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SCIENCE AND TECHNOLOGY COMMITTEE (STC)

MISSION REPORT

Visit to Singapore
6-9 May 2019

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This Mission Report is presented for information only and does not represent the official view of the Assembly. This report was prepared by Henrik Bliddal, Director of the Science and Technology Committee.

I. INTRODUCTION

1. From 6 to 9 May 2019, members of the Science and Technology Committee (STC) conducted the first ever visit to Singapore by the NATO Parliamentary Assembly (NATO PA). The delegation consisted of 20 Members of Parliament from 11 NATO Member States. It was led by Maria Martens, STC Chairperson. This report compiles the most important findings of this visit.

2. For several years, the Committee has been focused on the profound changes taking place in the global science and technology (S&T) landscape. More and more cutting-edge technologies are being developed in countries outside the Alliance. And some of these countries could soon begin to outpace traditional S&T leaders. As one of the most innovative and technology-focused states in the world, the Committee found it crucial to visit Singapore to understand its role in global S&T developments. Singapore's desire to become a Smart Nation was a central theme, with artificial intelligence and cyber security playing key roles. Defence transformation and innovation were also major subjects of discussion.

3. To fully understand the role S&T plays in Singapore's national strategy, it is essential to understand the strategic advantages and, perhaps more importantly, disadvantages the city-state confronts in shifting global and Southeast Asian security environments. Delegates, therefore, also received in-depth briefings on Singapore's strategic position, foreign policy goals, and political relations with individual Allies, NATO, and the European Union (EU).

II. SINGAPORE'S STRATEGIC POSITION, FOREIGN POLICY, AND POLITICAL RELATIONS

A. SEEKING ADVANTAGES IN THE FACE OF STRUCTURAL DISADVANTAGES

4. Singapore is a small city state of about 5.7 million inhabitants spread over merely 700 km², with no natural resource base nor any strategic depth. The country is highly dependent on global trade and sea lines of communications. Its multi-ethnic society could present pressure points for malicious actors. And the country is ageing and has a low fertility rate. In short, the state faces a number of structural disadvantages it must continuously overcome.

5. Small states like Singapore had no intrinsic value for the international system, one speaker argued. Singapore would always remain a little red dot on the map, he added. Its political leadership thus has fewer options and narrower margins when acting internationally. As a result, Singapore could never feel it had reached an end point, one speaker told the delegation. It would need to continuously reinvent itself to remain relevant to its friends. If Singapore did not, no one would pay attention to such a small country.

6. Since becoming an independent republic in 1965, Singapore has thus worked hard to develop strategic advantages, based on economic strength, skilled diplomacy, and robust defence. The economy is the central pillar to Singapore's long-term survival. Singapore has to remain an open, global, and safe place for the outside world, the delegation often heard. It has to focus on sustaining a business-friendly environment, a highly-skilled talent pool, and a high-tech manufacturing base for the many big companies and start-ups located in Singapore. Deterrence and diplomacy go hand in hand in Singapore's security strategy. Singapore seeks a broad network of friends through bilateral and multilateral channels. It wants to be "an enemy of none and friend to all". Moreover, many speakers underlined the need for a continuation of the rules-based international order to increase Singapore's security. Complementing diplomacy, the country maintains very robust defence capabilities, by spending around 3.3% GDP on defence annually.

B. REGIONAL SECURITY CHALLENGES

7. Regionally, Singapore finds itself in a challenging security environment. One expert argued that the region is a veritable “supermarket for threats”. For one, significant militarisation is taking place in Southeast and East Asia, and the Korean Peninsula and the South China Sea remain flashpoints. However, other challenges abound, including:

- nationalist sentiments (at times with Singapore as a focal point);
- an undercurrent of mistrust (sometimes bordering on resentment); and
- non-conventional and hybrid threats, including radicalisation, cyber threats, and disinformation operations.

