Spurring Space Industry Development in Malaysia: the Enabling Capabilities

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Abstract

Malaysia's endeavour to a space program is an important milestone in carving our very own niche in the space sector. This initiative can act as a catalyst, not only to the space industry, but also to the existing thriving local aerospace sector in the country. Science, technology and innovation are the main drivers that will move our nation's economy forward. Aspects of these enabling capabilities are especially important to the development of the space industry, and are priorities for the success of Malaysia's space initiative. The authors have identified five specific existing enablers that has Malaysia possessed in order to succeed in this highly competitive business. These enablers are; Supportive Government Policies; Strong and Developed Infrastructures; Innovative Financing Schemes; Vibrant Business Climate; and High Quality of Life. However, this study cautions that these enablers will only facilitate our space endeavour, but not necessarily ensure its success. This paper also dwells on the issue that these factors are not only important enablers to the space industry, but also can be promoters of innovative ideas and applications. Sometimes this is perceived as pushing technology, when, in fact, the entire system works together to provide solutions to delivery policy problems.

Keywords: Malaysia space industry

Spurring Space Industry Development in Malaysia: the Enabling Capabilities

Introduction

The government's effort to spur the space industry is an important moment in the history of Malaysia, after five decades of independence. Many may not realize that, after more than three decades of Malaysia's foray into space, we have carved our niche in the space technology sector. With Government Transformation Program (GTP) and Economic Transformation Program (ETP) initiatives currently under implementation, Malaysia will enter a new and more political phase, aiming at a better living environment for its citizens.

There is no doubt a strong government backing, via established related policies, can act as a catalyst to a more vibrant space and aerospace industry in any nation. Any government decisions related to space have to come in close proximity with many other fields, including, but not limited to, telecommunications, broadcasting, trade, export controls, competition, arbitration and government procurement law. It suffices to say that the political framework of the nation is the only one adequate to provide the appropriate conditions in order to reap the benefits of the related policy.

There is a strong will by the current government set-up to put our scientific talents, technologies and entrepreneurial skills in the space sector, at the service of Malaysia, and its citizens. The vitality of Malaysia's space program is in question at a critical point in time. Government leaders are due to make decisions about space future development, which will affect not only national security, but also the ability of the nation to successfully compete with others in the commercial use of space, as well as to maintain a substantial role in modern space applications and technologies. These decisions also affect the health of not only our fledging

space industry, but also aerospace, which is crucial to all aspects of the space program, and fundamental to the future of our efforts in space.

A healthy and vibrant space industry will aid the country to become a better neighbour and a respected global partner. The nation will be better able to act in defence of its core values of democracy; respect for the rule of law; and sustainable development and maintenance of peace and order through dialogue and diplomacy. In addition, Malaysia will be more strongly equipped as a global leader in the political, economic and scientific spheres. By investing in the suitable domains and effective programs, the space industries will help raise Malaysia's political standing in the world, sharpen its economic competitiveness and enhance its reputation for scientific excellence.

Space Industry in Malaysia

Malaysia's involvement in the space industry is part of the broader effort to attain the Vision 2020 objective of turning Malaysia into a developed country. To bring about this progress, the government has to implement various initiatives, one of which was Malaysia's foray into the space industry.

The key driver underlying increased government interest is the recognition that space activity, whether satellite communications, remote sensing, or navigation applications, ties directly to national power, economic benefits, and societal wellbeing. At the same time, new industries have emerged within the space sector, including satellite-based imagery products, location-based services, and various applications from satellite communication. Effective strategies and policies must be able to align these to the national vision. These, amongst others, include investment in critical infrastructures, programs, and applications development, as well as

education, training, and outreach, in order to stimulate end-users demand to maximize national interest, usage and social benefits.

The space industry can generally be divided into two broad categories – the 'Upstream' sector, and the 'Downstream' sector. The Upstream sector consists of activities involved with the development, construction, launch and operations of space systems, and the associated ground segment. The Downstream sector represents activities involved in the business of exploiting satellite capabilities, and selling commercial products and services directly to end users. Serving these two categories are satellite operators and earth station operators that provide telecommunication and other related services (see Figures 1 and 2).

