



# Bermuda National Space Strategy 2020 – 2025

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## Minister's Foreword



Space has never been more exciting and promising, for Bermuda and for the world.

The space industry is undergoing a revolution. Once the exclusive domain of national governments, space is increasingly accessible to private companies with capital and big ideas. Today, technology is sufficiently advanced to enable new commercial activities in space which seemed like science fiction only a short time ago. Entrepreneurs are building rockets to take humans to Mars, preparing to launch hundreds – and in some cases, thousands – of small satellites into orbit to provide ubiquitous Internet on Earth, and taking high-resolution photos of our planet with increasing

frequency. These are only a few examples, but they highlight the unprecedented level of innovation taking place within the industry today.

Satellites are an important part of this picture. According to the U.S.-based Satellite Industry Association (SIA), the global satellite industry grew to \$277 billion in 2018, with services, such as broadband, generating the lion's share of revenues. Innovation is again responsible: geostationary communications satellites, which have expanded the reach of wireless communications on Earth for decades, are now so advanced they can deliver data at speeds comparable to terrestrial networks.

The Government of Bermuda welcomes this innovation and growth, and we see the commercial space industry as an important part of Bermuda's future. Some may wonder why Bermuda has an interest in space. After all, we are a small island nation perhaps better known for our world-famous beaches than our orbital ambitions. My answer is simple: the space industry provides tremendous economic opportunities for the people of Bermuda. Although space is miles away, the benefits of investing in it will accrue at home. Attracting new businesses to our shores will spur domestic economic growth and create new high-quality jobs. Building partnerships with industry stakeholders will afford students and workers in Bermuda new education and training opportunities in the STEM fields. Adopting space technologies for governmental and scientific use will enable better decision-making on environmental management and other issues. In these ways, space matters to Bermuda.

Bermuda can also make valuable contributions to the global space economy. As a highly transparent, blue-chip jurisdiction with an excellent regulatory and compliance reputation, we are an ideal place to establish a space or satellite business. We have a long history of government-industry collaboration, which we are prepared to draw on to develop new regulatory frameworks that support the growth of space and satellite businesses while ensuring Bermuda is able to meet our international obligations and serve as a responsible member of the global space community.

The following strategy, developed in consultation with the Bermuda Space and Satellite Policy Advisory Panel, is a plan to capture these opportunities and their benefits. It lays out our vision for Bermuda's domestic space and satellite ecosystem and the actions required to realize it. Our primary audience is threefold: the public, to explain why space matters to Bermuda; the international space and satellite

community, to advertise that Bermuda is open for business; and those in Government who will be responsible for implementing the strategy.

To be successful, we must leverage Bermuda's unique strengths as a global risk capital, an emerging FinTech hub, and a stellar jurisdiction for business. We must also maintain a constructive and cooperative relationship with our colleagues in the United Kingdom, because the success of our respective domestic space industries are intertwined. Perhaps most importantly, we must change the way Bermudians and the world think about Bermuda's relationship to space by becoming a leading jurisdiction for global space and satellite business. Only then will we have achieved our vision.

I am confident this strategy will take us there.

The Hon. Walter H. Roban, JP, MP

Deputy Premier and Minister of Home Affairs

## Executive Summary

The Government of Bermuda recognizes that the commercial space industry is undergoing a period of unprecedented innovation and growth. This is creating new revenue streams and job opportunities in the industry. The Government has developed the following strategy to seize these opportunities for the benefit of all Bermudians.

This strategy presents a vision for Bermuda's domestic space industry in the year 2025 and lays out a plan to achieve that vision. It outlines priority industry areas for Bermuda, based on anticipated benefits, including the following:

- Satellite communications;
- Remote sensing/earth observation;
- Space insurance;
- Space situational awareness and debris monitoring;
- New space (e.g. on-orbit servicing, asteroid mining)

The strategy then identifies four strategic pillars and lays out four corresponding strategic goals to direct the Government's efforts.

### Strategic Pillars:

- Development of policies and regulation
- Domestic capacity building
- International partnerships and engagement
- Utilization of Bermuda's national orbital resources

### Strategic Goals:

- 1) Build Bermuda's reputation as a responsible, leading jurisdiction for space and satellite-related business;
- 2) Enhance domestic space and satellite-related capabilities;
- 3) Further integrate Bermuda with the international space community;
- 4) Generate revenue from national orbital allotments.

As the governmental body with primary responsibility for space and satellite matters in Bermuda, the Ministry of Home Affairs will lead the implementation of this strategy, with support from other governmental bodies, including the Ministry of Education and Department of Workforce Development, as well as the Regulatory Authority and non-governmental partners, namely the Bermuda Business Development Agency.