8. To manage these challenges, Singapore and other countries in the region work together in several multilateral arrangements. Chief among them is the Association of Southeast Asian Nations (ASEAN). Some speakers argued that developments in ASEAN over the next few years could foreshadow whether the rules-based, multilateral international order can be sustained in the long run. One expert, therefore, argued that Europe and North America need to pay close attention to Southeast Asia.

9. Three specific security challenges with a regional dimension were heavily discussed during the visit: maritime security, terrorism, and information operations.

10. Regional maritime security was an important topic throughout the visit. A third of global trade – or 7% of annual global GDP – passes through the Strait of Malacca. Singapore has two command and control centres tracking the circa 1,500 ships passing through the Strait every day as well as their patterns of life. The country works extensively with international partners on improving maritime security. Specifically, this includes:

- cooperation in ASEAN and through bilateral relations;
- a Code for Unplanned Encounters at Sea;
- Guidelines for Air Military Encounters;
- ASEAN-China maritime exercises;
- an information fusion centre; and
- negotiations on an ASEAN-China Code of Conduct in the South China Sea.

11. At the national level, Singapore is renewing its submarine capabilities with the purchase of German-built submarines; maintains good underwater surveillance technologies; and builds up its mine countermeasures, focusing on unmanned technologies.

12. For citizens, it is difficult to imagine a terrorist attack in Singapore. However, the country maintains high vigilance. As a member of the international coalition against Daesh, Singapore is an attractive target for fighters returning to Southeast Asia and a successful terrorist attack could set a fire to the national consensus. The Singaporean authorities are very concentrated on domestic online radicalisation as well. Singapore has just passed a Protection from Online Falsehoods and Manipulation Act, which is one of the government’s tools to address radicalisation. It must be noted that the act has been widely criticised internationally, as it is seen as limiting free speech. Members discussed these issues extensively with interlocutors.

13. Foreign actors, including Russia and China, were engaged in information operations in Singapore, members heard from several sources. The delegation also learned about foreign interference in domestic politics in Indonesia, Malaysia, Myanmar, and Taiwan. Delegates and experts discussed several remedies against such interference, for example legal roads, cyber hygiene, media literacy, face-to-face society, and critical thinking skills.

C. SINGAPORE AND THE US-CHINA RELATIONSHIP

14. At the global level, Singapore has always been forced to navigate between the great powers. The state of the China-US relationship continues to be of vital interest to Singapore and the region. While the relationship has seen more competition and less cooperation in recent years, Singapore continues to hope for constructive relations, even amidst strategic competition. However, the increasingly adversarial relationship is negatively affecting Singapore, which traditionally has had good relations with both countries. It did not want to be forced to choose between good relationships with China or the United States, one interlocutor argued, but this was becoming increasingly difficult. Consequently, the nation's security and economic interests continue to diverge, several observers argued.

15. Cooperation with the United States remained very strong, members understood from several briefings. For example, about 1,000 military personnel are stationed in the United States for training purposes across four bases. Singapore saw China as close but treated it with high vigilance, too, delegates learned. The year 2017 was a particularly bad year between the two countries, in part because of tensions over the South China Sea and Taiwan. However, relations have normalised since.

D. SINGAPORE'S RELATIONS WITH NATO AND THE EU

16. Singapore has very good relations with all NATO and EU member states. Increasing interest in Singapore by NATO Member States, NATO, and the EU was something Singapore ought to welcome, the delegation heard, as there was much to learn from each other. With NATO as an institution, the country has built up very good high-level contacts in recent years. Practical cooperation exists on cyber security and defence, S&T, and strategic communications. Moreover, the Ministry of Defence (MOD) always looks towards NATO when it comes to new norms (e.g. counterterrorism, cyber security and defence, and hybrid operations), members heard.

17. In Southeast Asia, two views of Europe exist. Some observers thought that Europe was increasing its footprint as a reaction to China. Others believed it was doing so due to economic opportunities. Singapore is the ASEAN coordinator for relations with the EU, which the country values highly. The government thus seeks to play a constructive role and explain ASEAN's positions to the EU.

