

# CONTENTS

- 2      **Editorial**
- 4      **A Structured Systems Engineering Approach to Evaluate  
Complex Inter-dependencies of Rapid Transit System**  
*NG Zhi Da, CHENG Siew Yen, CHUA Keng Lim, LIM Weng Chiat*
- 14     **Methodology of Establishing the Ship-Helicopter Operating Limits**  
*LIU Yaowen, WONG Bingxiong David, SITO Kenwyn, LI Zhike, HAM Wan Ling*
- 30     **Development of an Unmanned Truck Platoon for Logistics Resupply**  
*GAN Hao Yi, GUO Yongqiang, LIM Jun Min Leonard*
- 38     **Collision Detection and Collision Avoidance for Unmanned Surface Vessels**  
*LIM Lian Nang, BAY Zi Jing, TAN Shu Jun*
- 46     **Operationalising MINDEF Bug Bounty Programme**  
*CHIAM Tze Wei Raymond, SOH Yiyong*
- 54     **Application of Commercial Off-The-Shelf Game Engines  
for SAF Experimentation**  
*LIM Chee Hong, TAN Chee Ann, LOKE Yu Juan, BOO Tai Yi*
- 62     **Design and Development of Passive Armour for SAF Vehicles**  
*TEO Ee Sheng Wilson*
- 74     **Applied Augmented Reality for Maintenance on Board Ships**  
*LIM Bee Hua Lena, POH Chun Siong, ONG Beng Shen Aaron, GOH Chue Hsien*
- 84     **Development of Transmission Network Planning Tool**  
*SOH Zhao Sheng, CHUA Chee Wee*

# EDITORIAL



**Tan Yang How**  
President  
DSTA Academy

In an age where technology is progressing at an increasing rate, new security threats, especially to digital and interconnected systems, are rapidly emerging and indeed highly complex. However, technological progress also opens up many opportunities for agencies such as DSTA to develop innovative and impactful solutions which can effectively meet users' urgent operational needs in the new environment, while maintaining the need for speed to market and to be cyber safe. These are two key challenges faced by DSTA programme teams, evident in the articles compiled in the fourteenth issue of DSTA Horizons. The nine articles also lend insights into the incorporation of systems approach and integration of new technologies in our work at DSTA.

**'A Systematic Systems Engineering Approach to Evaluate Complex Inter-dependencies of Rapid Transit System'** proposes an approach to quantifying the performance of the Rapid Transit System by modelling the various train systems through Optimised Decisions In Network together with a suite of analytical tools, which will enable the identifying of risks areas and the evaluation of design options to improve the robustness of the Rapid Transit System. Future developments for such an approach is also discussed.

**'Methodology of Establishing the Ship-Helicopter Operating Limits'** puts forth a methodology to maximise the operational capability between ships and helicopters, as well as the integration process involving the preparation, conduct of qualification trials, and post-trial analysis.

**'Development of an Unmanned Truck Platoon for Logistics Resupply'** covers the objectives, design, challenges and lessons learnt from the development of an Unmanned Truck Platoon prototype. It also outlines the design and development of a user-friendly and operationally robust system, shares insights gleaned from the development of the prototype, and introduces concepts and technology enablers in both military and commercial domains.

**'Collision Detection and Collision Avoidance for Unmanned Surface Vessels'** describes the development of a Collision Detection and Collision Avoidance algorithm, challenges in its integration and validation on board an Unmanned Surface Vessel, and possible applications which can help achieve manpower savings and reduce the need for direct human operation in risky missions.

**‘Operationalising MINDEF Bug Bounty Programme’** outlines the motivation behind the running of the Bug Bounty Programme organised by the Ministry of Defence in January 2018, the challenges faced in the swift addressing of vulnerabilities found through the Programme and how members of a cross-departmental Technical Operation Centre overcame these challenges.

**‘Application of Commercial Off-The-Shelf (COTS) game engine for SAF experimentation’** discusses the selection, adoption and integration of a COTS game engine by DSTA as part of its Modelling and Simulation environment, and how additional development was done for the configurability, scalability and interoperability of this integrated environment to support large-scale, distributed and short cycle experimentations.

**‘Design and Development of Passive Armour for SAF Vehicles’** explores the design, development and choice of armour materials found in SAF vehicles, the way armour systems on SAF vehicles are tested and qualified, and presents an overview on the use of finite element software to improve the effectiveness of an armour system by investigating ways of packaging armour materials together.

**‘Applied Augmented Reality for Maintenance on Board Ships’** outlines a demonstrator project which assessed the viability of Augmented Reality in supporting maintenance works carried out by the Republic of Singapore Navy on board ships, and the performance and limitations of commercial off-the-shelf Augmented Reality development software. Potential challenges in scaling up, and general recommendations for deployment of Augmented Reality in the near future are also discussed.

**‘Development of Transmission Network Planning Tool’** traces the development of Network Capacity Planning Tool for the analysis of nodes and bandwidth utilisation, in order for active planning to be done to meet future network demands as well as the process of developing the tool, the methodologies involved, and future developments.

We hope that this issue of DSTA Horizons will continue to enrich the knowledge of readers and help them gain a better understanding of the various fields of technology, both defence-related and otherwise, that DSTA is involved in. We would like to express our gratitude to the authors for their good work and dedication, and to invite all to contribute to this culture of collaborative learning.