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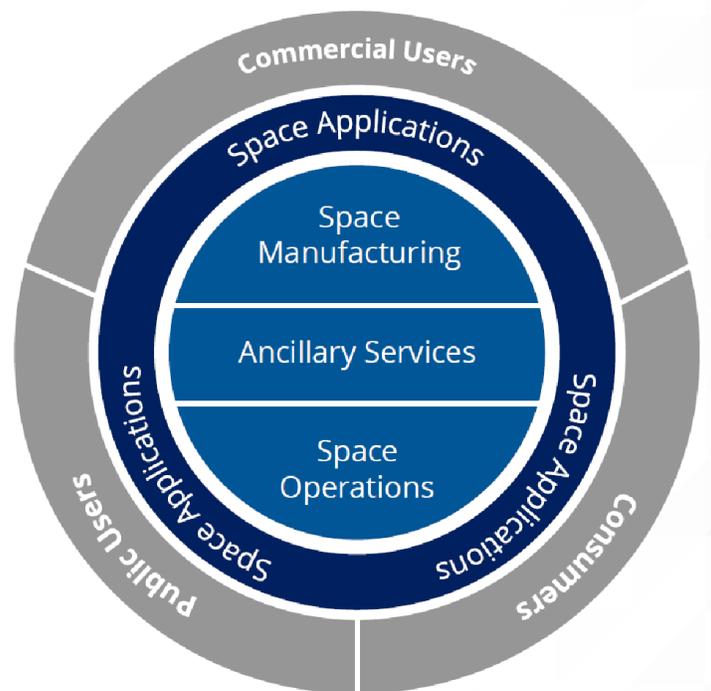
## Strategic Vision

The Government of Bermuda is pursuing activities related to the space industry as part of its broader effort to grow and diversify the domestic economy. While Bermuda maintains a leading role in the global insurance industry and continues to enjoy a vibrant tourism sector, economic diversification is necessary to provide additional jobs and careers for Bermudians while ensuring our economy remains resilient as global markets evolve.

In 2019, the global space industry was valued at roughly \$350 billion dollars, and experts predict it will become a trillion dollar industry by 2040. Given this considerable economic potential, the Government of Bermuda views the space industry as an important part of a broader economic strategy.

## Building a Space Ecosystem

The global commercial space ecosystem can be divided into several categories, as depicted below:



By 2025, the Government seeks to establish a space ecosystem in Bermuda that is driven primarily by private space companies providing a range of space applications to consumers within or outside Bermuda. While priority will be given to commercial activity that generates public sector revenue, the Government will also seek to increase the use of space-based applications and technologies by public and non-governmental users in Bermuda where appropriate in order to leverage space-based capabilities for public service and scientific gain. For example, government departments which conduct scientific experiments or perform work that builds on science, such as the Department of Environment and Natural Resources, can leverage earth observation satellite data to enable better environmental decision-making. Such data can also assist with environmental conservation and scientific activity related to shipwrecks. In addition, organizations like the Bermuda Institute for Ocean Sciences (BIOS) can benefit from space technologies when taking scientific measurements in the ocean via remote underwater vehicles.

Given the relatively small size of Bermuda, we do not envision the island becoming a major center for the manufacturing of traditional satellites, but we do envision the island supporting small satellite manufacturing facilities, which require considerably less space.

## Strategic Goals

Over the next five years, the Government intends to take a number of actions to enable Bermuda to reap the benefits of the space economy. These include implementing policies and regulations to attract space companies to the island; consulting with industry stakeholders to enhance our ability to attract business; organizing educational and training camps/workshops; collaborating with international stakeholders; holding space-related events to raise Bermuda's global space profile; and working with industry partners to capitalize on Bermuda's national orbital resources.

Ultimately, our vision is to create a space ecosystem that improves the lives of all Bermudians by creating high-value jobs and careers while generating revenue that the Government can use to better serve the people. To realize this vision, the Government will seek to achieve the following strategic goals from the period 2020-2025:

- 1) Build Bermuda's reputation as a responsible, leading jurisdiction for space and satellite-related business;
- 2) Enhance domestic space and satellite-related capabilities;
- 3) Further integrate Bermuda with the international space community;
- 4) Generate revenue from national orbital allotments.

## Current State of Space in Bermuda: Efforts Undertaken Thus Far

### Launch Tracking

Bermuda has deep ties to the space industry that began with the tracking of spacecraft launches. Bermuda's relationship with the U.S. National Aeronautics and Space Administration (NASA), which continues to this day, got its start roughly sixty years ago when the space agency looked to Bermuda for help tracking some of the earliest spacecraft launches. During the Mercury Project in the 1960s<sup>1</sup>, Bermuda was an integral part of NASA's ground communications network. While the primary control center for the project was located at Cape Canaveral Air Force Station in Florida, a secondary control center was established in Bermuda. Following the Mercury Project and through most of the Space Shuttle Program, Bermuda hosted a tracking station for NASA to support space exploration.

NASA closed the tracking station in 1997 due to the development of space-based tracking systems but signed an agreement in 2012 to reestablish the station. The agreement has been extended to 2026, and NASA continues to track launches from Bermuda: Today, NASA's Wallops Flight Facility operates a permanent tracking station from Cooper's Island, which supports International Space Station cargo resupply missions and will support upcoming commercial crew launches to the orbital laboratory, as well as NASA's upcoming integrated launches of the Space Launch System and Orion spacecraft on missions to the Moon. The station will also support NASA's upcoming Ionospheric Connection Explorer (ICON) satellite launch, Minotaur launches and slated flights of Rocket Lab's Electron Launch vehicle from Wallops.