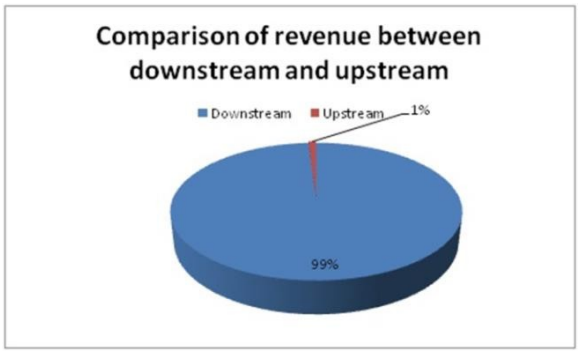

Figure 1. Comparison of Revenue between Downstream and Upstream (SIRIM, 2008)

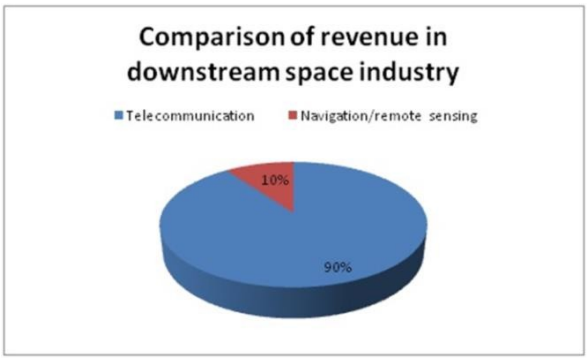

Figure 2. Comparison of Revenue in Downstream Space Industry (SIRIM, 2008)

In 2005 alone, the space downstream industries contributed to RM16.73 billion compared to only RM3 million by the upstream industry. The huge gap trend in revenue generated continues for the year 2006, where the downstream and upstream industries generated RM21.61 billion and RM3.5 million, respectively, to the local economy (SIRIM, 2008) (see Figure 3).

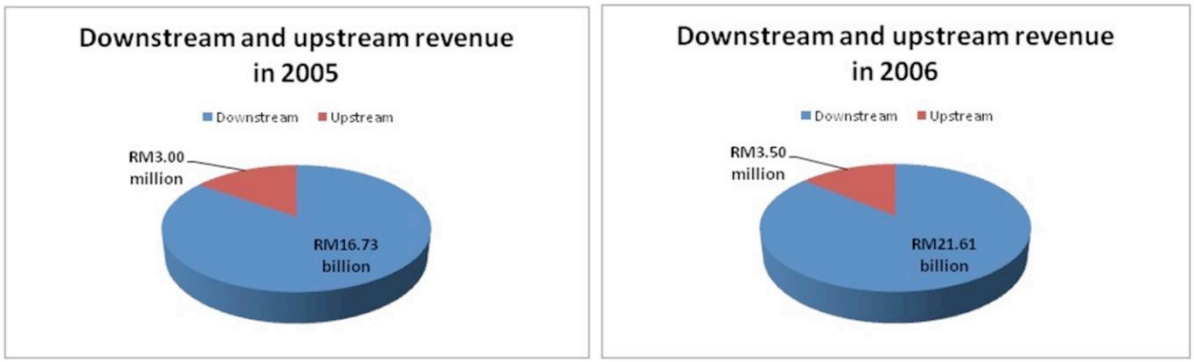

Figure 3. Downstream and Upstream Revenue in 2005 and 2006 (SIRIM 2008)

The Malaysian space industry segment shows a similar trend. Segments in satellite services, including telecommunication, are the most lucrative part of the services industry, of which comprise over 60% of the total revenue from this industry. In satellite-related telecommunication services, the broadcasting segment is the most lucrative compared to the mobile and broadband services segments.

The most visible satellite communications service in Malaysia is the direct to home (DTH) broadcast service, operated by ASTRO (Astro Malaysia Holdings Berhad), which offers more than 150 TV channels. The latest statistics show that the residential subscriber base is more than 3 million, or 54% of Malaysian homes. Indeed, the DTH subscription in Malaysia is among the highest in the world in the Ku-Band segment. Its radio business has 10.6 million listeners over its eight stations, every week. ASTRO leases transponder capacity from MEASAT (see Table 1).

Space has proven to be among the few sectors in which growth can remain resilient during the world-wide recession. This has been possible due to the diverse range of customers for Space-enabled services, from commercial telecommunications, to institutional surveillance.

Table 1

Comparison of Asia-Pacific DTH Subscription Base (MEASAT, 2009)

Country	**2006 (million)**	**2007 (million)**	**Growth (%)**
Australia	1.17	1.35	15.4
India	1.49	2.31	55.0
Indonesia	0.17	0.27	58.8
Japan	3.73	3.66	-1.9
Malaysia	1.94	2.17	11.9
New Zealand	0.67	0.73	9.0
Philippines	0.11	0.12	9.1
South Korea	1.98	2.12	7.1
Thailand	0.40	0.46	15.0

In terms of the remote sensing sector, the number of user agencies in both public and private sectors are increasing on a yearly basis, which indicates a positive business trend. The future of remote sensing downstream business in Malaysia will definitely improve. In a review exercise conducted by the National Remote Sensing Agency (ARSM) of the local remote-sensing market, the growth of the industry over the next decade is predicted to be promising. The study indicates that government agencies represent a significant revenue source for many remote sensing related businesses.

