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Policy Framework for Space Sector Development: What can Malaysia Learn?

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Abstract

Malaysia made a good start in its space endeavour, and is currently making gradual progress in the space sector. Since 1996, Malaysia has joined countries who operate their own satellites. Later in 2007, Malaysia made a significance leap by sending the nation's first astronaut into space. In order to ensure its space sector development is progressing and continues to sustain, a policy framework is needed as a guideline for the government. A policy framework that comprises a set of core principles will act as a backbone for the national space policy. This paper reviews the documents that are related to the national space policy from Canada, Australia and Japan. All of the principles in the policies will be reviewed, and the similarity in these principles will then be highlighted. This paper further proposes several principles for Malaysia to consider as part of its policy framework in space sector development.

Keywords: Policy framework; space sector development; developing country

■ 1.0 INTRODUCTION

Venturing into space is among the strategic initiatives implemented by fast growing nations, and has long been adopted by fully developed nations. This involves not only a manned spaceflight venturing into the galaxy, or a lunar landing and Mars probe, but space in this context also involves all the technologies related to it that bring direct benefits to the people back on earth. The use of outer space has become important to civil, industrial, governmental and military users (Tabarcia & Stroescu, 2010). On a daily basis, civilians use the Global Positioning System (GPS) for transportation, watching a live telecast on their television screens, and following real-time weather forecasts. These are all examples of downstream space applications, apart from the more complex usage of technology such as spy satellites by the military, and homeland monitoring by the government. Space programs and technologies related to these are becoming an integral part of the strategic and developmental policies of many relatively wealthy developing states that aspire to elevate their international status, security, and economic future (Harding, 2013).

Since the 1970s, both developed and developing countries have been expanding their investment in multiple space-related areas, including satellites for communication, weather monitoring, reconnaissance, and global positioning (GPS); as well as for ground-based hardware and software used to process the data received (Harding, 2013). Since then, the demand of Earth Observation Satellite (EOS) images for various Remote Sensing (RS) applications is ever increasing in both the public and commercial sectors, which is being dominated by the public sector. EOS images and RS applications have become an important administrative tool (Subari & Hassan, 2014).

Russia (previously the Soviet Union) and the United States are the two undisputed space faring countries. Other countries that are catching up include China, India, Japan, Brazil, France, Germany, Italy and the United Kingdom. Harding (2013) categorizes the involvement of developing countries in space programs into one of three tiers of development, based not only on the level of technology used, but also on the manner in which each program fits within the country's overall national security and/or development policies. Brazil, China and India have been categorized as first tier states. With the similarity on the fast growing economies of the post-Cold War period and strong political support, they have achieved the capability to autonomously produce space technology, developed their own launch capability for both orbital and geosynchronous satellite placements, and built national space agencies with thorough involvement in space development.

The 'second tier' states include those that have produced some of their own space technologies with basic launch capacity, have their own national space agency, and frequently collaborate with more advanced states' programs in the production of space technology. According to Harding, four countries have been categorised into this 'second tier' category: Iran, Iraq, Israel and South Africa. In the case of

Iraq, besides the illustrious achievement in space technology, including becoming the ninth country to have an independent orbital launcher; the country's space program was terminated due to the UN sanction and the Gulf War in 2003.

As for the 'third tier' states, the criteria highlighted for the category are; the countries occasionally make contributions in space-related technologies, almost always purchase space-related technologies from more advanced producers, and almost always collaborate with other more developed space actors in achieving their space policy goals. With this loose criteria set by Harding, almost any developing country which has initiated its space endeavour, and has set up a national policy related to space, can be categorized as a third tier space actor. These include Malaysia, as well as other countries in South East Asia such as Singapore, Thailand and Vietnam.

Malaysia is not far behind, possessing communication satellites run by a private company since as early as 1996. MEASAT Satellite Systems Sdn. Bhd. is considered a pioneer and a large-scale player in the Malaysian satellite industry. According to the company's information, in 2013, they have managed to earn US $99 million in revenue from their three existing satellites, namely, MEASAT-1, MEASAT-3 and MEASAT-3a. Moreover, they have also forecasted US $260 million for 2017 revenue when they start to operate the MEASAT-3c (Bernama, 2014). Apart from that, two years after sending the nation's first astronaut, a high resolution Medium-Sized Aperture Camera Satellite called the RazakSat was launched into low earth orbit by a Falcon 1 rocket on July 14, 2009. Intended to serve as a capacity demonstration project in earth observation, RazakSAT was operated for about a year before it was shut down due to system failure. The Malaysian government is currently developing a second EOS, referred to as the RazakSAT2, which is intended as an operational EOS. With it, Malaysia will gain access to more high resolution images of its home soil from the satellite perspective.

