Virginia Commercial Space Flight Authority

Strategic Plan 2012 – 2017

December 1, 2012

VIRGINIA COMMERCIAL SPACE FLIGHT AUTHORITY

December 1, 2012

The Honorable Robert F. McDonnell
Commonwealth of Virginia
Patrick Henry Building
1111 E. Broad Street
Richmond, VA 23219

Dear Governor McDonnell:

As required by Chapters 779 and 817 of the 2012 Acts of Assembly and Item 430 of the 2012-2014 Appropriations Act, I am pleased to present you with the Virginia Commercial Space Flight Authority's ("VCSFA") 2012 – 2017 Strategic Plan. This is the first installment of the strategic plan, and updates will follow every four years and as otherwise necessary.

During the 2011 Session of the General Assembly, House Bill 813 and Senate Bill 284 were introduced to reconstitute the Authority, reform its Board of Directors, amend its powers and duties, and provide the Authority with the requisite funding to become a truly independent authority of the Commonwealth. This legislation was signed into law and took effect on July 1, 2012.

Since that time, staff from the Authority has been diligently working to implement the provisions of the legislation, and much has been accomplished, including:

- New customers have contacted me and other members of your administration to determine how they may use the Authority to further their interests in using space for research missions, commercial revenue generating projects, and human space flight;
- NASA has provided constructive assistance to support the VCSFA to provide launch vehicle suppliers and mission payload builders a new access to space;
- The Authority has built a new management team that is evolving and shifting focus from starting a new business to building a stronger base for winning additional new business and providing skilled technical expertise for success in the future;
- The Authority has renegotiated the business arrangement with Virginia based Orbital Sciences Corporation that will benefit both parties for at least the next 5 years. This arrangement allows Orbital to fulfill its obligations to NASA and provide a base for the Authority to attract new customers that may take advantage of the VCSFA assets and economies of scale;
- The Virginia Economic Development organization has mobilized to bring the Commonwealth new companies to utilize our state-wide assets and create new jobs.

4111 Monarch Way, Suite 201, Norfolk, Virginia 23508
Phone: (757) 440-4020 FAX: (757) 440-4023

VIRGINIA COMMERCIAL SPACE FLIGHT AUTHORITY

Clearly, the space industry has become aware of the efforts to re-energize our facility at Wallops Island. All of these re-energizing activities for VCSFA are coming at the right time given the increased requirement for access to space from the U.S. government, military agencies, international users, and commercial space users. As a result of these accomplishments, the VCSFA is now poised to become one of the most useable spaceports in the United States. This Strategic Plan charts the path to achieving that goal, as well as the associated economic development and job creation opportunities resulting from Virginia's position as a leader in a rapidly growing arena.

I am tremendously appreciative of your leadership in helping bring about these changes and accomplishments, and I look forward to continuing our efforts to make the Mid-Atlantic Regional Spaceport at Wallops Island a major factor in Virginia's continued economy prosperity.

Sincerely,

Dale K. Nash
Executive Director
Virginia Commercial Space Flight Authority

cc: The Honorable Sean T. Connaughton
Virginia House of Delegates
Senate of Virginia

4111 Monarch Way, Suite 201, Norfolk, Virginia 23508
Phone: (757) 440-4020 FAX: (757) 440-4023

Contents

Glossary

AAC	Alaska Aerospace Corporation
AST	Office of Commercial Space Transportation
Authority	The Virginia Commercial Space Flight Authority
Board	The Virginia Commercial Space Flight Authority Board of Directors
CFS	Cecil Field Spaceport
Commonwealth	The Commonwealth of Virginia
CST&EI	Commercial Space Transportation & Enabling Industries
DBS	Direct Broadcasting Services
DOD	Department of Defence
FAA	Federal Aviation Administration
FSS	Fixed Satellite Services
GDP	Gross Domestic Product
GEO	Geosynchronous Launch
Governor	Virginia Governor Bob McDonnell
HB 813	Virginia House Bill 813
HDTV	High Definition Television
ISS	International Space Station
KLC	Kodiak Launch Complex
LEO	Low Earth Orbit
MARS	Mid-Atlantic Regional Spaceport
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NGSO	Non-Geosynchronous Launch
NLS	NASA Launch Services
NRO	National Reconnaissance Office
Orbital	Orbital Sciences Corporation
Plan	This document, The Virginia Commercial Space Flight Authority Strategic Plan
SpaceX	Space Exploration Technologies
STEM	Science, Technology, Engineering and Mathematics
SWOT	Strengths, Weaknesses, Opportunities, Threats
ULA	United Launch Alliance
VCSFA	The Virginia Commercial Space Flight Authority
VSGC	Virginia Space Grant Consortium
WFF	Wallops Flight Facility

1. Executive Summary

1.1 Purpose

This Strategic Plan ("the Plan") was developed in response to Chapters 779 and 817 of the 2012 Acts of Assembly (HB 813/SB 284), which requires the Virginia Commercial Space Flight Board of Directors (the Board) to submit a strategic plan to the Governor and the General Assembly no later than December 1, 2012.

The Plan evaluates the current state of the Virginia Commercial Space Flight Authority (VCSFA, or Authority), the industry landscape, the Authority's competition, and available launch forecasts and trends. Building on these items, the Plan describes the strategic objectives and key actions for VCSFA for the 2012 to 2017 period. The strategic plan is an extension of the work accomplished in the report "Governance, Organization and Competitive Landscape Review of the Authority" conducted in December 2011 and serves as a foundation for accomplishing the Commonwealth's priorities and the Authority's objectives.

1.2 Overview

Sections 1 to 3 of the Plan assess the key drivers that may shape the future of VCSFA and the commercial space industry over the next five years. Selected key drivers impacting the strategic direction of VCSFA are highlighted below:

- **Shift in National Space Policy –** The National Space Policy calls for a new approach to space exploration and seeks partnerships with the private sector to enable commercial space flight opportunities. The new focus on space exploration at the federal level encourages education, technological and environmental research, and support of national security measures and promotes a competitive commercial space industry.[1] Each element of the federal government's policy has the potential to afford VCSFA with opportunities to expand launch services into these markets.
- **Governance and Resource Enhancements** – Based on the "Governance, Organization and Competitive Landscape Review," the General Assembly passed the House Bill 813, which reconstituted the VCSFA Board of Directors ("Board") and reduced the number of Board members from thirteen to nine, increased annual funding support for the Authority, and made several other changes to the administrative powers and duties of the Authority. House Bill 813 authorized $9.5 million in funding each year to VCSFA from the Transportation Trust Fund for operations, personnel, site maintenance and infrastructure. The funding is committed for the five years spanning FY2012 to FY2016.
- **Commercial Launch Demand Forecast** – The Federal Aviation Administration (FAA) forecasts growth in the commercial space transportation and enabling industry (CST&EI) sector, as market demand for commercial space flight increases. The FAA and Commercial Space Transportation Advisory Committee forecast an average annual demand of approximately 29 commercial space launches[2] for the 10 year period from 2012 through 2021.
- **Economic Impact to the Commonwealth** – Commercial space transportation, a sub segment of the aerospace industry, is an important component of Virginia's economy. In 2009, the aerospace

[1] National Space Policy of the United States of America, June 28, 2010

[2] 2012 FAA Commercial Space Transportation Forecasts

industry contributed a total economic impact of $7.6 billion and supported 28,110 jobs in the Commonwealth[3]. This accounted for 1.9% of Virginia total spending and industry jobs accounted for 0.8% of total employment.[4] By these measures, the aerospace industry is more productive than the average industry in Virginia.[5]

- **Key Client Expansion –** Orbital Sciences Corporation (Orbital) is among the ten largest U.S. space system and launch vehicle manufacturers with over 1,000 rockets, launch vehicles, and satellites built or under contract.[6] Orbital's launch vehicles, satellites and space systems business sectors accounted for $483 million (36%), $554 million (41%), and $434 million (23%) in revenue respectively during 2011.[7] The company has exhibited steady growth in recent years and successfully completed launches of eight sounding rockets, delivery of seven satellites and launch vehicles for future missions, and the completion of several construction and testing milestones in the Antares rocket and Cygnus spacecraft programs in the U.S.[8]

  Orbital, which is ranked among the top 35 public companies in Virginia, has been headquartered in Virginia since 1983 and has expanded its Virginia-based employment from 6 to over 1,800 people. Company revenues for 2012 are expected to increase 12% over 2011 revenues. Orbital is currently in the process of readying its Antares space launch system for providing a broad range of launch services. The anchor contract for Antares is the Commercial Resupply Services to the International Space Station (ISS) for the National Aeronautics and Space Administration (NASA) to be launched out of Wallops. Such missions are planned to be flown through to the end of 2016.

- **Thriving Commercial Space Industry and Competition** – There are currently eight FAA licensed commercial launch site operators in six states: Virginia, California (2), Florida (2), Oklahoma, New Mexico, and Alaska.[9] Each of these states, with the exception of California[10], have state-owned space authorities responsible for facilitating commercial space activity. Of the eight licensed operators, only four (Virginia, California, Florida, and Alaska) have spaceports that are currently licensed to launch small and medium lift rockets for sub-orbital or orbital slots, and these four are currently the main competitors in the U.S. commercial space launch market. While California, Florida, and Alaska offer services similar to VCSFA, the Mid-Atlantic Regional Spaceport (MARS,) which the Authority operates, is ideal for providing equatorial access for low earth orbit for small to medium size launches on the east coast. MARS also offers easier and more economical access to the International Space Station, an important consideration for commercial space companies serving NASA for ISS resupply missions. Given these advantages, MARS is an attractive spaceport for commercial space companies.