III. SCIENCE, TECHNOLOGY, AND INNOVATION IN THE CIVIL SECTOR

A. THE OVERALL S&T LANDSCAPE

18. S&T had become "the new pillar of the economy", Assembly members heard. Innovation through S&T was the key to overcome many of Singapore's national and international challenges, most interlocutors agreed. Singapore is already highly ranked in global S&T statistics. For example, it is ranked number 12 in innovation and number one when it comes to the innovation talent pool. However, the government is implementing further S&T and innovation initiatives. Nationally, Singapore will invest about USD 14 billion between 2016 and 2020 through the Research, Innovation and Enterprise 2020 Plan.

19. In addition to its focus on technology, Singapore focuses heavily on people in pursuing its S&T goals. To increase skills (especially in "brain-intensive" research areas), universities engage in high-level international cooperation to tap into other research communities and mindsets. Singapore's universities also emphasise continuing and life-long learning. For example, graduates in 'sunset industries' from the National University of Singapore (NUS) have the opportunity to come back to the university and receive additional training or degrees.

B. START-UP CULTURE

20. A key driving factor for the Committee visit was to learn more about the Singaporean start-up culture, in order to understand how the country copes with and leads S&T change. Several key reasons exist why Singapore is home to about 5,400 start-ups in the high-technology sector. The country:

- has about 50 high-end manufacturing plants;
- has a high density of leading global companies;
- is the 2nd easiest place to do business in the world;
- has the 3rd most connected start-up ecosystem;
- offers the strongest intellectual property rights regime in Southeast Asia; and
- is the most innovative country in Asia.

21. Interlocutors argued that innovation could not be taught but had to be experienced. This was the key reason for founding Block71 (the world's most tightly packed start-up ecosystem) and the NUS Hangar (a base to house NUS start-ups and entrepreneurs as they nurture their business ideas). The delegation paid a visit to Block71, engaging with several start-ups.

22. The Singaporean government does not expect all start-ups to succeed, of course. Moreover, Singapore could not become Silicon Valley, one interlocutor cautioned. While Singapore had the S&T, researchers, and students, commercialisation, time-to-market, and general transformation were still lacking, one speaker underlined.

C. SMART NATION INITIATIVE, ARTIFICIAL INTELLIGENCE, AND CYBER SECURITY

23. S&T plays a very large role in Singapore's aim to become a hyperconnected country through digitalisation, with the goal of building a vibrant ecosystem for economic growth and social development. The most notable plank supporting this aim is the Smart Nation initiative, begun in 2017. The initiative is a whole-of-nation effort led by the Prime Minister's office, with a budget of USD 1 billion per year. It is based on three pillars: the economy, government, and society.

24. Artificial intelligence (AI) is a key factor in the Smart Nation initiative. While many technological and non-technological obstacles remain, Singapore is embracing this technology with open arms. While the country only has a small pool of AI researchers, they are of high quality. Indeed, Singapore is ranked as number one in AI research and development based on citation impact. The government has initiated a two-phased AI Singapore Roadmap. Under the roadmap various institutions:

- conduct grand challenges (for example on healthcare, sensemaking, urban design, and cyber defence and forensics);
- run a flagship programme called "100 Experiments";
- have instituted an apprenticeship programme to increase the talent pool; and
- engage in outreach through the "AI for Everyone" and other initiatives throughout society.

25. Singapore is conscious of the ethical and legal challenges of AI. The government is, therefore, working on an AI governance framework on norms and ethics. Indeed, data privacy was often a key topic of discussion between the members and their interlocutors.

26. Cyber security must also be built into the Smart Nation concept. Singapore has learnt some hard lessons on this in recent years and has redoubled its cyber security and defence efforts. Delegates received detailed briefings about Singapore's cyber policies and strategies from civilian and defence authorities. This included a presentation on the 2016 cyber security strategy – the first for the country – which rests on four pillars: resilient infrastructure; a safer cyber space; a vibrant cyber ecosystem; and international partnerships.