To indicate potential demand for remote sensing data, both public and sectors were asked to select the types of data they uses from five independent data providers. Both sectors show preference to SPOT, Landsat and Radarsat data. These types of data are commonly used in a variety of development applications, including municipal planning, vegetation analysis and

transportation management (MIGHT, 2009).

Table 2

Agencies Involved in RS Activities (2000-2006) (MIGHT, 2009)

Year	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***
Public	34	35	50	35	63	70	76
Private	21	13	27	18	14	35	34
Total	55	48	77	53	77	105	110

Table 3

Types of Data Requested by Private Sector (2000-2006) (MIGHT, 2009)

Data/Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Landsat	35	52	32	11	9	13	3
SPOT	35	14	29	31	20	169	177
Radarsat	0	0	0	0	3	4	4
Ikonos/Q-Bird	0	0	2	7	6	2	0
Modis/OCM/NOAA	0	0	0	0	0	3	0
Total	70	66	63	49	38	191	184

Table 4

Types of Data Requested by Public Sector (2000-2006) (MIGHT, 2009)

Data/Year	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***
Landsat	109	141	212	168	194	97	92
SPOT	116	65	101	119	358	671	904
Radarsat	9	1	5	52	311	321	302
Ikonos/Q-Bird	1	9	5	37	110	47	67
Modis/OCM/NOAA	0	0	1	39	54	19	62
Total	235	216	324	415	1027	1155	1427

Overall, the remote sensing sector indicates a steady growth in the coming decade. The ongoing challenge in the remote-sensing industry is to make high-quality data accessible to more

users, at affordable prices. The use of maps, aerial photos, and digital aerial and satellite imagery has evolved in the past three decades, from primarily scientific and academic applications, to commercial use in the media and Internet. Widespread consumer applications of geospatial data have evaded the remote-sensing industry thus far, but there are several technological developments that have the potential to broaden the access and use of geospatial data. The number of remote sensing applications, for instance, has grown by over 300% (SIRIM, 2008).

In terms of revenue, there is an increasing trend for ARSM alone, the main government agency responsible for remote sensing activities. In 2004, the revenue for remote sensing data services provided amounted to RM117, 856, and subsequently increased by nearly four folds, to RM562,844, in 2005. In 2006, it showed a more positive growth to RM823,970.

Table 5

Number of RS Applications (2000-2006) (MIGHT, 2009)

Year	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***
Public	82	86	98	102	298	382	458
Private	33	23	32	23	16	52	52
Total	115	109	130	125	314	434	510

The revenue breakdown in terms of the three main segments of the downstream space industries shows that the telecommunication sector (including broadcasting) monopolizes over 99% of the total revenue generated. In 2006, for example, the telecommunication sector churned out RM21.61 billion in revenue, compared to RM820,000 by the remote sensing and navigation sectors combined.

Within the satellite navigation and positioning sectors, generically known as the Global Navigation Satellite System (GNSS), conventional post-processing precise positioning

applications and real-time navigation applications have merged. Precise GNSS systems for surveying, mapping, and location-tracking applications, have been widely employed in Malaysia. Vehicle navigation systems are common; even the use of GNSS for high precision navigation such as aircraft approaches and landing is currently considered. GNSS has given the much needed precise time-scale for commercial transactions such as e-banking and service billing, among others.

In order for the country to attain success in the space industry, it does not require us to spend huge sums of money for space technology development through innovation; we can process and develop data for multiple uses, namely, humanitarian, civil and commercial applications. The key is to take the lead, and start. Although space technology is used for sensitive purposes such as for defence and security, non-sensitive data that can be bought through proper arrangements, and reprocessed using innovation for sale to other countries. The processed data may be of benefit for many purposes, depending on the needs of the countries, like early warning for tsunamis and earthquakes, early detection and location of forest fires, cargo ships course adjustments due to changes in weather and piracy threats, and fuel conservation.

The Enabling Capabilities

Talent, innovation, infrastructure, competitive business climate, supportive government policies, stability, and quality of life, are the main drivers that will move our nation's economy forward. These enabling capabilities are important to space development; acting as enablers of the space industry; and promoters of innovative ideas and applications, and are priorities for the success Malaysia' space endeavour.

This paper has identified five primary enablers that the nation possesses to enable the space

industry to thrive, which are as follows:

1. Supportive Government Policies;
2. Strong and Developed Infrastructures;
3. Reliable Financing Schemes;
4. Vibrant Business Climate; and
5. High Quality of Life.