With this progress in its space activities, Malaysia is still without a policy in its space sector development. Therefore, considering the importance of having a big picture of the nation's aspiration in space and space technology, this paper investigates the optimal criteria or principles to constitute to a suitable policy framework in this field for Malaysia. As a developing nation with some constraints on resources, Malaysia will have to correctly decide the best area to venture in, in terms of the space sector. There is a great deal of interest to be taken into account, be it the return of investment, the benefit to the public, science and technology involved, nation's sovereignty, public enculturation, private sector involvement and political agenda. This study highlights the most prioritised among these factors.

■ 2.0 SPACE POLICY FRAMEWORKS OF SELECTED COUNTRIES

This paper explores the guiding principles used by three countries for their national space-related policy or policy framework. The countries are Japan, one of Asia's leading space-faring nation, and Canada and Australia, which are two countries with a population size similar to that of Malaysia. Analysing these guiding principles will potentially identify the common issues shared among the three nations. A set of guiding principles will then be proposed to constitute Malaysia's policy framework for space sector development.

2.1 Basic pillars for Japan's development and utilization of space

Japan has launched a Basic Plan for Space Policy on January, 2013, initially to cover a five-year period starting from 2013, but subject to be reviewed as needed based on follow ups (Government of Japan, 2013). On January, 2015, Prime Minister Abe unveiled a new 10-year Basic Plan on Space Policy that is more focused on security and commerce. In this study, the Six Basic Pillar in Basic Plan on Space Policy published on January, 2013 will be reviewed.

The first pillar is Peaceful use of space. It covers two main scenarios. The first is the surveillance of the sea and air in Japan using space applications. The Ministry of Defence is developing a new communications satellite for the Japan Self Defence Forces (JSDF). The second scenario involves exploring Space Situational Awareness (SSA), which protects satellites from possible collisions with debris. In terms of the second pillar, Improvement of people's lives, Japan advances further in space applications which have not yet reached their maximum potential, and focuses on improving its effectiveness in industry, human life, administration and disaster management. Japan will also make use space technology to counter any disaster that occurs on earth, since the space-based technology will not be affected by what occurs on the ground. The third pillar, Development of Industry, refers to the situation where some advanced countries dominate the space-technology market such as satellite manufacturing and rocket launching services. Japan realised that they need something outstanding in order for the space technology market's rapid movement could be shared and utilised. They will encourage new entrepreneurs to enter the space industry and promote their businesses, focusing not only on space-related products, but also problem-solving services.

With regards to the fourth pillar, Prosperity of human society, Japan has completed a science module conducted in ISS known as KIBO in 2009. Since then, a large-scale space exploration will be executed with a clear order of priority. Japan will also continue to engage in space science research, as well as in the exploration for the great benefit of mankind. In the fifth pillar, Promotion of international cooperation, Japan will offer their technology such as remote-sensing satellite systems to other countries. In doing this, the receiving countries will obtain critical information they need, especially for managing natural disasters. Moreover, the industrial base in Japan will yield a good return. International partnerships can also be a platform for participating nations to share the huge costs of large-scale projects.

In the sixth pillar, Consideration for the environment, the environment in this context refers to two main viewpoints. The first is the viewpoint of the global environment. Japan stressed on the importance of space programs for an effective and efficient solution for global

environmental problems such as climate change. The second viewpoint refers to the space environment. The issue of space debris resulting from the collision of manmade satellites or ballistic missiles is an urgent problem to be addressed for sustainable space development and utilization.

