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## **Singapore's Next Frontier: In Search of Defence Innovation**

*By Michael Raska*

### **Synopsis**

*Singapore's scientific and defence industrial base is adopting new strategies to exploit the potential of next-frontier military technologies.*

### **Commentary**

FOR SINGAPORE, the rationale for pursuing military innovation has never been greater. As military-technological gaps in East Asia narrow and the character of regional security challenges becomes progressively more complex and contentious, Singapore must search for its niche military-technological “force multipliers” – developing superior skills and knowledge, intelligence, information and technology – to better protect itself.

Moreover, Singapore faces demographic challenges and shrinking military force, which requires integrating platforms and systems in new ways, while pursuing benchmarks of operational efficiency, automation, networking, agility and functionality.

### **Next-Frontier Technologies**

Future growth areas with advanced technologies that blur the lines between physical, cyber and biological domains hold much promise. The list of potentially disruptive military technologies is extensive and encompasses various domains and disciplines. These include the use of robotics, artificial intelligence and learning machines, as well as modular platforms with state-of-the-art sensors that improve target detection and tracking. Advanced materials with adaptive properties also have the potential of making military equipment lighter and yet more weather-resistant, while quantum technologies could enable the next generation of secure communications.

The reality is that many countries worldwide are accelerating their efforts in a strategic competition for the development of these cutting-edge military technologies to counter current and future threats, as well as sustain the margins of technological superiority.

Much of the current debate portrays the next-frontier defence technologies as synonymous with a “discontinuous” or “disruptive” military innovation in the character and conduct of warfare. Historically, however, most military innovations have arguably followed a distinctly less than revolutionary or transformational path, consisting of incremental, often near-continuous, improvements in existing technologies and capabilities.

### **Singapore's Defence Innovation Strategy**

Singapore's defence ecosystem has traditionally projected such an adaptive approach with the adoption of a gradual, phased, building-block approach in the research and development of niche defence technologies. In particular, Singapore's defence technologies have evolved parallel with increasing operational requirements of the SAF, while placing a premium on cost-effectiveness and self-sufficiency, and maintaining rigorous oversight in technical evaluations, systems engineering and industry collaboration.

This approach to defence innovation has enabled Singapore's development of professional competencies, but at the same time it could have hampered alternative, “bottom-up” innovation. In other words, as a small state with limited defence resources, Singapore had to balance between preserving tried and tested strategies, technologies, and military structures with select novel military-technological and conceptual innovations.

Next-frontier defence innovation, however, is driven by more than breakthroughs in technology, which in themselves do not guarantee successful innovation. To succeed in a dynamic competitive environment, Singapore's defence and technology base must also facilitate greater agility to incorporate creative ideas from diverse sources.

Current efforts to forge closer collaboration with both local and global enterprises point toward that direction. MINDEF, for example, has been working with a number of local SMEs to boost Singapore's defence capabilities, with projects including a compact autonomous underwater vehicle capable of autonomous detection of minelike targets in shallow waters.

In February 2018, Defence Science and Technology Agency (DSTA) and Boeing signed a collaboration agreement to co-develop and engage in research and experimentation in data analytics for the Singapore Air Force's fleet of aircraft. The idea is to use select algorithms and models to enable the early detection of system failures, facilitate diagnosis of problems, and in doing so, reduce downtime and improve availability of the aircraft.

At the same time, Singapore's Defence Technology Community seeks collaboration with commercial entities worldwide to gain access to novel ideas and solutions. In this regard, DSTA is hosting the upcoming inaugural Singapore Defence Technology

Summit 2018 – a unique meeting of leading defence technology policy makers, chief defence scientists, and top-ranking security professionals from academia and think tanks.

### **Opportunities and Challenges**

Going forward, the key challenge for Singapore’s defence planners is to successfully prioritise, generate, and incorporate these emerging technologies in its future weapons systems and military operations.

According to Singapore’s Ministry of Defence (MINDEF), some ongoing projects include Unmanned Watch Towers (UWT) designed by defence engineers and scientists from DSO National Laboratories to enhance its 24/7 coastal surveillance capabilities while optimising manpower resources. MINDEF/SAF and DSTA also recently introduced the Live Digital Testbed at the RSS Singapura – Changi Naval Base, a first-of-its-kind digital sandbox within MINDEF and the SAF to support the design and testing of smart digital solutions using data analytics, machine learning, artificial intelligence and natural language processing technologies.

These initiatives indicate that Singapore is taking multiple paths toward defence innovation - recognising its enablers and constraints, while accelerating efforts that may ultimately shape its paths and patterns toward a “transformative” defence innovation.

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