Supportive Government Policies

Space is an industry which needs strong government support in terms of regulation, national interests, promotion, international co-operation and R&D. Government policies that maintain a favourable business environment, with opportunities for growth and profits, have transformed Malaysia to an attractive place to conduct business in the region. It cannot be denied that the policies in place have enabled the private sector to become a partner with the public sector in achieving national development objectives.

A major factor that has attracted investors to the country is the government's commitment to maintain a business environment that provides companies with opportunities for growth and profits. This commitment is witnessed in the government's constant efforts to obtain feedback from the business community, through channels of consultation such as regular government-private sector dialogues. One example is the Liberal Equity Policy. Since June, 2003, foreign investors could hold 100% of the equity in all investments in new projects, as well as investments in expansion or diversification projects by existing companies, irrespective of the level of exports, and without excluding any product or activity (MCMC, 2010).

Space is a complex issue characterized by strong government interventions prompted by issues surrounding international standing, national prestige, influence in international negotiations and military superiority. RTM initiatives with ASTRO to reach out rural Sabah and

Sarawak is a good example of government intervention. The Internet High Speed Broadband (HSBB) project by Telekom Malaysia Berhad (TM) is another program that shows the positive outcome yielded by government intervention. HSBB fibre optics will provide the majority of the superfast broadband links in Malaysia, as set out in the Digital Malaysia Plan. To date, more than 800,000 premises have HSBB facilities. The HSBB hook-up rate currently stands at 300,000 households, and is increasing on a daily basis (MCMC, 2010).

The upstream industry is capable of creating significant downstream activities. Targeted investment in the upstream, particularly where there is involvement by both the manufacturer and satellite operator, has its advantages. This is particularly true in the Earth observation and navigation services industry. The government acts as the promoter of downstream services. In the case of the satellite communication sector, for example, promotion through the encouragement of government agencies to use broadband in their work routines is the norm.

The government, or its agencies, acting as the anchor customer, is vital in the development of the downstream space industry. The existence of an anchor customer provides confidence on upstream and downstream investment by suppliers by ensuring a known and reliable market. The satellite navigation and positioning downstream industry will prosper if the related government agencies, such as the Forest Research Institute Malaysia (FRIM) and Department of Irrigation and Drainage Malaysia (JPS), acquire and apply this space technology in their routine operational work. Promoting the usage of hand-held computers that are satellite navigation equipped for census purposes is also considered. During the address canvassing operation, computers can be used to record coordinates for every structure, including newly identified addresses. Space technology also will enable staff to conduct data collection for non-response follow-up operations; allow the removal of late mail returns; and record daily payroll for all

census enumerators. The use of space technology will generally lead to improved productivity and reduced errors.

The Malaysian government has identified space as a key high-technology industrial sector alongside aerospace, life sciences, biotechnology and defence. Space has also provided skilled jobs for scientists, engineers and technicians. It also provides Malaysia with a technological cutting edge, which is vital in an increasingly competitive world. It stimulates innovation and creates commercial opportunities for a range of other business sectors, and hi-tech small and medium enterprises (SMEs).

Strong and Developed Infrastructure

The physical infrastructure has become an indispensable asset for our economy, environment, and safety and security applications; and provides an essential enabler for science. There do exist other related sector infrastructures that can be adapted as enablers for space. The advantage of the space industry in Malaysia has been the nation's persistent drive to develop and upgrade its infrastructure. Over the past couple of years, these investments have paid off, and Malaysia can boast of having a well-developed infrastructure, among the newly industrialized countries of Asia.

The ICT sector as a whole is making a big play on its future role in helping other sectors to manage their resources in a ‘smart’ manner, in order to reduce environmental impact. Energy and transport are two important areas where carbon needs to be reduced, whilst maintaining the benefits of energy and transportation available on demand. The ICT sector expects to be allowed to grow its electricity demand in order to achieve these greater benefits. Space can deliver many of these benefits, including rural broadband and the bulk of TV and radio entertainment, with a key advantage over terrestrial alternatives: virtually no carbon is produced here on Earth. It also

provides a platform for universal climate change monitoring and assurance to the data in order to turn climate change modelling into reliable predictions.

Space-related manufacturing activities are divided into three tiers, each of which encompasses companies and activities that involve different degrees of system complexity. At the top of the value chain are Tier 1 integrators, which are the largest of the firms that design, integrate, market and sell whole space systems to end users. The next tier consists of companies that provide subsystems such as power modules, structures or communications systems. The third tier, component developers, is where the local aerospace companies can flourish.