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<sup>1</sup> The Mercury Project was the United States' first man-in-space program that began in 1958 and completed in 1963.

Bermuda also has a relationship with the European Space Agency (ESA) centered on tracking the launch of spacecraft. In 2012, the ESA set up a temporary tracking and telemetry station at Cooper's Island to track the launch of a rocket carrying a French satellite. This was to take advantage of Bermuda's important geographic location. The ESA launch site in French Guiana is used in some cases for northbound launches. Once the vehicle is out of range of tracking facilities there, it cannot be seen again until it is within range of facilities in Canada. Bermuda fills this gap, ensuring continuity during a critical early stage of the launch. Today, the ESA continues to track launches from Bermuda, and we anticipate that this will continue for the foreseeable future. We anticipate also that this will present opportunities for further collaboration with ESA at other levels and in other, multilateral, projects.

### Science, Engineering, Technology and Mathematics (STEM) Education Initiatives

In 2019, the Ministry of Home Affairs and the Ministry of Education partnered with NASA and the Challenger Learning Center of Alaska to hold Bermuda's inaugural Summer Space Camps. The camps were available to public school pupils aged 11 to 14 and featured classes on gravity and buoyancy, coding, alternative power, weather and hurricanes, climate change and other topics.

Ongoing activities include continuing our partnership with the Challenger Learning Center of Alaska to provide a select group of Bermuda's high school students the opportunity to learn from instructors at the Center in Alaska, as well as organizing a class in Bermuda that gives students hands-on experience building small satellites.

### Advisory Panel

The Ministry of Home Affairs established the Space and Satellite Policy Advisory Panel in June 2018 to provide advice on the development of the space and satellite industries in Bermuda and to serve as a vehicle for guiding Bermuda's advocacy efforts on behalf of the satellite industry in international policy fora. The Panel is subdivided into six working groups:

- ITU Spectrum and Regulatory Provisions Working Group
- Earth Stations Regulations Working Group
- Space Sustainability Working Group
- Space Insurance Working Group
- Small Satellites Working Group
- STEM Education Working Group

As of December 2019, the members of the group include:

- Adam Sturmer, Senior Vice President at Marsh Space Projects;
- Bruce Kraselsky, Managing Director at Space Partnership International;
- Chuck Schumann, Vice President and Founder at Pacific Dataport, Inc.;
- Danielle Wood, Assistant Professor of Media Arts and Sciences and Director of Space Enabled at MIT Media Lab;
- Jennifer A. Manner, Senior Vice President of Regulatory Affairs at EchoStar;
- Kyle James, Business Development Manager at Bermuda Business Development Agency;
- Ray Duffy, Senior Vice President at Marsh Space Projects;
- Ryan Henry, Senior Manager at SES Satellites; and
- Scott Gibson, Vice President of Legal Services at SES Video.

In December 2018, the Panel presented to the Minister a report recommending strategies to attract space and satellite-related business to Bermuda while growing its domestic space and satellite capabilities. In 2019, the Panel assisted with planning Bermuda's first-ever space camps and space sustainability workshop. The Panel also contributed to the development of the national space strategy.

## National Orbital Allotments

The International Telecommunication Union (ITU), the UN agency responsible for managing allocations of radio spectrum and allotments of satellite orbits at the international level, has allotted a total of four satellite orbit locations, and their associated Broadcast Satellite Service (BSS) and Fixed Satellite Service (FSS) radio channels, to Bermuda. The orbital locations are at 96.2°WL (BSS), 92.3°WL (BSS), 37.1°WL (FSS) and 31W°L (BSS). After successive governments took steps to build upon the ITU allotments, in 2013, two commercial companies, SES and EchoStar, collaborated to bring the allotment at 96.2°WL into use, effectively creating Bermuda's first satellite network. We will continue to work with these industry partners to commercialize that network and build upon this success.

The other three allotments remain unused. Two of these are not solely "Bermudian": One is shared with the Caribbean Community, and one is shared with the UK and other Overseas Territories in the Atlantic and Caribbean. Bringing either of these into use would present the opportunity for enhanced cooperation and capacity-building through international partnerships.

## What Differentiates Bermuda?

A key part of our strategy will involve incentivizing space companies to select Bermuda as their place of business. To do this, we must first make a convincing argument for Bermuda's advantages relative to other jurisdictions with which we are competing.

### Relationship with United Kingdom

The success of this strategy will depend upon maintaining a constructive and cooperative relationship with technical and regulatory authorities in the United Kingdom, which is a well-established space-faring nation. The UK's ambitious Space Innovation and Growth Strategy is a model which others have followed, and has resulted in a period of strong and sustained growth in the UK's domestic space industry. We believe that Bermuda's success will contribute to this continued growth, and vice versa.