2.2 Canada Space Policy Framework

Canada is among the ambitious countries in catching up with other larger space faring nations. In 2012, Canada's space industry had provided about 8,000 highly skilled jobs, and contributes $3.33 billion to Canada's economy. About $2.66 billion, equal to 80% of space sector revenues, is represented by the satellite communications industry. Canada is also well-known for its involvement in large space projects such as International Space Station (ISS). Canada's Dexter, a robotic "handyman", is attached to ISS for maintenance jobs. Canadarm2, a 17-metre long robotic-arm that assembles the ISS while in space, is also readily available. Canada is currently working with NASA and ESA for a James Webb Telescope, a major space observatory scheduled for launch in 2018 (Canada Space Agency, 2014).

Looking at the reality of space, which is increasingly congested, contested and competitive, and the opportunity awaiting within the fast growing economic sphere of space commercialization, Canada has come out with five core principles to guide their space activities (Canada Space Agency, 2014, 2015). The first principle is *Canadian Interest First*. Canada has listed out national sovereignty, security, and prosperity as the key drivers for their activities in space. The second core principle in Canada Space Policy Framework is *Positioning the Private Sector at the Forefront of Space Activities*. Under this principle, the Government of Canada will support the private sector in technology innovation that is in line with national interest. The third principle is *Progress through Partnership*. The Canadian Government acknowledges that space venturing is costly. Under this principle, an international partnership will progress by Canada. Control and regulatory measures in export activities will be used to protect technologies and data from being stolen or falling into the wrong hands.

The fourth principle is *Excellence in Key Capabilities*. Canada will continue to focus on the areas of space technology in which they already have expertise in, such as telecommunications, remote sensing and robotics, and also new niches based on their latest technological achievement. The last principle for the Canada Space Policy Framework is *Inspiring Canadians*. Space will be used as a tool to motivate young Canadians to pursue their careers in science, technology, engineering and mathematics. The Canadian Government will also cooperate with industries, universities, and colleges to convey the importance of space in their effort to recruit, support and retain highly qualified personnel.

With the implementation of the core principles mentioned above, the Canadian Government believes that through the Canadian Space Program, both industry and academia can fulfil their mission and deliver their predefined tasks (Canada Space Agency, 2014).

2.3 Australia's Principles for Space Industry Policy

Australia has launched the Principles for National Space Industry Policy in 2011 (Australian Government, 2011). The National Space Industry Policy itself will forecast Australia's space activity, and the core principles will act as a backbone this policy. Australia later released its Satellite Utilisation Policy in 2013, which it follows closely (Space Coordination Office, 2013).

The first principle in the document is *Focus on space applications of national significance*. According to this principle, applications for Earth Observation, Satellite Communication, Position, Navigation and Timing will be top priority to the government. They believe that these applications have security, and economic and social impact on their country. The second principle is *Assure access to space capability.* Based on this principle, Australia will ensure access to the space system they rely on such as the radio frequency spectrum. In order to access, process, store, integrate, use and distribute the data and information from the space system, all infrastructure, capabilities and skills, including those from public and commercial stakeholders, must be readily available. The third principle is *Strengthen and increase international cooperation.* Australia will strengthen its relationship with the nations that it relies on for space system capabilities, as well as with its regional neighbours with developing capabilities.

The fourth principle is *Contribute to a stable space environment.* Australia is committed to support international laws for access to space. They will promote peaceful, safe and responsible activities in space through the contribution of monitoring and managing the space environment. The fifth principle is *Improve domestic coordination*. Australia will develop a Whole-of-Government approach in their space sector development. Information-sharing across government agencies and domestic coordination with the commercial sector will be optimised. The sixth principle is *Support innovation, science and skills development.* The Australian Government will collaborate with public and private research and development organisations to enhance national capabilities through research and innovation in the focused area, or in areas aligned with its national interest. Students and teachers will be approached by the context of space in science, mathematics and engineering to make sure Australia's future generation of engineers, scientists and workforce is equipped with the competencies required to secure their jobs in the future. The seventh principle is *National Security and economic well-being.* Australia will use their space capabilities and domestic and international arrangements related to space technology to protect their overall national security and economic well-being. They will also attempt to explore new technologies to overcome challenges associated with natural disasters, energy and resource security.