[3] "Competitive Analysis of Virginia's Space Industry," December 2011 (accessed September 14, 2012), Virginia Department of Transportation, page 3, http://www.transportation.virginia.gov/docs/SpaceCompAnalysis.pdf

[4] Virginia Department of Aviation, Virginia's Aerospace Industry, An Economic Impact Analysis, November 2010, Revised Edition January 2011, page 3

[5] Virginia Department of Aviation, Virginia's Aerospace Industry, An Economic Impact Analysis, November 2010, Revised Edition January 2011, page 3

[6] Orbital Sciences Corporation, 2011 Annual Report

[7] Orbital Sciences Corporation, 2011 Annual Report

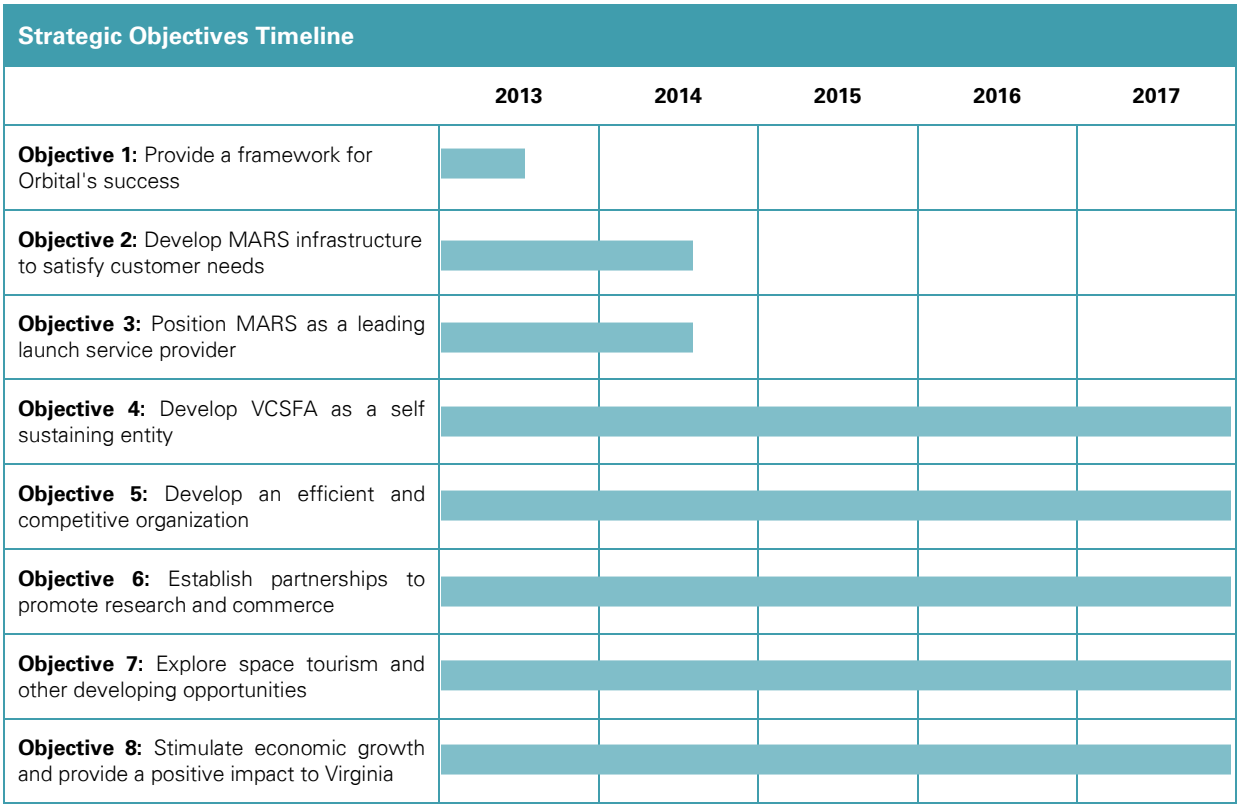
[8] Orbital Sciences Corporation Press Release, Orbital First Quarter 2012 Financial Results, April 20, 2012

[9] FAA Launch Data and Information, http://www.faa.gov/about/office_org/headquarters_offices/ast/launch_license/active_licenses/, Sept. 6, 2012

[10] California Space Authority ceased operations June 10, 2011. Spaceport Systems International, LLP now operates the California Spaceport.

1.3 Strategic Objectives

Section 4 of the Plan presents VCFSA's Strategic Objectives and Direction. VCSFA's eight objectives are summarized below. These objectives include both tactical and strategic actions that VCSFA plans to undertake over the next five years.



The objectives and related actions are presented below:

Objective 1: Provide a framework for Orbital's success as the "initial launch" customer

- Develop a contract with Orbital that provides an appropriate level of support for the current ISS contract and future missions
- Beyond ISS contracts, understand Orbital's launch business objectives with a view to providing the necessary support and balance with requirements of a multi-user environment

Objective 2: Develop MARS infrastructure to satisfy customer needs, manage the business, and enhance competition

- Make MARS a multi-user facility
- Review and update current infrastructure

Objective 3: Position VCSFA as a leading launch service provider

- Focus on small and medium-lift launches
- Create a competitive cost and charging structure and understand per launch unit costs
- Increase launch preparation efficiency and expanding customer service

Objective 4: Develop VCSFA as a self sustaining entity

- Reduce dependency on state funding through optimal use of resources
- Make best use of external contractors and internal management resources while maintaining schedules in a multi-user facility
- Utilize an effective marketing strategy to develop sustainable revenue streams from new and existing customers and initiatives
- Develop partnerships with other states and educational institutions to share costs and benefits of launch facilities

Objective 5: Develop an efficient and competitive organization

- Aggressively develop and engage a new business development strategy
- Provide a proactive management and governance structure at the operational level
- Establish core values that focus on efficiency and mission success
- Build strategic alliances, seek sustainable investment resources, and negotiate optimal business agreements with key industry players

Objective 6: Establish partnerships to promote research and commercial opportunities

- Promote aerospace science and research
- Enhance research capabilities to position Virginia as the leading space authority in the U.S.
- Expand relationships with educational institutions
- Strengthen relationships with key aerospace industry, military and research establishments

Objective 7: Explore space tourism and other developing opportunities

- Assess developments in the market for space tourism and explore the potential to leverage MARS facilities in order to benefit from this developing market
- React quickly to take advantage of any opportunities in this market in the future, should they be a viable proposition at MARS

Objective 8: Stimulate economic growth and provide a positive impact to the Commonwealth

- Develop Virginia as an industrial hub to benefit businesses in the state through alliances and encourage investment through policies and incentives
- Create highly skilled jobs in the aerospace sector focusing on employer and industry needs
- Enhance aerospace education by fostering relationships with educational institutions

1.4 Strategic Direction

VCSFA has a unique heritage and a vibrant future because of the re-energizing efforts that have been completed by the Commonwealth during recent years. Recent actions taken by the Governor and the General Assembly have demonstrated that the Authority will be given the opportunity to grow and benefit from the future of space exploration as codified in the National Space Policy and aggressively compete with other spaceports to attract new business. Based on the forecasted growth in demand from the U.S. government, military agencies, international users, and commercial space users, the supply of launch facilities is less than adequate to accommodate all of the current and the projected demand. As such, the Authority will adhere to a policy of making investments quickly to attract customers while carefully monitoring the commercial space market development and launch capacity supplied by other states. The Authority will balance longer term VCSFA investments with benefits for the Commonwealth (e.g. jobs, education, industry growth, etc). This *Opportunistic Midcourse* provides the Authority with the best opportunity to serve the commercial space market. This strategy allows VCSFA to move with the industry, yet it does not commit significant public funds to investment in areas that are still evolving, such as heavy lift crew launches or horizontal launches. The *Opportunistic Midcourse* positions VCSFA to capitalize on its current strengths, proactively follow the market, quickly adapt to serve changing industry demands and attract new business to the Commonwealth of Virginia.

PAGE LEFT BLANK ON PURPOSE

2. Introduction

Recent advances in the commercial space industry open new opportunities for space authorities such as the Virginia Commercial Space Flight Authority (VCSFA, or Authority). The VCSFA operates the nation's oldest, continual use launch site at Wallops Island and has a robust vision for the future of space. In the 2010-2012 Biennium (HB1500 / SB800) State Budget, the General Assembly recognized space flight's growing role in aviation and transferred the responsibility for the oversight of the Authority from the Secretary of Commerce and Trade to the Secretary of Transportation. The General Assembly required the Office of the Secretary of Transportation to conduct a review of the governance, organization and competitive landscape of the Authority in order to identify the necessary steps to make the Mid-Atlantic Regional Spaceport (MARS) the leading commercial space launch facility in the country. Additionally, the General Assembly required the development of a strategic plan to position the Authority for the future demands of the commercial space flight industry.

The U.S. space program, after nearly a century of space exploration and investment by the Federal Government, is currently undergoing radical change. It is evolving from an industry led by government objectives to one which can be supported by the private sector. Against this backdrop, many companies (both launch providers and launch users) are looking to form partnerships and alliances for the next step of space flight. Accordingly, it will be important for the VCSFA to take advantage of this once in a generation change over the next five years. If the VCSFA can consolidate its position at Wallops and attract those customers looking to fill the initial vacuum of opportunity within the U.S. commercial space flight market, the VCSFA should be able to grow with the market into the future. This Plan evaluates the macroeconomic landscape and VCSFA's competitive positioning over the next five years, and it presents the Authority's objectives and key actions for achieving them.

2.1 Background and History

Previously known as the Virginia Space Flight Center, the VCSFA was created by the General Assembly in 1995 to pursue the following four objectives:

- Develop and enhance infrastructure that facilitates timely, efficient, safe, and low-cost access to space;
- Provide education and research in aerospace technologies and processes;
- Preserve, as a national asset, the expertise and

Wallops Island is known as the "original space coast." The island was the location for the launch of the first research rocket on July 4, 1945, more than a decade before the creation of NASA.