The main relationship is with Office of Communications (Ofcom). Ofcom represents the UK, and the British Overseas Territories and the Crown dependencies, at the ITU. That role includes submitting applications for orbital locations and radio frequency assignments for satellite networks on our behalf.

The regulatory framework which we have established for Bermuda companies to make these filings was developed in cooperation with Ofcom and ensures that Bermuda applicants meet Ofcom's requirements and those of the ITU, as well as our own, ensuring that the process is clear, consistent, streamlined and transparent. We will continue to work closely with Ofcom as the international regulatory framework continues to evolve.

Another key relationship is between Government House and the UK Space Agency, under the Outer Space Act 1986, as extended to Bermuda. The UK is one of the three depositary states for the UN's Outer Space Treaty, and the Outer Space Act is the legislation by which the UK ensures that its international obligations under that treaty and related international agreements are met. This includes licensing companies

launching satellites and conducting other activities in outer space. Extending the act to Bermuda companies enabled their inclusion in that framework, increasing the scope for their participation in space activities. The framework for licensing space activities is different to the arrangements for filing notices with the ITU. When the Outer Space Act was extended to Bermuda companies, licensing authority was vested in the Governor, and in practical terms the UK Space Agency would give advice on applications. However, we also see a role for the Government of Bermuda facilitating early discussions between Bermuda companies and Government House, particularly in the case of companies which have ready filed notices with the ITU as part of the same project, and to ensure that the interests of Bermuda and Bermudians are safeguarded. We will continue to keep that framework under review. In particular, we will review amendments which have been made to the Outer Space Act in the UK, since the act was extended, but which have not been extended to Bermuda, and consider whether negotiating the extension of those amendments would bring benefits to Bermuda and Bermudians. We will also consider whether UK legislation about other space activities, particularly sub-orbital manned spaceflight (space tourism), would bring benefits to Bermuda and Bermudians if it were extended.

### Relationship with United States

Bermuda has maintained strong ties with the U.S. for over 400 years, due in large part to our close proximity to the eastern coast of the U.S. We have been close trading partners since the 1700's, and international business remains one of the key pillars of our economic relationship. Our people-to-people ties are also strong: hundreds of thousands of American citizens visit Bermuda each year for leisure, and many even live and work on the Island, while many Bermudians vacation in the United States or move to the country to complete their higher education. In the area of space, Bermuda and the United States have cooperated for many years and continue to do so to this day. This has centered on our partnership with the National Aeronautics and Space Administration (NASA), which began roughly sixty years ago and which we continue to strengthen and expand.

### Regulatory Leader

Bermuda is a model for other countries around the world in terms of regulatory management. Through proactive collaboration with industry and government stakeholders on the development of a regulatory framework for insurance business, Bermuda established itself as a global risk capital and has long boasted one of the world's most vibrant insurance industries. The Government is quickly becoming a leader in the FinTech space, having developed and enacted multiple pieces of innovative legislation to support digital asset businesses. Importantly, we have a sterling reputation not just for developing forward-thinking regulatory frameworks, but also for developing *responsible* regulatory frameworks. We are in the process of replicating these successes to become a global model for space and satellite regulation.

### Policies in Place to Attract Space Business

Bermuda has already implemented or is currently implementing certain policies which enhance the Island's global competitiveness as a jurisdiction in which to conduct space-related business. These policies include the following:

**ITU Satellite Filing:** In 2007, the Government put in place regulations for the notification and coordination of satellite filings with the International Telecommunication Union (ITU). Filing through Bermuda affords operators several advantages. With a standard administrative fee of only \$12,000, the filing process in Bermuda is relatively low-cost. As a smaller jurisdiction, applicants do not have to wade through the

cumbersome bureaucracy often experienced in other countries, resulting in a process that is efficient and personable. The Ministry of Home Affairs, which processes applications, acts as the operator's advocate and is prepared to engage in coordination meetings to the extent necessary. Moreover, the Ministry's space and satellite staff are consummate professionals who understand applicants' businesses.

To file a satellite network with the ITU through Bermuda, an operator must submit a proposal to the Ministry of Home Affairs that includes corporate and commercial information, as well as technical details about the project. After reviewing an operator's application to ensure it meets these requirements, the Ministry will send the proposal to the United Kingdom (Ofcom) for filing with the ITU. As the project progresses, the Minister will issue a series of certificates to the operator, and issue a license when the network is brought into use.

**Earth Station Regulations:** Bermuda is located in the Atlantic Ocean approximately 650 miles east-southeast of Cape Hatteras, North Carolina. At this location, the island is ideally positioned for earth stations that support a range of space and satellite-related activities. For example, earth stations in Bermuda enable monitoring of space launches over the Atlantic Ocean and can support the calibration of Ground-Based Beam Forming systems. Bermuda is also well situated for earth stations which support the provision of services to maritime vessels and aircraft in and over the Atlantic Ocean. The Government of Bermuda has a streamlined process in place for authorizing earth stations and is in the process of finalizing regulations to ensure earth stations deployed on the island are subject to the minimum amount of regulation necessary, while ensuring they can appropriately interface with other systems and services, including international registration, if needed.