In addition to the three manufacturing tiers, there exist numerous companies that provide engineering, operational services or related software, to support many activities that are performed among aerospace companies and their customers. Aerospace companies often face serious financial constraints, but we do believe it may take years for financial investors to have confidence in the sector, as they gain comfort through increased expertise and successful portfolio investments.

The relationship between academic and industrial communities in space is much more complicated compared to other sectors. Universities are a major source of new ideas, knowledge and highly skilled people, which are of benefit to the space industry, particularly in satellite development. All five premier universities (i.e., Universiti Teknologi Malaysia, Universiti Malaya, Universiti Kebangsaan Malaysia, Universiti Sains Malaysia and Universiti Putra Malaysia) possess adequate facilities to conduct space science research, and the consortium serves to strengthen and expand their linkages between the space research community and international national space programs. Besides the five mentioned universities, there are other research institutions such as the Standards and Industrial Research Institute of Malaysia

(SIRIM), Rubber Research Institute Malaysia (RRIM) and Malaysian Nuclear Agency (Nuclear Malaysia) that have space science research facilities. These institutes provide collaboration opportunities to universities and other research organizations in enhancing knowledge that is associated with space science and technology.

Reliable Financing Scheme

At each stage in a company's operations, financial strength is the key to ensure the success of a company. Access to financing provides the difference between having a good idea, and establishing a successful company.

Malaysia's well-developed financial and banking sector has posed it as a reliable trading nation. Established financial facilities are available through domestic and foreign commercial banks, as well as their nationwide network of branches. Commercial banks, merchant banks, finance companies and industrial finance institutions are major sources of credit to the industrial sector in Malaysia. To complement Malaysia's financial system, the government has established an International Offshore Financial Centre (IOFC) in Labuan, Sabah. Companies in Labuan enjoy minimal taxes and confidentiality. To date, over 2,700 offshore companies have initiated their operations in Labuan. These include offshore banks, trust companies and insurance related companies. The Labuan Offshore Financial Services Authority (LOFSA) promotes and develops Labuan as an IOFC.

The Malaysian government provides capital guarantees, or anchor tenancy agreements, to allow Malaysian-based operators to raise necessary budgets to buy satellites and fund launches, so that they can enter new space-enabled service markets and grow their businesses. Although this need is common in the space sector, it is requested that the government takes into account the high capital costs involved in the procurement and launch of individual satellites, as well as

the need for Malaysia to be first to market to exploit a growing export market.

Commercial activity in space is capital-intensive, and start-ups can be difficult to get off the ground. Moreover, it is a feature of this market in which large upfront investment is required. Once a company gets it right, it can create businesses capable of generating significantly high cash flows. Another characteristic of this market is that the cost of satellites is frequently much greater compared to the investment required to set up and run a service operation.

The Private Finance Initiatives (PFI) Program was initiated in the Ninth Malaysia Plan, aimed at facilitating greater participation of the private sector to improve the delivery of infrastructure facilities and public services. Space sector financiers are nearly non-existent in Malaysia, but are represent a key factor in the commercialization of space technologies. Malaysia needs its own expertise in space related insurance, law, debt and equity capital markets. We do have a venture capital industry that has produced several winners, but they are not space-related. It is vital to maximize the use of private finance for the Public Sector procurement of space technology. We should encourage a selection of Malaysia-based banks to actively develop capabilities in co-financing space projects in the local industry.

The introduction of PFI Program is enhancing the Public Private Partnerships (PPP) Program. The latter involves the transfer to the private sector the responsibility to finance and manage a package of capital investment and services, including the construction, management, maintenance, refurbishment and replacement of public sector assets such as buildings, infrastructure, equipment and other facilities, which in turn creates a standalone business.

In these PPP projects, a contract is formulated for the private party to deliver public infrastructure-based services over a long period of time. The private party raises its own funds to finance all, or a portion of, the assets that will deliver the services based on agreed performances.

The public sector will in turn compensate the private party for these services. In some PPP projects, part of the payments may flow directly from public users.

Vibrant Business Climate

Malaysia has invested greatly in the development of a healthy business environment, including effective support instruments, excellent industry locations and powerful infrastructure. A healthy business climate will no doubt ensure space industry players receive the required assistance.

Malaysia's market-oriented economy, supportive government policies and large local business community that is ready to do business with the space industry, have all contributed to Malaysia being a highly competitive place to conduct business. For example, a market-oriented economy and government policies that provide businesses with the opportunity for growth and profits have made Malaysia a highly competitive manufacturing and export base. Malaysia's rapid move towards a knowledge based-economy enables companies to do business in an environment that is geared towards information technology.

