further boost young peoples' interest in working in the industry, helping to sustain the next generation digital workforce.

Thales also introduced us to a team from Cardiff University — Prof Omer Rana and his PhD student Abu Mohammed — to explore R&D collaborations, in which they shared their focus in the oil and gas sector. iTrust and NCL also took the opportunity to introduce the capabilities and activities of both labs.



Fig 7: Neil McElhinney introducing one of NDEC's OT testing platforms



Maritime Cyber Security Webinar

Maritime Autonomous Surface Ships: Current and Future Cyber Security Challenges

With the integration of advanced technologies such as artificial intelligence, machine learning, and the internet of things (IoT), ships are becoming more connected than ever before.

The advent of Maritime Autonomous Surface Ships (MASS) has revolutionised the shipping industry, providing increased efficiency, safety, and reliability. However, as the shipping industry evolves with the integration of advanced technologies and the interconnectivity of MASS systems, cybersecurity risks are becoming increasingly apparent.

This 2-hour webinar will explore the current and future cybersecurity challenges associated with MASS, including the capabilities of MASS systems, standardisation, and cybersecurity risk assessment. We have lined up four distinguished speakers from the academia and industry:

- Mr Noriyuki Kajita, Autonomous Ship Project Team Member, Digital Transformation Center, ClassNK, will give a technical overview of MASS to facilitate substantial needs for new cyber security requirement. He will also share the timeframe of social implementation of MASS as well as the discussion at IMO on MASS Code.
- Ms Päivi Brunou, Managing Director, METSTA Ry, will speak about the regulations and standards impacting the development of autonomous

maritime solutions.

- Dr Victor Bolbot, Post-doc Researcher, Research group on Safe and Efficient Marine Systems, Aalto University, will discuss the various approaches for identifying and managing cyber risk as well as the challenges and opportunities for research in MASS.
- Mr Matti Suominen, Director, Maritime Cyber Security, Wärtsilä, will explore how maritime OEM vendors like Wärtsilä navigate the new innovations that increasingly make vessels more connected while concurrently making traditional security through isolation become less relevant.

New iTrust staff

iTrust welcomes a project manager and cyber security technology engineer to the team!

R Aanand received his Masters in Security by Design (MSSD) from the SUTD in 2022.



Being a mid-career switcher, he is relatively new to cyber security, having spent significant years in the finance sector previously. His career switch to cyber security came from an innate interest in technology, which he rediscovered in between jobs during the pandemic. His enthusiasm, perseverance, and efforts were recognised, and he was awarded the IMDA Future Communications Research and Development Programme Scholarship Award in 2022.

In his spare time, Aanad is an amateur movie critic, a sports enthusiast, and an established musician.



Vanessa Lee holds a BSc (Hons) in International Business from University of Birmingham.

Prior to joining iTrust, she was at NUS Yong Loo Lin School of Medicine. Prior to joining iTrust, she was at NUS Yong Loo Lin School of Medicine supporting the Admissions and Outreach team

in the Dean's Office, Office of Students department. Vanessa enjoys the adrenaline of events planning and execution. She aspires to bring her enthusiasm to every event and project she manages.

Vanessa also has experience in supporting international conferences during her time in at National Supercomputing Centre. During her time in NSCC, she assisted the conference organising committee with speaker allocation, marketing materials and other administrative matters. She has also organised workshops and talks for individuals who are interested in Supercomputing.

In her down time, Vanessa enjoys travelling, hiking and photography.



iTrust is now on LinkedIn — connect with us! Feel free to reach out to us to explore research collaborations, testbed usage and training and testing services. Email addresses end with the domain @sutd.edu.sg

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