■ 3.0 ANALYSING THE FRAMEWORK PRINCIPLES

Referring to the principles and pillars listed by Canada, Australia and Japan in constituting their policies and policy frameworks in space activities, the following are the four main areas similarly emphasized by the three countries;

i. Activity in space is prioritised by the sector that brings the most benefit to the country and its people

There exists a broad range of space related programmes that can be run by a country which decides to be serious about space development; be it manned or unmanned space exploration, satellite technologies (manufacturing, launching, operations and applications), science and technology research conducted in outer space itself, or even space tourism. But what is the optimal programme that should be prioritised? Both Canada and Australia have clearly addressed this question by placing the highest interest in their set of principles. Canada in their Policy Framework had put *Canadian Interest First* as the first core principle; and Australia also mentioned it in their first principle, *Focus on space applications of national significance*. Canada highlighted national sovereignty, security, and prosperity without mentioning specific applications as their priority. Meanwhile, Australia stated in its principle that its focus will be on applications that have a significant impact on security, economic and social factors. The applications mentioned to be prioritised are Earth Observation, Satellite Communications, Positioning, Navigation, and Timing. The integration of these applications will be a solid foundation for their capability in areas related to disaster management, land management, and weather and climate forecasting.

As for Japan, the area of focus is only mentioned in pillar number 2, which is *Improvement of people's lives*. Japan has placed emphasis on natural disaster management, and how the space system can assist the country in mitigating it.

ii. Forging international cooperation

As venturing into space involves a massive financial budget, vast knowledge and expertise in space, science and other relating factors such as time, human resources and infrastructure; collaboration among nations is the most ideal alternative that is practised by leading space-faring nations. Even America and Russia, which were previously involved in a fierce competition in space exploration during the Cold War, are now actively cooperating in space; for example, the International Space Station (ISS) is among their collaboration projects.

By comparing the principles/pillars by Canada, Australia and Japan, all three countries have placed international cooperation as their core principle. Canada has put this in their third core principle, *Progress through partnership*. Australia has also added this to their third principle, *Strengthen and increase international cooperation*. Japan has this concept in their fifth pillar, *Promotion of international cooperation*. One example of a win-win situation in international cooperation among developed nations in space, as mentioned by Japan, is that where a country that obtains remote-sensing data from developed nations can use the data to assist their disaster handling, and at the same time, the supplier nation can maintain and strengthen their industrial base.

iii. Encouraging private sector involvement

Since the Government has many areas to focus on in space venturing, the private sector can play a crucial role in commercialising the space industry. Canada has shown government encouragement for private sector involvement in their second principle, *Positioning the Private Sector at the Forefront of Space Activities*. Canada will utilize the industry which has greater capacity, knowledge and skills, in a manner that may be more efficient and cost effective. Meanwhile, Japan has mentioned the needs to push the industry in their third pillar, *Development of industry*. In this pillar, in order to lure more private sector involvement in the space industry, the Japanese Government will create a favourable environment for private sector involvement.

Australia also mentioned that it will encourage industry participation in its space activity under its second principle, *Assure access to space capability*. The Australian Government (2011) mentioned that the principle is consistent with their Australian Industry Participation National Framework, which was previously established in 2001.

iv. The peaceful use of outer space

The concerns associated with the space environment were mentioned by Australia and Japan in their principles for space policy. Their concerns were mainly on space collisions between two satellites, or between a satellite and space debris. Australia mentioned this principle number 4, *Contribute to a stable space environment*. Apart from a space situational awareness programme, Australia will also support international regulatory frameworks and guidelines such as the Space Activities Act 1998, European Union's Code of Conduct for Outer Space Activities and UN Space Debris Mitigation Guideline. As for Japan, space situational awareness and issues of space debris are mentioned in pillar number one, *Peaceful use of space*, and in pillar number 6, *Consideration for the environment*.

As for the other remaining principles and pillars, they are more focused on the interest of each individual country, and are mildly related to each other.

■ 4.0 WHAT CAN MALAYSIA LEARN?