**LLC Legislation:** Bermuda's LLC legislation provides entrepreneurs greater flexibility when establishing new businesses. The Limited Liability Company (LLC) Act, adopted into Bermuda law in 2016, is a hybrid vehicle that enhances the considerable freedom of contract already offered by Bermuda exempted companies and limited partnerships, combining key characteristics of each. It follows Delaware's LLC statute closely, yet also includes a number of Bermuda optional variants.

**Tax Free Filing:** Bermuda maintains a 0% corporate tax rate, including on space and satellite business.

## Opportunities/Priorities

To realize our vision, the Government will prioritize its efforts in five key areas that offer the greatest economic opportunities for Bermuda and fit within the commercially-driven space ecosystem we aim to establish:

- Satellite communications
- Remote Sensing
- Space insurance
- Space situational awareness and debris monitoring
- New Space

### Satellite Communications

Satellite communications involves the transmission of voice, video and data between people on Earth, whether they are in fixed locations or moving. According to one estimate, the satellite communications

market will reach nearly \$7.5 billion by 2022, indicating a strong economic opportunity for Bermuda.<sup>2</sup> Within this sector, markets for value-added satellite services, including broadband, satellite radio, and mobile, are growing. Examples of the commercial applications of these services include the following:

- Provision of broadband to the home, enterprise or government
- Provision of narrowband voice and data, including to small devices embedded in traditionally unconnected objects, i.e. Internet of Things (IoT) and Machine-to-Machine (M2M) connectivity
- Supporting the rollout of 5G connectivity
- Broadcasting

To take advantage of these growing markets, the Government will seek to attract companies that provide communications services via satellite.

### Remote Sensing/Earth Observation

Remote sensing, also called earth observation, is the science of obtaining information about objects or areas from a distance using satellites. This information can be in the form of data or imagery. According to one estimate, the earth observation data and services market is expected to reach \$8.5 billion by 2026.<sup>3</sup>

In the commercial arena, remote sensing satellites are increasingly used to gather satellite imagery of the Earth's surface for use in business intelligence products. In recent years, there has been considerable investment and innovation in private remote sensing satellite services to meet growing demand for satellite imagery among data analytics companies. These companies apply artificial intelligence to satellite imagery to derive insights that allow their customers to make better business decisions.

Remote sensing also has many science and public sector applications, such as the following<sup>4</sup>:

- **Management of ocean resources:** Ocean health is critical for the quality and security of life of all Bermudians, a consequence of Bermuda's location in the subtropical mid-Atlantic Ocean. Remote sensing data can help Bermuda responsibly use our ocean assets, including commercially important fish stocks and deep-sea ecosystems like seamounts and corals, by enabling the monitoring of ocean circulation and current systems, the measurement of ocean temperature and wave heights, and other applications.
- **Disaster prevention and preparedness:** Due to Bermuda's position in the mid-Atlantic Ocean, we are occasionally in the path of tropical storms and hurricanes. While Bermuda is generally resilient in the face of such storms, it is important that we use all the tools at our disposal to ensure adequate disaster management capabilities. Remote sensing data enables tracking of hurricanes and other natural disasters.
- **Natural resource management:** Bermudians enjoy a unique natural heritage. The Government seeks to protect this heritage by managing the development of land to ensure optimal use while

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<sup>2</sup> BCC Research. "Satellite Communications Global Market to Reach Double-Digit CAGR". GlobeNewswire, April 2018, <https://www.globenewswire.com/news-release/2018/04/11/1468321/0/en/Satellite-Communications-Global-Market-to-Reach-Double-Digit-CAGR.html>.

<sup>3</sup> Euroconsult. "Earth Observation". Euroconsult-ec.com, <http://www.euroconsult-ec.com/earthobservation>.

<sup>4</sup> National Ocean Service, U.S. Department of Commerce. "What is remote sensing?" <https://oceanservice.noaa.gov/facts/remotesensing.html>

conserving important flora, fauna and natural habitats. Remote sensing data can help in this effort by enabling the monitoring of land use, mapping of wetlands, and charting of wildlife habitats.

- **Coastal mapping and erosion prevention:** As an island nation, changes along Bermuda's coasts can have an impact on the safety, security and quality of life of all Bermudians. Remote sensing can enable Bermuda to develop a clearer picture of the state of our coasts by enabling the monitoring of shoreline changes and mapping of coastal features.

Some organizations within Bermuda, including the Department of Environment and Natural Resources and the Bermuda Institute for Ocean Sciences (BIOS), use remote sensing for scientific research purposes or to enhance public-sector decision making with respect to the environment.

## Space Insurance

Bermuda's risk industry is one of the most vibrant and respected in the world. It comprises leading insurance and reinsurance companies, captive insurers, and alternative reinsurance vehicles in converging capital and risk markets. Bermuda's captive insurance industry is the global leader, with more than 800 companies generating over \$20 billion in annual gross written premiums. The Island is also one of the world's top three reinsurance centers (with New York and London) and the world's single most important property and catastrophe market.