One of Malaysia's major pull factors is its large pool of young, educated and trainable workforce members. Many of Malaysia's university graduates are trained overseas in fields such as engineering and accountancy, allowing them to easily adapt to an international corporate environment. English is widely used in Malaysia, especially in business, hence, facilitating investors' communication with local personnel and suppliers. The country's legal and accounting practices are derived from the British system, and are thus familiar to the majority of international companies.

Malaysia's space upstream industries such as satellite manufacturing, launch services and the capital equipment part of ground systems, are relatively negligible, compared to its

downstream industries of Satellite Communication, Navigation and Earth Resources applications. The upstream industries are relatively new in the country, and will hopefully grow, as the RazakSAT EO (Earth Observation) program grows, and draws in more companies to participate. Malaysia needs to create a synergy model between its upstream and downstream space industry, primarily because the success of the US space industry is due to the direct links between the upstream and downstream industries, which clearly create significant market activities.

Malaysia's EO downstream industry basically relies on satellite data obtained by providers from other nations. In Europe, there is clear linkage between the upstream and downstream industries in that the main players are in both. For example, Astrium owns Spot Image and Infoterra. Malaysia's navigation downstream industry is an emerging space-based business, which, if correctly managed, is predicted to become as significant as satellite communications.

Space activities are global by nature. They frequently have global objectives, and encompass heavy and risky expenses that cannot be borne by one investor alone. Typically, they are pursued on the basis of mutual interest, and with no exchange of funds. In search of a sustained solution, Malaysia must seek for a strategic partner that is capable of meeting its technology and training needs. Unfortunately, none of the existing local space industry companies are in a position to do this, and consequently the country needs to turn its attention to global space powers. Any existing national laws and excessive restrictions on international cooperation must be reviewed, at least in order to reduce economic loss. In a broad policy approach, Malaysia should further build up its space partnership with Russia and China; maintain and develop its longstanding cooperation with the US in the fields of science and applications; initiate or extend cooperation with the rapidly emerging space powers such as India and Brazil;

and strengthen its role in international space-related organizations and initiatives.

The industry needs to be confident enough to aggressively increase its investment in Research and Development (R&D), its capabilities and its people. It will need to take the required risks involved in grasping new opportunities in order to be the first to market with innovative services. It is recognized that the majority of the investment required to meet the growth target will have to come from industrial sectors rather than from governmental ones. This require private venture capital taking advantage of opportunities offered in commercial markets and Private Finance Initiative (PFI) style arrangements to meet future government requirements for end-to-end services. Likewise, operators must be able and willing to raise the capital needed in financial markets. Estimates of Malaysia's gross value generated by space companies has to be indirectly calculated, but evidence from other nations such as the UK and the US suggests that a relatively high percentage of turnovers (about 50%) are accounted for by value added, as opposed to costs of purchasing other goods and services. This implies a sector with a relatively small percentage of total GDP (slightly below 0.5%), but represents a higher average labour productivity than most other sectors. This appears to be explained by a combination of above-average levels of skills, high capital intensity and innovation related efforts, which typically command a premium for the associated risk. Malaysia Telecommunication services, for example, which is highly dependent on space technologies, provided approximately 7.8% to the 2010 GDP, and this translated to RM22 billion in GNI (OECD, 2008). A competitive business climate wins programs, business locations and launch and technology development activities. ANGKASA ardently supports incentives, tax relief programs, workforce initiatives and processes on state and local levels; and works with industry, government and associations to improve the space business environment as a whole.

The upstream sector includes the manufacturing of space hardware, and providers of services that enable the launch of systems into space. This comprises prime companies and systems integrators for space and ground equipment, which in turn build on the contributions of subsystem and component suppliers. The downstream sector includes operators of satellites and providers of space-enabled products and services. These range from products and services that can only be delivered through space, to those that compete with, or complement, other forms of enabling infrastructures and services. The area of R&D that should be emphasized for both sectors includes: Small Satellite Manufacturing, Satellite Operation, Insurance, Satellite Telecommunication Services, Earth Observation, Location Based Services, and Civil Protection and Emergency Management.

Malaysia can be considered to be among the most successful Southeast Asian countries in attracting FDI. It has always endeavoured to maintain the competitiveness of FDI determinants such as legal infrastructure. Numerous policy instruments have been set up. The Malaysian government has improved the value of the present determinants, and is considering new strategies to attract FDI. Malaysia has taken advantage of tangible assets such as natural resources, abundant labour, and intangible assets such as trade status, under Generalized System of Preferences (GSP), macroeconomic stability, liberal trade regimes, and a resourceful legal infrastructure, to bring in FDI. The government’s main policy is to bind FDI as a part of the economic development strategy to acquire foreign technology, capital, and skills.