Source: The Washington Post, "Virginia aims to claim the next Space Coast," July 9, 2011

capability for launch operations resident at the NASA Wallops Flight Facility; and

- Stimulate aerospace-related economic activity in the region.

The Authority is charged with operating the Mid-Atlantic Regional Spaceport (MARS), an FAA-licensed, full-service spaceport located on the southern portion of Wallops Island. Because of its geographic location, MARS is attractive for launch azimuths from 38 to 60 degrees, making it an ideal location from which to reach the International Space Station (ISS) and other similar sub-orbital and orbital objectives. Today, MARS has two launch facilities, one mid-class and one small-class facility, as well as access to support infrastructure facilities through agreements with NASA. The support infrastructure facilities include vehicle and payload processing integration facilities, support instrumentation and emergency facilities.

The Authority services two launch pads at MARS:

- **Pad 0-A –** MARS Launch Pad 0-A is a medium-class launch facility capable of launching payloads of up to 15,400 lbs to low earth orbit. It also features the first all-new large-scale liquid-fuel launch site to be built in the U.S. in many years. The pad will serve as the base pad for the Antares resupply missions to the ISS. The pad will also be available for other Antares missions and could potentially serve other launch vehicles with some modifications.
- **Pad 0-B –** Launch Pad 0-B is a small-class solid-fuel launch facility capable of launching payloads of up to 8,400 lbs to low earth orbit. The pad also features a 133 ft movable service tower.

  Recent and planned launch activity includes:

  - 2006 – Launch TacStat -2
  - 2007 – Launch NFIRE
  - 2009 – Launch TacSat -32011
  - Launched Operationally Responsive Space –ORS-1
  - 2012 – Manifested to begin launch activities for Antares to the ISS
  - 2013 – Manifested to launch NASA LADEE to the Moon and ORS-3

Significant events following the establishment of VCSFA have helped shape the future of space industry in the Commonwealth and the region:

- 1997 – VCSFA received a launch license from the FAA for launch activity to orbit. Furthermore, VCSFA entered into a Reimbursable Space Act Agreement with NASA. The agreement enables VCSFA to establish and operate a commercial space flight center at NASA Goddard Space Flight Center (GSFC), Wallops Island.
- 2003 – Establishment of Maryland Memorandum of Agreement (MOA) that expanded the management of the spaceport and was a unique bilateral agreement between the two states.
- 2008 – VCSFA entered into a Memorandum of Understanding (MOU) to assist Orbital Sciences Corporation ("Orbital") in developing launch capabilities at Wallops Island that accommodate the needs of ISS resupply as well other medium launch missions.
- 2011 – A study commissioned in response to the biennial state budget reviewed the governance, organization and competitive landscape for VCSFA. The report identified a number of findings related to VCSFA and outlines eight key recommendations designed to enhance the economic competitiveness of Virginia's space flight industry and the governance structure of the Authority.[11] These recommendations include:

[11] See http://www.transportation.virginia.gov/docs/vcsfa_report.pdf

- Make the capital investment necessary to evolve MARS into a multi-use facility and attract new customers;
- The VCSFA should develop market-based usage cost rates that reflect the infrastructure, site, facilities, and range equipment at MARS;
- The VCSFA must focus on a long range strategy for MARS;
- The Board of Directors should be restructured to reflect the mission, purpose and size of the VCSFA;
- The VCSFA should re-evaluate and refresh agreements with other entities; and
- The VCSFA staff and organizational structure should reflect the strategic direction.

- April 18, 2012 – In consideration of the Governance, Organization and Competitive Landscape Review, the General Assembly passed House Bill 813 and Senate Bill 284, which reconstituted the Board by reducing the number of Board members from thirteen to nine, increased annual funding support for the Authority, and made several other changes to the administrative powers and duties of the Authority. The legislation authorized $9.5 million in annual funding from the Transportation Trust Fund for Fiscal Years 2012 to 2016 for operations, personnel, site maintenance and infrastructure, and required completion of a strategic plan by December 1, 2012.
- September 17, 2012 – Governor McDonnell announced that the VCFSA will own and operate all non-Antares-specific assets that can be used by future additional customers. McDonnell stated, "VCSFA's successful completion of the MARS spaceport development project and the impending commencement of on-pad operations, positions Virginia – with its business-friendly climate, tremendous institutions of higher education and diverse workforce – for continued growth in this vibrant high-tech market".[12]

2.2 The Path Forward

Strategic

A series of actions that demonstrate VCSFA will partner with customers and will quickly follow industry landscape and trends while strengthening Virginia's competitive position over the long term

Tactical

Immediate actions necessary for VCSFA to build institutional and infrastructure capabilities for efficient operations and demonstrate success for launch missions

Promoting commercial space activity, economic development and aerospace research has been a core mission of the Commonwealth since the establishment of VCSFA. This strategic plan intends to establish the direction of VCSFA over the next five years. The plan reflects views of Board members, the Office of the Secretary of Transportation, private sector partners and industry specialists. Furthermore, the plan takes into consideration the competitive position of the Commonwealth identified in the report entitled "Governance, Organization and Competitive Landscape Review and Competitive Analysis of Virginia's Space Industry."

[12] Press Release, "Virginia Commercial Space Flight Authority and Orbital Sciences Corporation Reach New Agreement on MARS," September, 17, 2012.

The path forward is both tactical and strategic. The tactical approach includes short-term (up to 18 months) actions identified in HB 813 and SB 284 that are required to setup the framework of the Authority and actions necessary for VCSFA to build institutional and infrastructure capabilities for efficient operations and launch mission success. The strategic approach reflects a series of actions over a longer term (18 months to five years) intended to strengthen the Commonwealth's competitive position.

2.3 Overall Strategic Direction for the VCSFA

The study conducted in 2011 - "Governance, Organization and Competitive Landscape Review of Virginia's Space Industry" - identified three strategic options for the Authority: status quo, full speed ahead, and opportunistic midcourse.

The *Status Quo* option involves maintaining historical launch strengths and incurring a low capital investment. On the opposite spectrum, *Full Speed Ahead* option involves setting up investments to participate in the "new big commercial space" and incur potential payoffs and associated risks of a new market.

Between the Status Quo and Full Speed Ahead Options lies the *Opportunistic Midcourse*. This strategic direction positions VCSFA to make some investments quickly to attract customers while carefully monitoring the commercial space market development and launch capacity supplied by other states, so that longer term VCSFA investments will balance the benefits for the Commonwealth (e.g. jobs, education, industry growth, etc).

The strategic direction considers numerous factors including maturity of the market, the uncertain future of commercial space supply and demand activity and the large investment needed to facilitate development. Given these factors, the *Opportunistic Midcourse* appears to be the right path forward for the Authority. This strategy positions VCSFA to capitalize on its current strengths and take advantage of viable current and future opportunities in the commercial space market.

3. Macroeconomic Analysis

The market for commercial space launches includes stakeholders such as the private sector, government agencies, educational and research institutions, and non-profit entities. Launch forecasts are impacted by the current political and economic landscape, social and educational aspects of space exploration, and technological advancements.

Historically, projections for commercial space launch activity have exceeded actual launches. Because of the complex nature of launch activity, launches are susceptible to delays and cancellations. Accordingly, the VCSFA should take a balanced view of market forecasts.

The outlook for commercial space launches for 2012 through 2021 shows an average of 29 launches annually, and half of these launches are expected to be for NASA's cargo and crew resupply missions to the International Space Station. Science and engineering launches are expected to encompass 26% of the market while telecommunications are projected at 11%.

Source: 2012 FAA Commercial Space Transportation Forecasts

3.1 Political Landscape

The state and federal perspectives on commercial space mirror the vision established by the Reagan Administration, which encouraged commercialization and privatization of space transportation. Together Virginia and the federal government see a growing and expanding opportunity for commercial space from a combination of commercial, civil, scientific, U.S. Government, NASA and military needs.

3.1.1 State Level

At the state level, VCSFA has historically had strong support from the Commonwealth. Furthermore, the current administration sees growing and expanding MARS as a strategic priority and is committed to its success. The Commonwealth has long been a pioneer in space flight, and it has recently taken various steps to demonstrate its commitment to becoming the leading commercial space state in the country.

- **Governor McDonnell** has expressed his commitment to making MARS America's top commercial spaceport. The further development of Wallops Island will continue to attract highly skilled and high-paying jobs to the Eastern Shore and other locations around the Commonwealth. Creating the top commercial spaceport in the country will also increase tourism to Virginia and boost the supporting industries. In addition, space launch activities may generate millions of dollars in revenue for the region and state.[13]
- **Virginia Commercial Space Flight Authority – Governance, Organization and Competitive Landscape Review** was completed in November 2011 as required by the 2010 – 2012 Appropriations Act. The report examined the organization and competitive landscape and provided recommendations for next steps:

[13] Press Release, "McDonnell Unveils Plan to make Wallops the Top Commercial Spaceport in America,"

- Develop a plan to implement new governance and organization structure;
- Make key governance and organization decisions;
- Conduct a study to determine the capital investment needed to attract new customers; and
- Develop a strategic plan to decide the future direction of MARS.

- **HB 813/SB 284 –** Approved by the Governor on April 18, 2012, this legislation, known as the Virginia Commercial Space Flight Authority Act, creates and establishes guidelines for organization of the Authority as a public body corporate and as a political subdivision of the Commonwealth of Virginia. The act mandates several restructuring and organizational changes to VCSFA that include: restructuring the Board of VCSFA and reducing the number of Board members from thirteen to nine; selection of a new advisory committee that is representative of knowledgeable specialists who understand the commercial space industry; and, other changes to the administrative powers and duties of the Authority. Furthermore, for Fiscal Years 2012 to 2016, the act allocated $9.5 million each fiscal year from the Transportation Trust Fund to the Commonwealth Space Flight Fund to support the capital needs, maintenance, and operating costs of facilities owned and operated by the Authority.
- **Partnership with Maryland** – VCSFA and Maryland signed a Memorandum of Agreement (MOA) which formed one of the most unique bi-state economic developments. The MOA created the Mid-Atlantic Institute for Science and Technology and provided funding support from Maryland to MARS.