Insurance is a fundamental part of most commercial space ventures, especially larger satellite or constellation operators with institutional lenders as part of their financing arrangements (who require insurance to be purchased as a condition precedent to a loan). Given Bermuda's thriving insurance industry and the need for insurance among most commercial space ventures, there could be opportunities for Bermuda to leverage its domestic insurance market and related experience for commercial space.

## Space Sustainability

Space Sustainability is a multifaceted concept that refers to maintaining earth orbit, and beyond, as a viable operating environment for spacecraft. The concept of space sustainability includes enabling the efficient use of space as a resource while managing orbital debris, enabling capabilities to provide space traffic management and reducing risk of satellite collisions. Space Situational Awareness (SSA), part of the broader concept of space sustainability, refers to the act of tracking artificial objects in space to provide space actors with the information they need to avoid collisions and ensure the safety of their orbital assets. Until recently, the United States Department of Defense (DoD) was the only organization in the world that provided this type of information, but operators are increasingly calling for greater transparency and precision than the DoD system can provide.<sup>5</sup> Today, there is growing demand for SSA sensors, software, products and services, and private companies are working to meet the demand. For example, many companies have plans to develop new sites for radar, radiofrequency, and optical sensors. Bermuda could build on its success as a location for tracking launches to become a host for SSA sensors and a hub for SSA products and services.

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<sup>5</sup> Balakrishnan, Asha et al. *Global Trends in Space Situational Awareness (SSA) and Space Traffic Management (STM)*. IDA Science and Technology Policy Institute, April 2018, <https://www.ida.org/-/media/feature/publications/g/gl/global-trends-in-space-situational-awareness-ssa-and-space-traffic-management-stm/d-9074.ashx>.

## New Space

“New space” is an umbrella term that refers to a range of entrepreneurial approaches to space development, including private spaceflight, deep space exploration, in-space manufacturing, asteroid mining, on-orbit servicing and others. Many new space ventures, such as asteroid mining, are in the conceptual or research stage and have yet to demonstrate commercial viability, while others, such as on-orbit servicing, are closer to becoming a commercial reality. As an example of the considerable economic potential this area holds, the market for asteroid mining is estimated to be \$2.84 billion by 2025 and could become a trillion dollar industry in the not-too-distant future.<sup>6</sup>

These activities are likely to be fueled by a new NASA policy which provides expanded opportunities at the International Space Station to manufacture, market and promote commercial products and services, with a view towards catalyzing the development of a thriving, sustainable commercial economy in low-Earth orbit (LEO). NASA’s stated goal in the long-term is to become one of many customers purchasing services from independent, commercial and free-flying habitable destinations in low-Earth orbit, and it will offer a portion of its Commercial LEO Development budget to facilitate development of commercial destinations to achieve that goal. With support from one of the world’s preeminent space agencies, there will likely be many new opportunities for the development of “New Space” activities.

The regulatory frameworks for many of these activities are still underdeveloped or non-existent in many countries, presenting an opportunity for a country like Bermuda, which has a rich history of successfully collaborating with industry to develop pro-business regulatory frameworks, to set itself apart from the international competition through smart legislation that responds to the quickly-evolving needs of space entrepreneurs.

## Strategic Pillars

An evaluation of Bermuda’s existing resources, strengths and needs suggests that our strategy to develop a vibrant commercial space ecosystem must rest upon four key pillars:

- Development of policies and regulation
- Domestic capacity building
- International partnerships and engagement
- Utilization of Bermuda’s national orbital resources

Each of these pillars corresponds to one of four strategic goals that Bermuda aims to reach:

- 1) Build Bermuda’s reputation as a responsible, leading jurisdiction for space and satellite-related business;
- 2) Enhance domestic space and satellite-related capabilities;
- 3) Further integrate Bermuda with the international space community;
- 4) Generate revenue from national orbital allotments.

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<sup>6</sup> Phase. “Space Mining Market worth \$2.84 billion by 2025.” MarketsandMarkets, <https://www.marketsandmarkets.com/PressReleases/space-mining.asp>

## Policies and Regulation

**Strategic Goal 1:** Build Bermuda’s reputation as a responsible, leading jurisdiction for space and satellite-related business.

One of Bermuda’s comparative advantages relative to other national jurisdictions is our ability to nimbly respond to changing economic dynamics and develop pro-business regulation that protects Bermuda’s interests while supporting the growth of innovative new industries. Currently, the Government is leveraging this experience to establish Bermuda’s position as a global FinTech leader; the same approach can secure Bermuda’s position as a space industry leader.

Bermuda’s existing space and satellite-related legislation includes the Satellite Network Notification and Coordination Regulations 2007. Potential new areas for regulation include on-orbit servicing, earth observation, and sub-orbital manned spaceflight (“space tourism” and micro-gravity research).