High Quality of Life

Space technology is a green technology, and its greatest asset is that it enhances the quality of human life. Malaysia views its space endeavour to strengthen the nation's prosperity and quality of life as its first priority mission. A major component of this mission can be

acknowledged through developing technologies to fulfil the needs of space programs, and then through helping businesses develop these technologies for commercial use.

Malaysia is among the most friendly and hospitable places in the world to work and live in. In addition, the country's tropical climate, with its uniform temperatures, allows light, comfortable clothing throughout the year. Expatriates and their families enjoy safe and comfortable living environments, with 21st century amenities, good healthcare and medical facilities, excellent educational institutions, and world-class recreational and sports facilities, at costs much lower than in their countries of origin.

One of the country's most distinctive features is its rich diversity of cultures, a heritage derived from its racial mix of some of the world's oldest civilizations: Malay, Chinese and Indian. This potpourri of race and culture has enabled Malaysians to speak at least two, or even three, languages: Malay (the national language), English, and their own mother tongue. Living in such a cosmopolitan environment, Malaysians are warm, friendly people who easily accept foreigners into their circle of friends.

To encourage the community at large to embrace space technology in their everyday activities, ease of access of the technology is vital. Affordability also plays a critical role to convince the general public. For example, to encourage the usage of GPS navigators, affordability plays a critical factor. Currently, the price range of RM400-RM800 is still out of reach for the majority of the population. A suitable message should also be disseminated to the general public, stressing that space technology is not only meant for advanced usage. High resolution EO images, for example, are not only used for resources management, but can also be used for our ordinary public life. The important step is that the government and media must convey the appropriate message so that space technology is embedded in citizens' daily

activities. This policy has in fact outlined the strategy to raise the level of public and media awareness on issues pertaining to the importance of space for nation-building and creating opportunities for experiential learning under the policy thrust on space as frontier knowledge.

Many space activities benefit the society at large, including the use of space for national defence, environmental monitoring, as well as the collection of various types of information. These activities exhibit some characteristics of 'public goods'. The distinctive feature of public goods is that many people can benefit from them simultaneously, without reducing their availability to others, or adding to their costs. Information is typically considered within this class of goods. For example, any given weather measurement undertaken by an EO satellite will not vanish as a result of someone using it, although the economic value of holding the information may depend on how many others have access to it. Many downstream space services possess the characteristic of non-rivalry, and thus have some element of public good.

There exists the perception that scientific and technological rewards for joining the human space flight to ISSs (International Space Stations) in the coming decades could be significant. Malaysia being a country with modest capabilities in engineering and science, the factor of astronauts and ISSs could be a stepping stone to greater ambitions. To put it in perspective, the scientific experiments conducted by Program Angkasawan Negara 1 have already demonstrated promising results, particularly in terms of Intellectual Property knowledge generation. Experiments on Crystallization of Important Enzymes/Proteins in Space has its own innovation merit, since it is in the process of patent pending. The Malaysian Trademark patent application PI 20062931, and more recently, the United States Patent and Trademark Office application entitled Crystallization of Enzyme and Method for Producing Same, demonstrated the breakthrough and originality of the mentioned experiment. Besides the patent applications, a

Malaysian trademark status was also applied under the heading TM ‘RNZlipase in Class 01’. Both the patent and trademark status are not possible if the same experiment were to be conducted on Earth.

Global information technologies (satellites, GPS and data surveillance) are producing new territorial principles of order, and new logic of space, are constituting forms of transnational power and sovereignty. Space systems and applications constitute a critical element of the global information infrastructure. Space-based civil, commercial, and military systems help provide communication, environment, observation, position, navigation, timing (PNT), and other important data and services to end users. Malaysia’s space capabilities are designed to be of a ‘dual-use’ nature, with defence-related and civilian applications. Malaysia should emphasize the use of space systems to enhance overall security and sovereignty. Both terms in this context cover, not only the military use of space, but also space-based systems for environmental concerns, energy security, crisis management, peacekeeping, civil protection, and other areas. The government has done much to promote space in the last decade, but does not yet have a coherent, overarching policy that encompasses civil defence and security components.

Space systems and services constitute a critical element in the global information infra-structure. Space-based civil, commercial, and military systems help provide communication, environment, image, position, location, timing, and other important data and services to users. Malaysia’s space capabilities should be of a ‘dual-use’ nature, with defence-related and civilian applications. Malaysia should emphasize the use of space systems to enhance security. Security in this context covers not only the military use of space, but also space-based systems for the environment, energy security, crisis management, peacekeeping, civil protection, and other areas. However, Malaysia’s current success in coordinating its security- and defence-related

endeavours highly relies on the level of consensus among government related agencies. Only when a clearly defined space-related policy has been formulated, will ANGKASA be positioned to negotiate space security-related undertakings, including a structured ANGKASA-MINDEF partnership.

