

E D I T O R I A L



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In this fifth edition of DSTA Horizons, we bring you 11 articles covering a wide range of projects and studies undertaken by the defence community. They attest to the diversity of expertise that resides within the defence community and the recognition to respond to the complex and fast-changing milieu today. Some articles in the edition discuss alternative ways to achieve greater efficiency and more effective use of resources. Others seek to share new perspectives on managing challenges and uncertainty. There are contributions which review and analyse the effectiveness of solutions already implemented and those which are informative reads. Of these, five have been presented at international and local conferences. We are in the privileged position to be able to compile their contents for the purpose of extending them to the defence community.

The first article, *Overcoming the Rain Fade Obstacle – Understanding Singapore's Rain Dynamics and Feasible Countermeasures Against Rain Fading*, recounts a research team's strive for greater accuracy in the prediction of rain fading and rain statistics in Singapore. Current rain attenuation models rely on data collected in various regions globally and might not provide an accurate representation of rain fade in Singapore. The team describes the main rain characteristics that are considered in developing a suitable model based on local weather information in the quest to create a reliable satellite communications system tailored for Singapore's environment.

Reducing the Risk of Flashovers in the Design of an Underground Ammunition Storage & Processing Facility is the second article which explores the possible causes of flashover in an underground ammunition storage area, and the engineering efforts adopted to implement the grounding, bonding and electrical systems within such a facility.

Being prepared to manage uncertainty is an essential skill in the undertaking of a complex project. The next article, *Creating and Valuing Flexibility in Systems Architecting: Transforming Uncertainties into Opportunities using Real Options Analysis*, discusses the notions of 'Real Options Thinking', akin to good management intuition and 'Real Options Valuation', akin to stochastic optimisation to promote a common 'options language' to facilitate project management especially in uncertainties. This framework increases our capacity to better identify, create and secure options, and empower us to actively manage uncertainties to create opportunities and reduce risks.

The fourth article, *Automated Red Teaming: A Proposed Simulation-based Framework*, discusses simulation-based operational analysis methods to uncover system vulnerabilities and to find exploitable gaps in military operational concepts. A proposal to use an automated red teaming framework, to complement the manual red teaming which can be human-intensive, was put forth. Both methods were tested on various maritime security scenarios and the result analysis is documented for a comparison of effectiveness between the two approaches.

The optimal provisioning and allocation of spare parts is vital in the management of systems with large fleet size, such as systems in the Army. The article, Spare Parts Management for Large-scale Fleet Scenarios, discusses an in-house developed simulation model known as PIPER that the Army uses to study the maintenance support concept, the impact of combat damage and workshop manpower staffing.

The traditional software development model is no longer adequate to meet the challenges of the fast-evolving needs of a Third Generation Singapore Armed Forces (SAF). The article, Continual Systems Development for Command, Control and Intelligence Systems, details the risk management framework adopted by DSTA which enables the SAF to develop a high level of flexibility to respond rapidly to meet changing needs and address emerging threats in the aspect of Command, Control and Intelligence systems.

The use of software to control and manage C4I systems has become pervasive in recent years. The seventh article, Software Safety – Back to Basics, Knowing Where to Tap, addresses the importance of fundamental software testing techniques such as white-box testing and the use of quantitative metrics as a proxy for software system acceptance to help mitigate the risks associated with software safety.

The article, Hazard Re-classification of 76mm Naval Gun Ammunition following UN Test Series 6, details the motivating factors, test programme and positive results of the re-classification. The results of this undertaking have significantly enhanced emergency response and platform survivability, as well as eased berthing constraints and increased storage flexibility and capacity.

Business Intelligence in Government Procurement describes how Business Intelligence, via a three-pronged approach of Intelligent Procurement, Portfolio Management and Performance Management, has helped GeBIZ users exploit past procurement experiences to reduce turnaround time, increase productivity and ensure accountability of public funds.

An informative read can be found in Introduction to Mine Clearing Technology, which provides an overview of the technologies and methods developed for mine clearing operations currently used by the military and humanitarian demining organisations. The article highlights that there is no single method to resolve the problem and that a combination of tools would ensure a more successful mine clearing exercise.

The last article, Future Energy and Power Challenges, highlights the various energy and power challenges faced by the Ministry of Defence and the SAF. The article also discusses the use of alternative energies, energy management modes and even advanced composites to overcome challenges and meet the energy and power demands in a cost-effective manner.

On a related note, and in keeping with saving the Earth's resources, we have printed fewer hard copies of DSTA Horizons this year. The online version of DSTA Horizons is posted on the DSTA website at www.dsta.gov.sg for easy access. We seek your help to convey this message to members of the defence community as we want to continue in our quest to promote learning, writing and sharing of valuable knowledge through DSTA Horizons.