## Domestic Capacity Building

**Strategic Goal 2:** Increase domestic space and satellite-related capabilities.

While attracting outside space-industry players to the Island will enable Bermuda to benefit economically from the commercial space boom, building domestic space-related knowledge and capacity will ensure the long-term sustainability and growth of our domestic space ecosystem. In fact, the two go hand in hand. Opening up STEM education opportunities will equip Bermudians with the knowledge they need to pursue careers related to space, while training initiatives will help Bermudians develop the skills required to obtain high-quality jobs in space and satellite-related fields. Over time, education and training opportunities will cultivate local experts and spur the development of locally-owned and operated organizations with an interest in space. Through such initiatives, our citizens will be better positioned to take advantage of a growing space economy.

Moreover, building technological capacity, i.e. enhancing Bermuda’s use of space and satellite technology, will contribute to the safety and prosperity of our community. Satellite technology, for example, can help Bermuda prepare for and recover from natural disasters or monitor changes to our land and ocean environment.

## International Partnerships and Engagement

**Strategic Goal 3:** Further integrate Bermuda with the international space community.

Further integration with the international community through partnerships and other forms of engagement will help Bermuda to raise its space profile and become both a more skilled and attractive space jurisdiction. Bermuda has a long history of forging partnerships with other governments and international and national bodies. As an Overseas Territory of the UK, Bermuda naturally has strong ties to the UK, but we also have longstanding relationships with the United States and Europe: as mentioned above, Bermuda has maintained successful partnerships with space industry organizations NASA and ESA. The Government also has extensive experience entering into agreements with like-minded bodies outside of the space industry, for example in the FinTech and insurance industries. To implement this strategy, Bermuda must build on existing partnerships with space industry stakeholders, establish new ones, and engage in multilateral fora where key decisions affecting the space community are made.

## National Orbital Resources

**Strategic Goal 4:** Generate revenue from national orbital allotments.

The first step to take advantage of the revenue-generating potential of Bermuda's orbital resources is to capitalize on the Government's partnership with Satellite Ventures (Bermuda) Limited (SVBL), the joint venture between SES and EchoStar that operates Bermuda's first and only live satellite network, BermudaSat-1. The Government must continue to actively engage its partners to ensure maximum effort is being made to generate revenue from the asset.

Bermuda's orbital slots are valuable resources that, if commercialized, can generate Government revenue and provide services of use to the public. Making timely use of the 96.2 WL and other slots is critical, as other countries could place satellites into orbital slots in close proximity to Bermuda's, potentially causing interference and complicating the launch of commercial services from Bermudasat-1 or future Bermuda networks.

## Implementing the Strategy

The following section outlines the strategic goals and objectives which Bermuda must achieve to realize its vision for the development of the Island's space ecosystem from the period 2020-2025. The strategic goals and objectives correspond to each of the strategic pillars described above.

### Policies and Regulation

**Strategic Goal 1:** Build Bermuda's reputation as a responsible, leading jurisdiction for space and satellite-related business.

Objective 1.1: Increase the space industry's contribution to Bermuda's economy as a percentage of GDP.

Actions

- Conduct an analysis of the space industry's current contribution to GDP and identify a target future percentage.

Objective 1.2: Attract five companies to Bermuda which fit into our desired space ecosystem.

Actions

- Update marketing materials related to Bermuda's space and satellite capabilities and offerings.
- Finalize and enact regulations to authorize satellite earth stations on the Island.
- Host international conference or workshop to spur collaboration with space industry stakeholders on development of forward-thinking regulatory frameworks to enable new technologies and business models.
- Develop and enact at least two new policies or regulations which enhance Bermuda's competitiveness as a jurisdiction for business related to satellite communications, earth observation, space insurance, space situational awareness, or new space activities.

- Hold networking event with local insurance community to explore interest in partnering with Government to develop new space products. Hold similar event with local finance community to explore funding opportunities for young companies.
- Work with Bermuda Economic Development Corporation (BEDC) to explore ways to facilitate venture capital opportunities for space startups. Interact with space startups to determine what type of support is needed. Consider leveraging Infrastructure Fund to support space startups, possibly through creation of physical working space on Island.
- Conduct analysis of suitable locations/available capacity for earth stations on island.
- Establish on-island stakeholder working group, chaired by the Bermuda Business Development Agency, to monitor and carry forward progress in target growth areas. The working group will report on such progress to the Space and Satellite Policy Advisory Panel.

Objective 1.3: Strengthen Bermuda’s relationship with the United Kingdom in the space domain.

#### Actions

- Consider the benefits and risks and, if necessary, successfully negotiate the extension of the UK Space Industry Act 2018 to Bermuda.
- Streamline the process of working with Government House and industry stakeholders to obtain a license to launch and operate a space object from UKSA.

Objective 1.4: Leverage synergies with other priority industry areas in Bermuda.

#### Actions

- Explore opportunities to collaborate with companies and organizations which simultaneously operate in the space and insurance or blockchain areas.