Conclusion

Malaysia's space industry is a must for the country, and is considered a key to the further development of the country's overall progress. With the existing enabler, it is predicted that Malaysia will take its initial step towards contributing vital dimensions to its space industry program, strengthening its policies, suggesting new ambitious and inspirational goals, and contributing to its initiatives for long-term growth. The achievement of the longer term objectives set out in the initiatives must be supported by strategies, plans of action, and a predefined road map, with the existing enabler considered a critical catalyst in the process.

The authors suggested that Malaysia's space industry endeavour is not about trying to build the nation's prestige on new foundations, but rather about the need to secure new infrastructures and services and to open up new opportunities. Its ambitions are practical and realistic, hence, expenditure must match ambition. A broader, cost-effective space industry initiative will require an increase in overall expenditure in the medium- and long-term. Redistributing current budgets will not take the country forward. Malaysia's endeavour is not to climb steadily towards the US or Europe's levels of spending, but rather to develop concrete actions designed to respond to concrete needs, and deliver genuine benefits with a progressive increase in a budget to match this.

The enabler cited can be considered one of the primary catalysts required to become a key space industry push, which will help to forge a return to strong growth in advanced technology

and manufacturing the nation is currently pursuing. It will also be an enabling factor in improving the future lives of our citizens by means of a smart and digitally enabled lifestyle, coherent energy provision, carbon reduction policies, advanced travel solutions, and a safer, secure Malaysia. The proposed usage of the enabler to invigorate the space industry is more than just a creator of wealth. It is a vital part of Malaysia's critical infrastructure, and a major contributor to the welfare and security of its citizens. A healthy space industry is pervasive, but the majority of its users are unaware of this. For example, its timing signals underpin the country's financial institutions, communication networks and other pivotal infrastructures. It also provides satellite imagery to protect our borders, deal with natural disasters, and enhance agricultural productivity, among other important factors.

A healthy space industry is considered a strategic asset for Malaysia, attributable to its valuable services and applications for both civilians and military users. Space-related cooperation is becoming an essential component of foreign policy planning and decision-making. This is where the enablers come into play.

References

Braun, T. M. (2012). *Satellite Communications payload and system*. John Wiley & Sons.

Bruca, L., Douglas, J. P., & Sorensen, T. (Eds.). (2007). *Space operations: mission management, technologies, and current applications* (Vol. 220). Amer Inst of Aeronautics.

De Maria, M., & Orlando, L. (2008). *Italy in Space: In Search of a Strategy, 1957-1975* (Vol. 4). Editions Beauchesne.

Dempsey, P.S. (2008). The Evolution of US Space Policy. *Annals of Air and Space Law* XXXIII.

Hays, P. L., & Lutes, C. D. (2007). Towards a theory of spacepower. *Space Policy*, *23*(4), 206-209.

Henry, P. (2008). The militarization and weaponization of space: Towards a European space deterrent.

Hertzfeld, H. R. (2007). Globalization, commercial space and spacepower in the USA. *Space Policy*, *23*(4), 210-220.

Kasturirangan, K. (2007). Space technology for humanity: A profile for the coming 50 years. *Space Policy*, *23*(3), 159-166.

Maogoto, J. N., & Freeland, S. (2007). From Star Wars to Space Wars'-The Next Strategic Frontier: Paradigms to Anchor Space Security. *Available at SSRN 1079452*.

Martinez, L. F. (2007). Science in Service of Power: Space Exploration Initiatives as Catalysts for Regime Evolution. *Air and Space Law*, *32*(6), 431-456.

MCMC Malaysia (2010). Satellite Industry Development Report.

MEASAT (2009). Report on Growth and Challenges of Satellite Industry.

MIGHT (2009). Report on Malaysia Aerospace Industry Outlook.

OECD (2008). The Space Economy at a Glance. Paris: OECD.

Rapp, D. (2007). *Human missions to Mars: Enabling technologies for exploring the red planet*. Springer Science & Business Media.

Sheehan, M. (2007). *The international politics of space*. Routledge.

SIRIM (2008). Report on Space Industry in Malaysia: A Strategic Development; SIRIM.

Space Security. (2007). Waterloo, Ontario: Space Security Organization.

Zelnio, R. J. (2007). Whose jurisdiction over the US commercial satellite industry? Factors affecting international security and competition. *Space Policy*, *23*(4), 221-233.