3.1.2 Federal Level

The federal government has taken a new role in the development and support of the U.S. space industry. The Obama Administration's National Space Policy calls for a new approach to space exploration that seeks partnerships with the private sector to enable commercial space opportunities. The focus on space exploration at the federal level will also expand education, technological and environmental research and support national security measures. Political interest is still focused on positioning the U.S. as the leading space nation in the world with less focus on federal government backed public sector activity; as such, there will be significant opportunities for state spaceports such as MARS to meet commercial launch demands.

Key elements of consideration for VCSFA's success at the federal level include:

- **National Space Policy**

  National Space Policy has undergone significant changes with the end of the Space Shuttle era, and the federal government has refocused its efforts on enhancing the commercial space flight industry in the U.S. Key elements include fostering the development of a competitive private U.S. commercial space flight market; encouraging space science, exploration and education; technological research, including development of new and revolutionary technologies for human and robotic space exploration; environmental research and monitoring of global climate change and natural disasters; and, utilizing space systems in support of national and homeland security. The National Space Policy emphasizes the need for strong and reliable U.S. launch systems and capabilities that encourage an innovative and entrepreneurial commercial space industry that is capable of supporting critical government functions.[14]

- **National Security**

  Space will play an increasingly large role in National Security measures in the future as the Department of Defense (DOD) leverages the opportunities for space systems to support national security, defense and intelligence operations. In 2011, the DOD issued this statement: "*Space*

[14] National Space Policy of the United States of America, June 28, 2010

systems are critical to ground navigation, smart bomb precision, and to relay unmanned aerial vehicle feeds to troops. Space also is necessary for early warnings of missile launches and for keeping the president connected to U.S. nuclear forces" [15] Maintaining the strength of the national space program with increasingly tight budget constraints could prove difficult for the DOD. Private commercial space companies may support DOD missions, which could create an opportunity for VCSFA to expand its operations into the military market.

- **Federal Aviation Administration and the Office of Commercial Space Transportation (AST)**

The FAA plays a vital part in ensuring that spaceports have the support to operate safely and successfully. In 1995 the AST was transferred to the FAA with the mission to "*ensure protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch or re-entry activities, and to encourage, facilitate, and promote U.S. commercial space transportation.*" [16] Over the past several years, the FAA has recognized the growing market for space launch operations in the commercial sector by providing launch data and information, issuing reports and studies on the commercial space industry, providing information on current legislation and international policies on the commercial space industry, and communicating the regulations for safe commercial space flight. The FAA has embraced the growing importance of the space industry and has taken a stance to facilitate improved safety requirements in both human and non-human U.S. space operations. The organization has demonstrated its commitment to the promotion of commercial space flight activities through:

Source: U.S. Department of Commerce

- Establishing the Air Transportation Center of Excellence for Commercial Space Transportation to encourage partnerships among academic, industry, and government to address challenges for commercial space transportation; and
- Establishing Space Transportation Infrastructure Matching Grant Program and issuing grants to four spaceports.

3.2 Economic Landscape

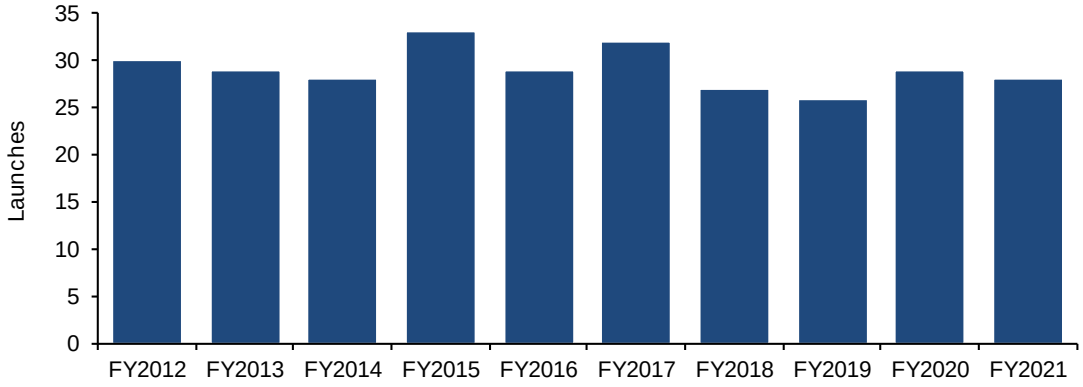
The Commercial Space Transportation and Enabling Industry (CST&EI) segment, as part of the aerospace industry, includes launch vehicle manufacturing and services, satellite manufacturing, ground equipment manufacturing, satellite services, satellite remote sensing, and distribution industries that have a measurable impact on the overall economy. Each of these sectors provides opportunities for VCSFA to bring economic growth to Virginia and the surrounding areas.

[15] *American Forces Press Service*, "DOD Space Program Broadens Industry, Foreign Partnerships", July 19, 2011. *http://www.defense.gov/news/newsarticle.aspx?id=64730*

[16] FAA Office of Commercial Space Transportation, http://www.faa.gov/about/office_org/headquarters_offices/ast/, 2012

The FAA and Commercial Space Transportation Advisory Committee forecast of global demand for commercial space launch service for the 10 year period from 2012 through 2021 shows an average annual demand of approximately 29 commercial space launches, as seen in the graph below.

Figure 1. Combined Global NGSO and GEO Commercial Space Transportation Launch Forecast 2012 to 2021



Source: 2012 FAA Commercial Space Transportation Forecasts

Figure 1, above, shows the FAA forecast for all global commercial space transportation launches from 2012 to 2021. This figure includes both non-geosynchronous (NGSO) and geosynchronous (GEO) forecasted launches.

3.2.1 National Economic Impact from CST&EI

According to FAA estimates, in 2009 CST&EI generated a total of $208.3 billion in economic activity, and from 1999 to 2009 the economic activity from CST&EI grew close to 340%.[17] CST&EI jobs more than doubled from 1999 to 2009, and total wages and salaries of those employed in the commercial space industry and related supporting industries increased from $16.4 billion to $53.3 billion over the same period.[18] With the exception of a small decrease in employment from 2002 to 2004, the overall trend of the economic impact of CST&EI on the U.S. economy has continued to grow.

3.2.2 Virginia Economic Impact from Aerospace Industry

As a significant segment of the aerospace industry, commercial space transportation is an important part of Virginia's economy. In 2009, Virginia's aerospace industry contributed a total economic impact of $7.6 billion to the state's economic output and supported 28,110 jobs in the Commonwealth.[19] The economic impact of the aerospace industry in Virginia in 2009 accounted for 1.9% of Virginia's gross

[17] The Economic Impact of Commercial Space Transportation on the U.S. Economy, FAA 2010, page 2

[18] The Economic Impact of Commercial Space Transportation on the U.S. Economy, FAA 2010, page 2

[19] "Competitive Analysis of Virginia's Space Industry," December 2011 (accessed September 14, 2012), Virginia Department of Transportation, page 3, http://www.transportation.virginia.gov/docs/SpaceCompAnalysis.pdf

state product and industry jobs accounted for 0.8% of Virginia's total employment, suggesting that the aerospace industry is more productive than the average industry in Virginia.[20] Furthermore, the aerospace industry in the Commonwealth had a direct economic impact of $4.3 billion in annual output and 9,029 jobs in 2009.[21]

Wages for aerospace workers are much higher than the state's average due to the advanced products and services provided and the required skill set to work in the industry. The average income in Virginia in 2009 was $48,334, while the average income in Virginia's aerospace industry was $99,385, over double the average for the state.[22] Wages in the aerospace industry have also been growing at a faster pace than the state average. From 2000 to 2009, growth in wages for the aerospace industry was 6.0%, while the state's overall wage growth was 3.6%.[23] Due to higher wages, the industry supports 2.11 additional jobs elsewhere in the Virginia economy which is higher than Virginia's industry average of 0.71 jobs. This suggests that every aerospace job in Virginia supports 1.4 more jobs than the average for all other Virginia industries.[24] The state also collects significant tax revenues associated with the aerospace industry. In 2009, Virginia collected an estimated $57.5 million in tax revenue that is made up of $44.9 million of personal income taxes and $12.7 million in corporate income taxes from the industry.[25]

While this data measures the impact of the aerospace industry as a whole, but not necessarily the exact impact of the CST&EI segment of the aerospace industry, it does provide an overall idea of how large the market for aerospace and related industries are in the Commonwealth.