### Domestic Capacity Building

**Strategic Goal 2:** Enhance domestic space and satellite-related capabilities.

Objective 2.1: Increase Science, Technology, Engineering and Math (STEM) educational opportunities.

#### Actions

- Continue to partner with NASA and the Challenger Learning Center of Alaska to hold annual Bermuda space camps.
- Establish a student exchange program with the Challenger Learning Center of Alaska.
- Create small satellite and microgravity experiments programs for high school students.
- Work with NASA and Advisory Panel to provide online resources to local high schools and Bermuda College.

Objective 2.2: Create workforce development and training opportunities for Bermudians to cultivate space and satellite skill sets.

#### Actions

- Partner with industry leader, through MoU or other means, to secure sponsorship of training and education opportunities.
- Through the Department of Workforce Development, support the training of Bermudians in space and satellite issues.

Objective 2.3: Increase public sector adoption of space and satellite technologies.

#### Actions

- Partner with commercial satellite company or non-profit organization, or join multilateral group such as the Group on Earth Observations, to leverage earth observation data to enhance public-sector environmental decision-making.

### International Partnerships and Engagement

**Strategic Goal 3:** Further integrate Bermuda with the international space community.

Objective 3.1: Expand existing partnerships with NASA and ESA.

#### Actions

- Join NASA's International Internship Program and the International Space Education Board. The International Internship Program enables foreign students to work alongside undergraduate or graduate level American students on research opportunities in the U.S. The International Space Education Board is a multinational initiative to share best practices and foster interest in space, science and technology among the student community worldwide.
- Host ESA experts in Bermuda to deliver seminars on space-related topics.

Objective 3.2: Establish new partnership with private or public sector organization.

#### Actions

- Explore opportunities to enter into memoranda of understanding or other agreements with countries which have a similar experience to Bermuda in terms of the development of their space industry, e.g. New Zealand, Luxembourg, Isle of Man, and Gibraltar.

Objective 3.3: Participate in international space-related activities and host events on space-related topics.

#### Actions

- Coordinate with the United Kingdom to provide input to the delegation that attends the Committee on the Peaceful Uses of Outer Space regarding long-term sustainability.
- Monitor the changes that the United States and other active space nations make regarding their national policies for space traffic management and consider whether these result in any need for changes in strategy or operational regulatory approaches in Bermuda.
- Attend at least one major space conference per year to maintain visibility and build relationships with stakeholders.

## National Orbital Resources

**Strategic Goal 4:** Generate revenue from national orbital allotments.

Objective 4.1: Continue working with industry partners to commercialize the 96.2 WL orbital slot.

Actions

- Hold annual discussions with SVBL partners SES and EchoStar on progress made.

Objective 4.2: Develop strategic plan to bring into use and commercialize the remaining three slots.

Actions

- Identify countries and/or private companies to serve as potential partners in making use of remaining slots.
- Determine how best to utilize the remaining slots to serve Bermuda's interests;
- Determine timeline for establishing new partnerships and placing assets into orbital slots.

## Roles and Responsibilities

**The Government of Bermuda:** Currently, there is no standalone space agency in Bermuda. The Ministry of Home Affairs oversees the development of the country's space and satellite sector and, as such, is the primary body responsible for implementing the space strategy. The Government will allocate funding on an annual basis to the Ministry of Home Affairs for the development of the space and satellite industries. The Department of Environment and Natural Resources within the Ministry of Home Affairs will play an increasingly important role in building out the use of space-bases resources within the Government for certain public services, such as environmental monitoring. The Ministry of Home Affairs will seek support from other Government offices as appropriate. For example, the Ministry of Education will play a supporting role as needed to help carry out education initiatives, and the Department of Workforce Development will support training initiatives.

**Space and Satellite Policy Advisory Panel:** The Government will continue to consult the Space and Satellite Policy Advisory Panel for advice on the development of the space industry in Bermuda, including the implementation of the space strategy, which the Panel played an integral role in developing. The Advisory Panel serves as an important resource for the Government to understand the views of a variety of industry stakeholders and to take them into account when formulating policy.

**Bermuda Business Development Agency (BDA):** The Bermuda Business Development Agency is an independent, public-private partnership that encourages direct investment and helps companies start up, re-locate or expand their operations in Bermuda. BDA has an important role to play in advertising Bermuda's space and satellite offerings, connecting interested stakeholders with the Government, and incentivizing companies to establish operations in Bermuda. The Ministry of Home Affairs will coordinate more closely with the BDA to work with prospective industry partners.

**Regulatory Authority of Bermuda (RA):** The Regulatory Authority is an independent body that regulates Bermuda's electronic communications and energy sectors. As such, the RA awards licenses for the use of radiofrequency spectrum in Bermuda. Along with the Minister of Home Affairs, the RA cosigns the

certificates of compliance, competence and coordination awarded throughout the process of filing a satellite network through Bermuda. Given its authority and activities related to radiofrequency spectrum, the RA will play a role in the licensing of satellite and other companies in the space industry going forward and should be consulted when developing related policies.