27. In light of the challenges, a Cyber Security Agency (CSA) was formed in 2015 to consolidate a range of government efforts, including coordination and implementation of strategy and policy; incidence response during peacetime (up to a certain point of severity); critical infrastructure protection; and resilience measures. The CSA has identified critical infrastructure and also conducted a review of cyber election security. Reporting for cyber incidences is encouraged for all private sector actors and obligatory for critical infrastructure providers and when personally identifying information has been targeted. The CSA also tries to educate and raise awareness across Singaporean society by:

- offering help for small- and medium-sized enterprises;
- instituting confidence-building measures;
- conducting company audits and cyber exercises;
- compiling a cyber readiness index; and
- being a safe harbour for cyber incident reporting.

28. Cyber innovation efforts, manpower development, and international partnerships (especially within ASEAN) are also key areas for the Agency's work.

IV. SINGAPORE'S DEFENCE TRANSFORMATION THROUGH S&T AND INNOVATION

29. Traditionally, Singapore has high levels of defence investments. Currently, it spends about 30% of its annual defence spending on major new equipment (compared with NATO's 20% goal) – more than 13% of which go to defence research and development. However, Singapore will only engage in dedicated research and development efforts when it cannot find anything on the market it can buy or modify.

30. Singapore is currently developing next-generation armed forces, the delegation learnt at the Defence Science and Technology Agency (DSTA) and the MOD. Priorities include transforming warfighting; building up hybrid defences; reducing manpower needs; and streamlining logistics support. People and innovation are at the heart of these next-generation forces. The Singapore Armed Forces (SAF) see technology as a multiplier of force. This is especially true as the SAF face severe manpower challenges under the conscription-centric system. By 2030, Singapore will see a 30% drop in the annual conscript rate, due to the low birth rate.

31. Innovation is key for the SAF and the MOD. Indeed, a separate innovation procurement department and a Head of Information for Innovation exist in the MOD. The SAF and the MOD pursue a combination of top-down and ground-up innovation on a number of priority areas (see Figure 1). New tools to spur innovation across the defence sector are being implemented. For one, MOD and SAF bring technology to the commanders to change mindsets. The Ministry was also conducting "hackerfests"; innovation calls; technology talks; and networking sessions.

**Figure 1:
Select Defence S&T priority areas**

- Artificial intelligence
- Augmented reality
- Combatting disinformation
- Cyber security and defence
- Data sciences
- Enterprise digitalisation
- Internet of Things
- Maritime security (incl. underwater capabilities)
- Network connectivity
- Precision firepower
- Resource and maintenance management
- Robotics
- Strategic communications
- Training
- Unmanned technologies and human-machine teaming

32. Digital transformation is a key line of these innovation efforts, with a designated Head of Digital Innovation. The DSTA has a Digital Hub focused on digital transformation in administration and operations, emphasising rapid prototyping and experimentation. The DSTA pursues a "Digital First" approach. Examples include initiatives on soldier performance, reduction of intelligence,

surveillance, and reconnaissance (ISR) operators' workload, smart fleet management, a smart airbase, automated weapon loaders, smart training, marksmanship, and maritime security.

33. The DSTA also works with the civil sector to bring technology and new ideas into the defence sector. The SAF and the MOD continue to switch to a mindset where failure can be tolerated and where not every piece of hardware or software needs to comply with the highest standards. The DSTA has also recognised that it should be closer to the civilian start-up community. It has, for example, recently set up a DSTA office in Block71 to demystify defence, but also have access to the brightest people and best ideas. The DSTA at Block71 focuses on AI, data science, robotics, and augmented reality. For example, the DSTA was working with start-ups on image analysis, a zero-footprint operations centre, and simulation tools based on e-sports software.

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