3.2.3 Orbital Sciences Corporation's Contribution to CST&EI Segment

Orbital is among the 10 largest U.S. space system and launch vehicle manufacturers and has been headquartered in Virginia since 1983. The company has provided over 1,000 rockets, launch vehicles, and satellites built or under contract.[26] The 2012 revenues are projected to rise 12% to $1.5 billion,[27] compared to 2011 revenues of $1.34 billion.[28] The company's launch vehicles, satellites and space systems business sectors accounted for $483 million (36%), $554 million (41%), and $434 million (23%) in revenue respectively during 2011.[29] The company has exhibited steady growth in recent years and successfully completed launches of eight sounding rockets and deliveries of seven satellites and launch vehicles for future missions.[30] Orbital's economic impact to Virginia has and continues to be substantial:[31]

[20] Virginia Department of Aviation, Virginia's Aerospace Industry, An Economic Impact Analysis, November 2010, Revised Edition January 2011, page 3

[21] Virginia Department of Aviation, Virginia's Aerospace Industry, An Economic Impact Analysis, November 2010, Revised Edition January 2011, page 2

[22] Virginia Department of Aviation, Virginia's Aerospace Industry, An Economic Impact Analysis, November 2010, Revised Edition January 2011, page 11

[23] Virginia Department of Aviation, Virginia's Aerospace Industry, An Economic Impact Analysis, November 2010, Revised Edition January 2011, page 11

[24] Virginia Department of Aviation, Virginia's Aerospace Industry, An Economic Impact Analysis, November 2010, Revised Edition January 2011, page 12

[25] Virginia Department of Aviation, Virginia's Aerospace Industry, An Economic Impact Analysis, November 2010, Revised Edition January 2011, page 14

[26] Orbital's Economic Impact in Virginia, An Orbital Space Sciences Document

[27] Orbital's Economic Impact in Virginia, An Orbital Space Sciences Document

[28]Orbital Sciences Corporation, 2011 Annual Report

[29] Orbital Sciences Corporation, 2011 Annual Report

[30] Orbital Sciences Corporation Press Release, Orbital First Quarter 2012 Financial Results, April 20, 2012

[31] Orbital's Economic Impact in Virginia, An Orbital Space Sciences Document

- Orbital has expanded its Virginia-based employment from six to over 1,800 people in recent years.
- Orbital estimated that the company will contribute over $18 billion to the Commonwealth's gross state product (GDP) for the 10 year period from 2006 to 2015 and $261 million of potential tax revenue.
- The company also estimates this activity should create over 1,000 direct jobs and 2.6 additional jobs for every Orbital job created.

Orbital is currently in the process of readying its Antares space system for providing a broad range of launch services. Orbital has estimated that its Antares program could have overall economic activity (i.e. value of all goods and services) of $4.25 billion in incremental gross state product over 15 years. Using Orbital's forecasts, the impact of the Antares class of launch vehicle could contribute over $200 million in new capital investment, approximately 1,300 jobs, and total tax revenue growth to Virginia of $64 million over a 15 year period.[32] The anchor tenant for Antares is the Commercial Resupply Services contract with NASA. These missions, which will be launched from MARS, are planned through the end of 2016. There are other launch opportunities for Orbital's Antares rocket:

- Antares has successfully "on ramped" onto the NASA Launch Services II (NLS II) contract and will start to have science missions assigned as the science launch requirements are identified. All NASA science satellite launch needs are generally covered by the NLS II contract. NLS is an Indefinite Delivery, Indefinite Quantity (IDIQ) contract type, meaning that actual missions are defined later as the NASA launch needs are identified. NASA generally buys launches in a "just in time" fashion and is expected to have other needs for a medium class launch vehicle.
- The U.S. Air Force has a defined need for medium launch vehicles, and, in past years, much of the original GPS constellation was launched by a medium class launch vehicle. The procurement strategy for this class of launcher is the OSP-3 procurement, currently in the selection process. Like the NLS contract, the Air Force OSP-3 contract is planned to be an IDIQ procurement type. Missions in the Antares class are identified, but the actual go-ahead of any missions will occur after the base OSP-3 award is made. Orbital bid both Antares and Minotaur for various mission classes. Both launch vehicles are compatible with MARS and the NASA Wallops Flight Facility Range system.
- Antares could also capture pure commercial launches. European and U.S. satellite builders have satellites in development supporting the national defense objectives of other countries that will likely launch on non-Russian, non-Chinese launchers. Antares, Vega (newly built European launch vehicle), Falcon 9, and Athena will be the likely competitors for that pool of spacecraft. Any of these missions flown on Antares would likely be launched from MARS.

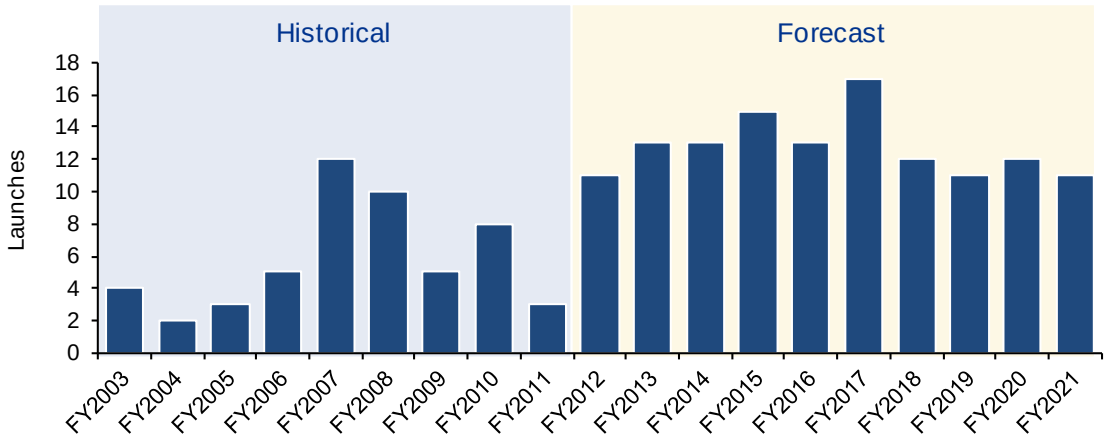
3.2.4 Non-Geosynchronous (NGSO) Launch Forecasts

The market for NGSO (launches that serve low earth orbit, medium earth orbit, elliptical orbits, and external orbits beyond earth) launches over the period from 2012 to 2021 are projected to serve an average of 13 launches per year. Approximately 50% of the launches projected during the next 10 years are expected to be medium to heavy lift NASA cargo and crew transportation missions to the ISS. Science and engineering launches are projected to comprise 26% of the market, while demand for telecommunications launches, 11% of launches, is expected to stay strong through 2017 and drop off for the following years.[33] Compared with the previous nine years (2003 to 2011), launch demand is projected to increase for NGSO launches as demonstrated by the figure below.

[32] CBRE Economic Incentives Group, IMPLAN Economic Impact Analysis, Sept 29, 2011.

[33] 2012 FAA Commercial Space Transportation Forecasts

Figure 2. Global Historical and Forecast NGSO Launches, 2003 to 2021



Source: 2012 FAA Commercial Space Transportation Forecasts

Figure 2, above, shows globally the historical and FAA forecast for all NGSO commercial space launches from 2003 to 2021.

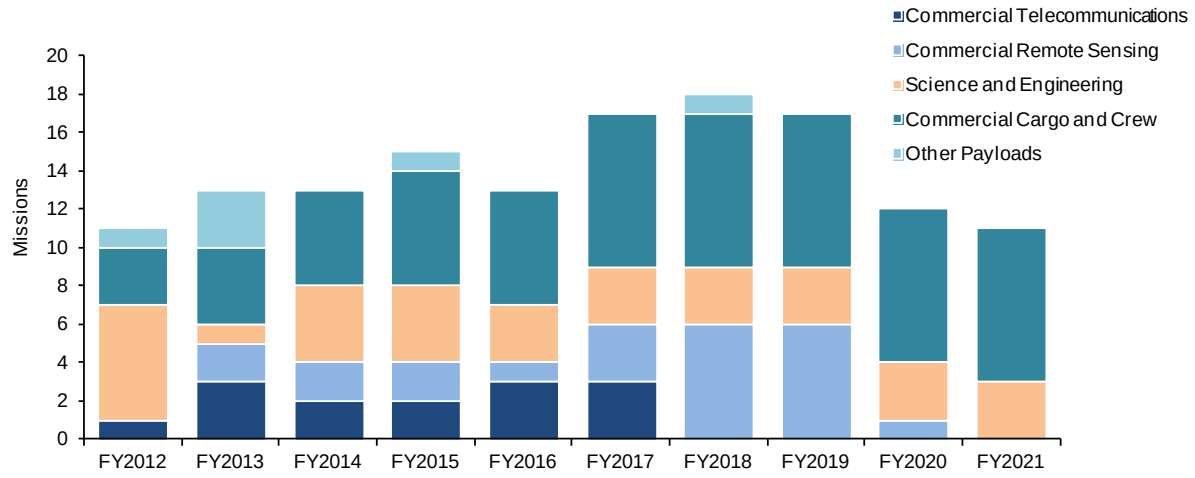
The various segments of the NGSO market that will influence the number of NGSO launches over the next 10 years include the following:[34]

- Commercial Telecommunications: One to three small to medium size launches are projected to occur each year through 2017, with no launches projected to occur from 2018 to 2021.
- Commercial Remote Sensing Satellites: Government agencies are often the largest commercial remote sensing satellite customers, and their support is a major factor in the demand for these systems. Commercial remote sensing satellite launches are projected at an average of one launch per year through 2021.
- Science and Engineering: The market for science and engineering launches is expected to produce 33 launches from 2012 to 2021, including 11 manifested payloads for basic and applied research launches and four space technology test and demonstration launches through 2015. Eighteen more launches are projected for 2016 to 2021 for an average of three launches per year.
- Commercial Cargo and Crew Transportation Services: This market is covered in the next section (Section 2.2.5) as it deals directly with NASA.

The figure below shows the projected launches over the period from 2012 to 2021, broken down by market segment.

[34] 2012 FAA Commercial Space Transportation Forecasts

Figure 3. Forecast Global NGSO Launches by Market Segment, 2012 to 2021



Source: 2012 FAA Commercial Space Transportation Forecasts

Figure 3, above, shows the FAA global forecast for all NGSO commercial space launches from 2012 to 2021. This figure shows the same number of forecasted launches as Figure 2, broken out by market segment.

3.2.5 National Aeronautics and Space Administration (NASA)

NASA has historically had a strong relationship with the VCSFA, as NASA owns Wallops Flight Facility and coordinates with the Authority for launches out of MARS. NASA's annual funding is likely to be around $17.7 billion[35] for the next several years, with a significant portion of that focused on fully implementing and servicing the ISS. Much of NASA's efforts will be focused on supporting the development of a heavy lift rocket and crew capsule by partnering with the U.S. commercial space industry to leverage the efficiencies of the private sector. NASA's timeline for launching a heavy lift rocket and crew capsule includes a test flight as early as 2017 and a crewed flight as early as 2021. Between 2012 and 2021, the Administration intends to find new ways to ship to and service the ISS that would likely include the use of mid-size rockets, the market that VCSFA currently services. This provides significant opportunities for MARS to service re-supply launches to the ISS.