In constituting a policy framework for space sector development in Malaysia, it is important to identify which sector or focus should be prioritised. The country may invest in the area of satellites and launch vehicles, space exploration, astronaut programs, ground-based and satellite-based scientific research, microgravity research, application of satellite services or public outreach. Malaysia, as a relatively

small country with restricted resources such as budget and human capital, must decide the best priority to be put in space sector development, hence, the requirement for a suitable policy framework. Thus, in guiding Malaysia to choose the optimal area of focus, this paper proposes some important principles as the basis for Malaysia's space sector development.

i. Space for economic growth

Malaysia aims to become a high-income developed nation by 2020. The space industry is worth billions in revenue globally. Malaysia has to tap into this opportunity. Currently, the commercial space sector in Malaysia is heavily centred on the telecommunications, broadcasting and remote sensing services, which are mostly from the downstream segment (Angkasa Malaysia, 2008). This is the market segment which will bring growth to the economy. Malaysia may also want to consider the upstream segment by developing and exporting Malaysian-made satellites to others, which undeniably requires a massive sum of capital, but promises a large return of investment ($15.9 billion for global revenues in satellite manufacturing in 2014.) This bold strategic initiative may be spearheaded by a wholly-owned company by the Ministry of Finance, Astronautic Technology (M) Sdn. Bhd. (ATSB), which has vast experience in developing the TiungSAT-1 (Malaysia first microsatellite) with Surrey Satellite Technology Ltd. (SSTL), United Kingdom in the 1990s; and in developing the RazakSat satellite with a South Korean company, Satrec Initiative, which was completed in 2003. Other industry players could be MEASAT, which currently owns and operates several communications satellites.

ii. Strengthening International Partnership

Malaysia has experience in international partnerships for space venturing projects, especially in terms of satellite technology. In fact, most of its space projects were conducted through international collaborations. This has started with the first microsatellite project, the TiungSAT, in 1997, which is almost entirely composed of British technology. A high-resolution Medium-Sized Aperture Camera satellite called RazakSAT was later jointly-developed with Satrec Initiative (SatRecI), a Korean firm. From these two satellite programmes, Malaysia gained a great deal of benefit, especially in knowledge and technology transfer to Malaysia's local engineers, policy makers and industry players. Within the remote-sensing sectors, GNSS and space science, various collaborations under the national space agency, ANGKASA, are in place. Malaysia has also fostered a relationship with other international space agencies such as the Federal Russian Space Agency (ROSCOSMOS), Japan Aerospace Exploration Agency (JAXA) and National Astronautics Space Agency (NASA) during the Angkasawan program. These existing collaborations, as well as new ones, would certainly assist future space ventures by the country.

iii. Encouraging Private Sector Involvement

Malaysia should pave the way for local industry players to take the lead in venturing into the space industry. This is in line with Malaysia's Economic Transformation Programme (ETP) direction, which states that ETPS's key thrust is to return the private sector to its rightful role as a major engine of economic growth (PEMANDU, 2013). ETP is part of Malaysia's National Transformation Programme (NTP) towards reaching the country's aspiration for Vision 2020. Notably, MEASAT is a successful example of a Malaysian private company which is currently doing well in the satellite industry. It started back in 1996 with the launch of the Maesat-1 and Maesat-2 by Binariang Sdn Bhd (it is currently known as Measat Satellite System Sdn Bhd). The two high-powered Boeing 376HP communications satellites bought from Hughes Space and Communications Company (now Boeing Satellite Systems) provide regional C-Band coverage, and have pioneered the use of Ku-Band in the high rainfall South East Asia region. Measat is currently operating a total of six communication satellites, including one serving the African continent.

iv. Capacity building in the space sector

Capacity building is important in ensuring that space sector development is a sustainable effort until Malaysia becomes one of the major space-faring nations. For a sector which is under the strict control of various international regimes, a long-term sustainability needs to be acquired. Hence, capacity building in the space sector requires the nation to develop and prepare its own human capital, indigenous technology, and development infrastructures such as laboratories and testing facilities, systems developers, good policies and governance. It could start with various awareness programs at schools to inspire students to explore space science and cultivate them to be a part of space sector development in the country, by sharing the same vision with the government toward space ventures. This is important for the country and its vision to become a developed and high-income nation by the year 2020.

■ 5.0 CONCLUSION

Malaysia has started well in its space endeavour. Since the first launch of Malaysia's communication satellite in 1996, and the development and launch of its micro-satellite in 2000, the country has gradually progressed in space sector development, and currently has its own facility to develop satellites on its home soil. The national space agency, ANGKASA, has been established in 2002. Therefore, to seriously venture into space and gain the most possible benefit offered by space in terms of the commercial, military and civil sectors, is not an impossible undertaking for the country. With a clear mission plan and a rightful policy framework for space sector development, Malaysia has the full potential to become among the leading space-faring nations.

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