NASA facility at Wallops
Source: VCSFA

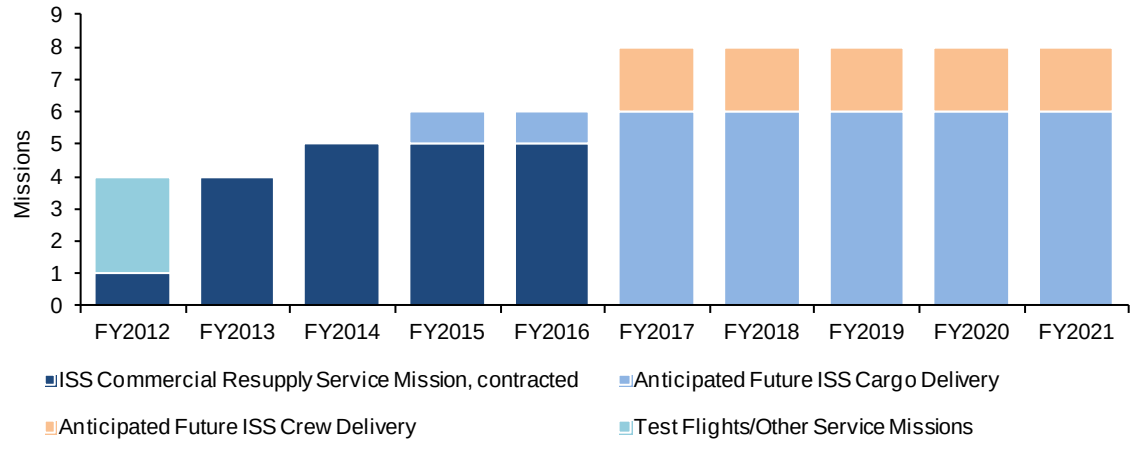
A total of 64 launches for commercial cargo and crew services to the ISS are projected to launch between 2012 and 2021, which is projected to be 50% of total commercial launches through 2021.36

[35] NASA FY 2013 Budget Request

[36] 2012 FAA Commercial Space Transportation Forecasts

For FY2013, NASA has four contracted commercial resupply service missions scheduled to launch to the ISS between commercial space companies Space Exploration Technologies (SpaceX) and VCSFA's customer, Orbital Sciences Corporation. NASA's contracted cargo resupply service missions to the ISS increase in 2014 through 2016 to five missions, and it is anticipated that one more resupply mission will be launched in 2015 and 2016. Forecasted launches in 2017 and beyond have yet to be contracted. This presents an opportunity for VCSFA to secure two to three mid-size resupply missions per year. The figure below shows the contracted and anticipated NASA ISS resupply service missions through 2021.

Figure 4. Forecast NASA Demand for Commercial Cargo and Crew Missions to the ISS, from 2012 to 2021



Source: 2012 FAA Commercial Space Transportation Forecasts

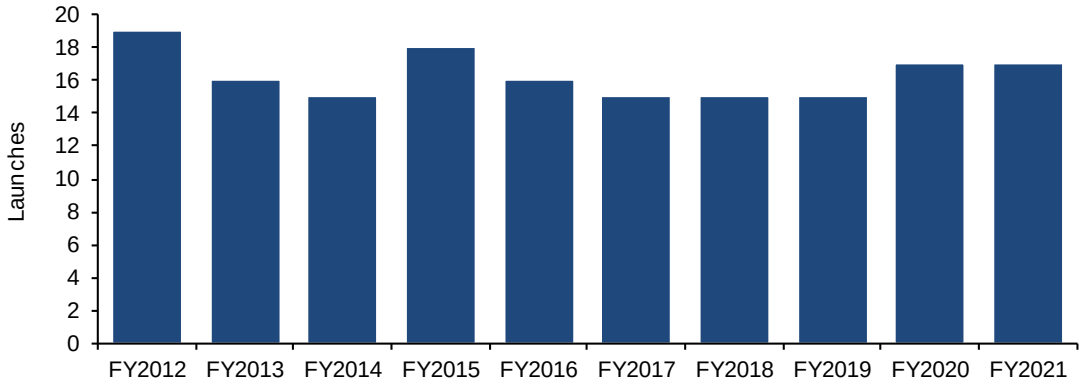
Figure 4, above, shows NASA's current plans for commercial cargo and crew services to the ISS. The launches in this section may carry significant financial and technical risk because many of the launches are on new launch vehicles or new spacecraft that are being developed with NASA-appropriated funds.

In September 2012, VCSFA and Orbital Sciences Corporation reached a new agreement on MARS. As part of this agreement, Orbital will launch 10 Antares missions from MARS, including one test flight, one demonstration flight, and eight resupply missions to the ISS through 2016. Commercial crew launches are expected to begin between 2017 and 2021, to the extent these are launched from heavy lift pads, VCSFA – as currently configured – may not be able to compete with other spaceports.

3.2.6 Geosynchronous (GEO) Launch Forecast

The market for GEO launches is expected to remain stable through 2021 at approximately 16 launches per year. Of these, medium-lift launches are expected to account for over half of all GEO launches, while heavy-lift launches are expected to account for 43% and small-lift launches for under 5%. The figure below provides a summary for the number of GEO satellites forecasted launches for 2012 – 2021.

Figure 5. Forecast Global Commercial GEO Launches, 2012 to 2021



Source: 2012 FAA Commercial Space Transportation Forecasts

Figure 5, above, presents the global FAA forecast for GEO launches for years 2012 to 2021.

Satellites will increasingly play a larger role in the global economy as enterprise and consumer demand continues to increase. The major market segments that will influence the number of GEO satellite launches over the next several years include the following:

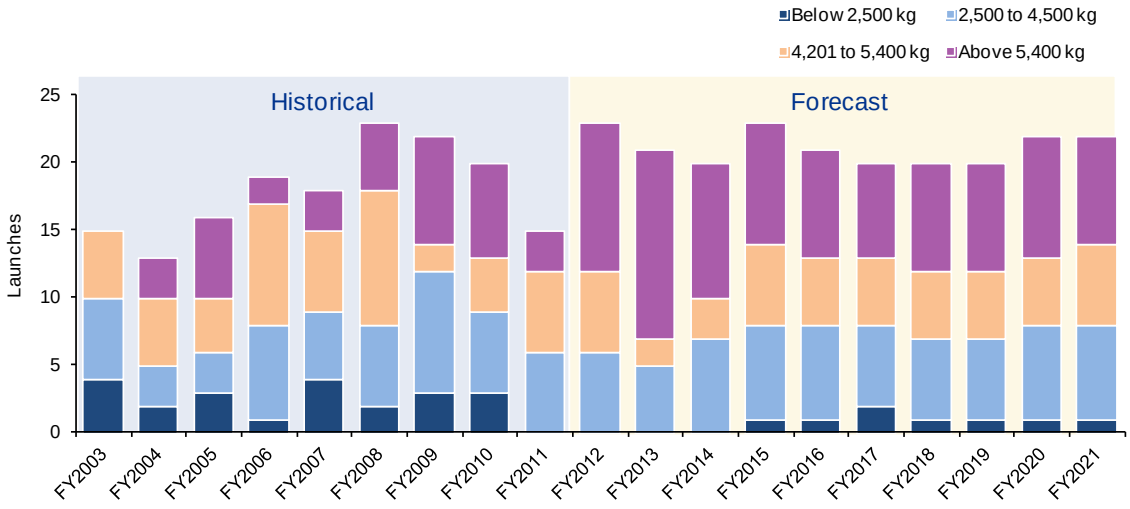
- Fixed Satellite Services (FSS): This market, which includes high definition television (HDTV) services, internet connectivity, and very small aperture terminal satellites (VSATs), is expected to perform well with new demand for larger replacement spacecraft. U.S. DOD may also have demand for these services as well.
- Direct Broadcasting Services (DBS): The DBS market has slowed somewhat with the lagging U.S. economy, yet commercial companies are still expected to launch several satellites in the next few years depending on demand for HDTV services.
- Broadband Services: The broadband market continues to spread globally, and launches are expected in the next several years in order to support these services. Government backed initiatives will also help drive the market to help provide broadband and other internet services.

Rocket liftoff at Wallops
Source: VCSFA

- Hosted Payloads: There also exists a market to serve hosted payload (small, less expensive payloads that are not cost justified for an entire mission), including experimental payloads, technology demonstrations, scientific missions, remote sensing, weather and climate monitoring, and national security missions. This market may provide for increased revenue opportunities when it is efficient to pair them with other satellites being launched.

Figure 6 displays the historical and projected number of satellite launches from 2003 to 2021. MARS has the infrastructure and capacity to serve between six to eight heavy medium to small heavy classes of launch vehicles when the required orbit is within MARS capability to achieve from a cost and schedule standpoint. The projections below show that there is an opportunity for MARS to increase the number of launches in the near-future.

Figure 6. Historical and Forecast Satellite Launches by Mass, 2003 to 2021



Source: 2012 FAA Commercial Space Transportation Forecasts

3.3 Social Considerations

Interest in space continues to capture the imagination of the public. As a major stakeholder, the public plays a role as a driver and beneficiary of commercial space development. There are several significant social factors associated with commercial space industry, including basic and applied research, education, and the rapidly approaching reality of space tourism. By conducting research and experiments, we are able to develop a greater scientific understanding of the benefits that space has to offer.

Maintaining a positive link between society and space exploration is key to the space industry's development from a demand perspective and is crucial to understanding market drivers. Space research and education has the potential for improving human lives, and space tourism will allow citizens to expand knowledge while gaining access to space.

3.3.1 Basic and Applied Research

Basic and applied research has been an important part of space exploration since humans first began traveling to earth's upper atmospheres and beyond. Space related research is grouped into four categories: earth science, space science, human research, and biological and physical research. Stakeholders hope that space research will provide new information that will improve human living conditions.

Research missions are largely driven by government and industry needs, and as mentioned above in Section 2.2.4, the projected demand for these types of missions is approximately 33 missions over the 10 year period from 2012 to 2021. Of these missions, 11 are projected for 2012 to 2015.

3.3.2 Education

Academic and educational sectors have shown a strong interest in researching and exploring space to strengthen knowledge and education on space exploration and application. Space based research is primarily concerned with Science, Technology, Engineering, and Mathematics (STEM) education for universities and schools to increase access and awareness of space. The market for education backed launches is wide and includes university built payloads ranging from small size experiments to CubeSat projects (10 cm cube) with costs ranging from $500 to $300,000.[37] NASA began the CubeSat Launch Initiative in 2010 to encourage U.S. non-profits and educational institutions to build CubeSats for launch in actual missions. As most academic space projects are small, they will accompany other launches when capacity is available and may provide opportunities to increase revenue by filling excess capacity on launches.

CubeSat
Source: NASA

Education will also take on an increasingly large role as more specialized training occurs to meet workforce demands. The commercial space market requires some of the most highly trained engineers and rocket scientists, and the universities in and around Virginia will benefit from the increased demand for these specialists.

3.3.3 Commercial Space Flight and Space Tourism as a Developing Market

Virgin Galactic Spaceship
Source: Virgin Galactic

Until recently, the prospect of a private citizen entering space has been limited at most. However, evidenced by the development of commercial space ventures such as Richard Branson's Virgin Galactic, the possibility of a private citizen going to space appears promising. As the space tourism market is in the early stages, it is difficult to forecast the actual demand for launches that will take place once the market becomes more commonplace.

Over the next several years VCSFA plans to actively monitor the market for human space tourism and assess its viability at MARS. Market dynamics and feasibility research will need to be assessed and completed, and significant planning and commitment would be required before VCSFA is capable of supporting space tourism.

3.4 Technological Factors

Technology changes at a rapid pace, and it is likely that new launch vehicle options will influence the dynamics of the launch industry. It will be important for VCSFA to update its technology to meet changing requirements for supporting launch customers and potential new business relationships in order to be the leading spaceport in the U.S. Spaceports across the nation have continued to bring their facilities up to the latest standards and readiness for commercial flight.

[37] 2012 Suborbital Reusable Vehicles: A 10-Year Forecast of Market Demand

Investment in technology and research is crucial to the advancement of the aerospace industry and is one of the key challenges within the industry. Reducing the costs associated with space flight, such as payload per kilo or passenger, through improved technology will help to attract more business to MARS and to develop a more sustainable commercial space industry in Virginia. Identifying the appropriate mix of technological advancement to match the development of the commercial space industry and recognizing those aspects of investment required in advance will help position VCSFA as the top spaceport in the country.

At Wallops in 2012, a large inflatable heat shield developed by NASA's Space Technology Program was successfully launched through the earth's atmosphere while travelling at speeds up to 7,600 mph. Strides such as this demonstrate rapid advancement towards the required safety standards and technological advancement required for commercial space flight development.

There are technical uncertainties that could have an effect on launches depending on factors such as satellite lifespan and demand for new and replacement satellites. Other factors that may affect the number of launches per year include launch vehicle issues, manufacturing delays and satellite technical issues.

3.5 Environmental Factors

Environmental safety is a concern that must be handled as a priority because of the harmful effects chemicals and waste can have on surrounding areas and the potential for negative perception of the space program. While most of the environmental damages caused by space launches occurred decades ago, the environmental impacts of launching rockets today can be harmful if launches and containment efforts are not carefully monitored. The VCSFA makes it a priority to follow federal and state regulations when launching spacecrafts and disposing of chemicals and waste. The Authority also continues to make it a priority to work with the Environmental Protection Agency (EPA) and other agencies to reduce the negative affects space launches.

Picture of Earth taken from NASA Terra satellite
Source: NASA

Space launches can also have significant benefits for the environment. Satellites provide vivid imagery and data that improves safety, agriculture, energy and oil exploration, forestation, pollution management and weather observations. This can improve data sharing and responsiveness to emergencies and natural disasters.

3.6 Legal Issues and Incentives

3.6.1 Federal Legislation

The Office of Commercial Space Transportation (AST) is tasked with regulating the U.S. commercial space transportation industry, ensuring compliance with international obligations of the United States, and protecting public health and safety. The AST is also responsible for recommending appropriate changes in Federal statutes, treaties, regulations, policies, plans, and procedures. All activities that VCSFA conducts will largely be governed by the FAA and AST. Several key documents governing the development and safe operation of launch vehicles in the U.S., among others, include:

- Commercial Space Launch Act (2011)
- National Space Policy (2010)
- Commercial Space Launch Amendments Act of 2004

As commercial space flight continues to evolve and as space tourism advances, VCSFA will remain current and compliant with new regulations and requirements by continuing to track changes in legislation, license requirements, and safety standards. This will help to attract private sector investment to MARS.

There are several regulatory acts aimed at promoting the safety and well-being of the public, and VCSFA fully supports compliance with this legislation. One such act is the Export Administration Act which is aimed at protecting U.S. national security by restricting exports to foreign countries as deemed necessary. When launch missions involve foreign companies or countries, VCSFA must take precaution to follow laws such as this that provide for the protection of U.S. security. As some regulations may extend the launch timeline, the Authority must factor in the extent to which such laws may delay obtaining necessary licensing for commercial space flight operations, from both a VCSFA perspective and from the perspective of its potential customers.

TacSat Launch at Wallops
Source: VCSFA

3.6.2 State Legislation and Incentives

Financial incentives are a common tool states use to encourage commercial space transportation companies to locate within their borders. Virginia is one the most progressive states in the nation in promoting innovative actions to provide incentives for space transportation companies to locate within its borders. Two laws passed by the state in 2007 and 2008 were aimed at boosting space industry presence in the Commonwealth:

- Virginia Space Liability and Immunity Act (2007) – This law addressed the challenges that existing tort law posed to emerging human space flight transportation companies. This law limits the liability of companies providing space flight services in the event of an accident, and requires participants to review and consent to the inherently risky nature of human space flight. The law puts VCSFA at a strong competitive advantage for attracting human space flight companies in the coming years as these companies begin more regular operations.
- The Zero G Zero Tax Act (2008) – This law provides an exemption from state income taxes to any space transportation company doing business in Virginia with the intent to either launch payloads from MARS or conduct space flight training. Virginia was the first state to pass such a tax exemption law for space launch companies.
- Foreign Trade Zone – MARS facilities are located within a foreign trade zone as designated by the Commonwealth. This allows space companies to be exempt from import duties when importing equipment for the purposes of launching. Additionally, the Commonwealth offers other non-space specific incentives (e.g., GOF, manufacturing tax credits, major jobs facility tax credit, etc.) that can be used to help attract new customers.

Generally, the customer's goal and requirements for sub-orbital or orbital placement of the mission payload will determine the appropriate launch site(s). To the extent there is a choice of launch sites, Virginia laws provide commercial space companies incentive to strongly consider MARS.

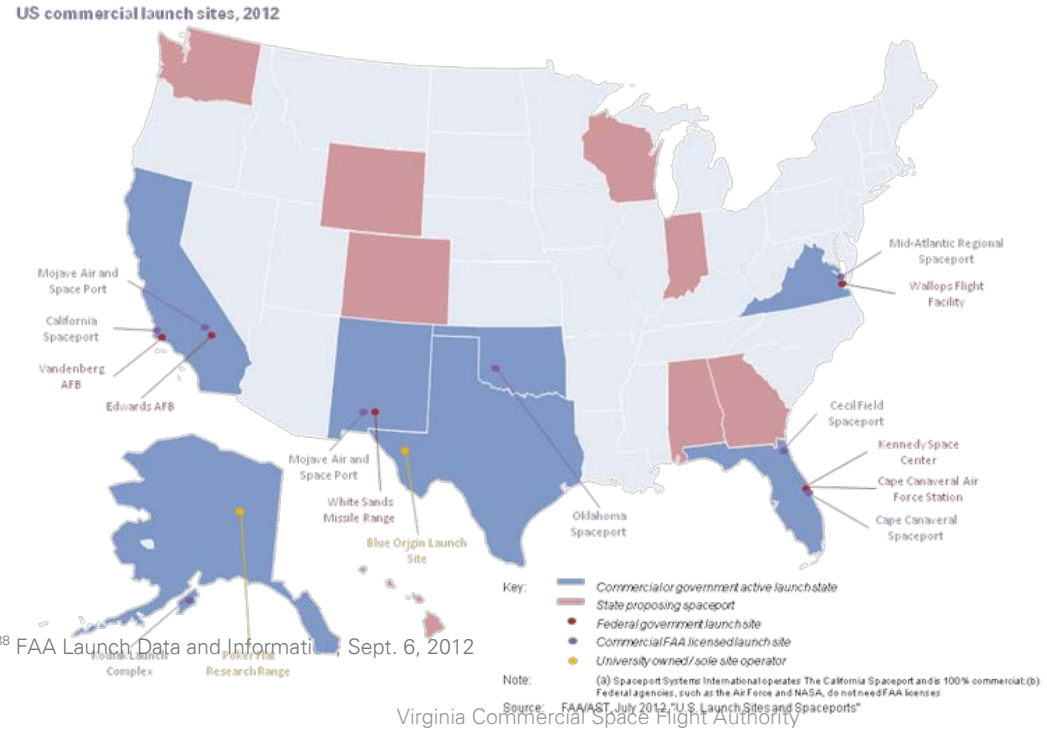
4. Competitive Positioning

The VCSFA is committed to providing responsive and cost effective launch services. That commitment will serve to meet the demand from commercial, government, and educational space operators for reliable, mission capable access to space. At the same time, the Authority will continue to assess the potential for growth and expansion into other markets. Virginia also has a strong presence in the field of space research and development and intelligence related operations, and the state is home to the National Reconnaissance Office (NRO) which manages national intelligence space programs. The Commonwealth receives a significant amount of federal funding dedicated to those operations.

4.1 U.S. Spaceports/Competitors

There are currently eight FAA licensed commercial launch site operators in six U.S. states: Virginia, California, Florida, Oklahoma, New Mexico, and Alaska.[38] Each of these states, with the exception of California, have state-owned space authorities responsible for facilitating commercial space activity. Of the eight licensed operators, only Virginia, California, Florida, and Alaska have spaceports that are currently equipped with infrastructure to launch small and medium lift launches for sub-orbital or orbital slots, and these four are currently the main competitors in the U.S. commercial space launch market. Several U.S. federal government launch facilities serve as launch pads for commercial vehicles, and commercial launch activities at these facilities are typically coordinated and planned through the operating state authority or commercial operator near that site. The figure below shows a map of U.S. spaceports and federal launch sites.

Figure 7. U.S. Spaceports and Federal Launch Sites



[38] FAA Launch Data and Information, Sept. 6, 2012

4.1.1 Florida

Florida has long been seen as the epicentre of civil space activity as NASA's largest flight facility is located at Kennedy Space Center in Cape Canaveral. There are three organizations located at Cape Canaveral: Cape Canaveral Air Force Station, NASA Kennedy Space Center, and state-owned Space Florida. All organizations share land, assets, and resources for launching space vehicles and have capacity to launch small, medium, and heavy lift vehicles. All commercial launches operate out of Cape Canaveral, while the Kennedy Space Center serves only NASA-related missions. Space Florida was created to "be the world leader in developing tomorrow's aerospace enterprise"[39] and it partners closely with NASA to invest in Florida's space program.

Cecil Field Spaceport (CFS) located near Jacksonville has small operations for suborbital launches, but does not appear to have the resources of MARS as of yet. CFS recently obtained "Space Territory" status from the Florida Space Authority, and it may be a future competitor to MARS in the suborbital reusable vehicle market.

Florida, with its historical ties to NASA and U.S. manned space program is one of the strongest space states in the country, and it appears it will continue to serve as one of the nation's premier launch facilities for space launches.

4.1.2 California

The California spaceport is operated at Vandenberg Air Force Base and is operated by Spaceport Systems International, a fully commercial space launch operator. As such, Vandenberg's "Space Launch Complex 8" operates free of federal or state taxpayer funds and is the only launch site in the U.S. to operate 100% commercially. The site has capability to launch small, medium, and heavy lift payloads to several launch azimuths.

California is a leader in the U.S. space industry and has strong support from the DOD for launching satellites, as well as a significant NASA presence. California's location, launch facilities, and relationships with the space industry position it to be a very competitive spaceport on the west coast and in the U.S.

4.1.3 Alaska

The Alaska Aerospace Corporation (AAC) operates out of the Kodiak Launch Complex (KLC) and is most commonly used for U.S. military and defense missions. KLC currently has capacity to launch small lift launch vehicles to polar orbit, and they have demonstrated interest in expanding to accommodate launches for medium lift launch vehicles. The KLC is the "nation's only high latitude service spaceport, and the only U.S. facility that can launch high inclination missions without land over-flight and the requirement to resort to energy consuming dogleg flight segments."[40] The AAC is a promising space agency, but it does not appear to be a significant competitor to VCSFA, as the two authorities focus on different launch azimuths.

4.2 Market Differentiation

There are several important aspects to consider when evaluating launch facilities. Critical factors in determining an optimal launch location include existing infrastructure, supported payload size, and geographic location for orbital access. Key selection criteria for spaceports include launch schedule, support and service, perceived capability and recognition, and cost. Other factors to consider when

[39] Space Florida, www.spaceflorida.gov, September 2012

[40] Alaska Aerospace Corporation, "Kodiak Launch Complex Overview," www.akaerospace.com/klc_overview.html, September 2012

evaluating Virginia's market differentiation include available workforce and the Authority's proximity relative to space industry suppliers and customers.

4.2.1 Virginia's competitive landscape

- **Virginia's Launch Capabilities**

Virginia is ideally situated to supply the ISS and other similar orbit inclinations while it primarily serves the small to medium lift of the Low Earth Orbit (LEO) and Geosynchronous Orbit (GEO) market. Small and medium lift launches can currently be launched out of Virginia, California, and Florida, and Alaska is pursuing expansion into this market. Heavy lift launches are typically launched out of Cape Canaveral, Florida and Vandenberg, California.

Each of the above mentioned spaceports have capabilities and characteristics that position each to serve unique markets. Florida's Cape Canaveral is well established and serves the majority of the heavy lift launch market activity with its strong ties to NASA through the Space Shuttle program. It is also ideally situated for the GEO market. California's Vandenberg facility is ideally situated for polar orbits for small to heavy lift launches. Alaska's Kodiak Launch Complex is well positioned to offer easy access to polar orbits for small to medium launches.

While the above facilities offer a similar service as VCSFA, MARS is ideal for providing access for small to medium size launches on the east coast to LEO. MARS can serve a wide array of launch vehicle trajectories, and it offers the shortest route for ISS resupply missions. Because the spaceport offers closer and easier access to the ISS than most other spaceports, it allows for cheaper costs for resupply and other missions to the station and similar orbits. This makes it an attractive spaceport for commercial space companies.

Tables 1 and 2 below show commercial launch capability by payload size and orbital access for the common US launch vehicles at the four competitive U.S., spaceports. Examples and commentary on spaceport and launch vehicle orbital access are included.

Table 1. Commercial Launch Capability by Payload Size

Payload size (without regard to orbital access)					
	Launch vehicles	**VA**	**AK**	**CA**	**FL**
Small lift	▪ Minotaur IV, Athena, Taurus I	●	●	●	●
Medium lift	▪ Delta II, Taurus II, and Falcon 9, Antares	◔	◔	●	●
Heavy lift	▪ Delta IV and Atlas V EELV rockets, space shuttles ▪ Although heavy-lift rocket providers are mature programs with established infrastructure and supply chains, spaceports seem less interested in competing in this segment, which typically serves civil & military customers.	○	○	●	●

Key: ◔ service is of interest and could be provided pending further investment; ● service currently available; ◑ service to offer capability is under construction and pending completion; ○ currently no plan to offer this service exists; ◑ investment and interest to develop this capability are planned and pending construction

Notes: (a) Spaceport usage is typically determined by launch slot required
(b) State evaluations of payload size do not take into account orbital access capabilities and vice versa

Table 2. Commercial Launch Capabilities by Orbital Access

Orbital access (without regard on payload size)					
	Commentary	VA	AK	CA	FL
Suborbital	■ Common suborbital launches include sounding rockets and target missile tests. ■ However, current tests are underway to serve space tourism as well.	●	●	●	●
Polar	■ Many military launches are designated for polar orbit. ■ Geographic limitations severely restrict FL and VA access to polar orbits.	○	●	●	○
GEO	■ Both commercial and government missions utilize GEO. ■ Florida's geographic location provides more economic access to GEO.	●	◔	◑	●
LEO	■ Mission can be operated out of all four states.	●	●	◔	●

Key: ○ currently no plan to offer this service exists; ◔ service is of interest and could be provided pending further investment; ◑ investment and interest to develop this capability are planned and pending construction; ◕ service to offer capability is under construction and pending completion; ● service currently available

Notes: (a) State evaluations of payload size do not take into account orbital access capabilities and vice versa; (b) GEO includes MEO for the purposes of this evaluation.

Furthermore, Virginia and Florida are the only states to have spaceports with customers (Orbital and SpaceX) that have contracted with NASA to launch resupply missions to the ISS.

■ Key selection criteria

Findings from the report on the competitive analysis and review of VCSFA and its competitors show that, other than the customer's physical launch pad requirement and orbital slot requirement, there are a number of criteria considered when selecting a spaceport from which to launch a vehicle. Several of the key selection criteria include launch schedule, support and service, perceived capability, and cost of launch. Table 3, below, compares each of the four competitive U.S. spaceports based on these criteria.

Table 3. State Spaceport Selection Criteria

State spaceport selection criteria						
Criteria	**Commentary**	**VA**	**AK**	**CA**	**FL**	**Findings**
Launch schedule	▪ Sources indicate that an on-time launch is first and foremost reliant on weather. ▪ However, types of missions are also important factors affecting launch schedules; missions associated with federal agencies such as the Air Force generally take priority over commercial and university launches.					▪ Market participants agree that launches operating out of California and Florida are more likely to face scheduling delays due to last-minute federal launches. ▪ Smaller launch sites in Virginia and Alaska seem less likely to experience scheduling setbacks.
Support/ Service	▪ Higher priority missions generally receive appropriate staff support to prepare for launch, leaving commercial providers to wait their turn for already limited resources. ▪ Accordingly, time constraints appear to give smaller facilities such as Virginia a greater advantage.					▪ While quality and level of support and service provided are estimated to be rated almost equally among all four states, Virginia and Alaska staff are suggested to be possibly more available and attentive due to their smaller size and eagerness to strengthen customer rapport.
Perceived capability/ Recognition/ Ease of identification	▪ States with successful track records are perceived to better accommodate commercial launches.					▪ Analysts indicate that California and Florida may be better able to handle launches with greater complexity due to their experience and sophisticated facilities. ▪ Wallops Flight Facility and MARS must demonstrate their ability to successfully launch already planned missions to gain market share
Cost	▪ Market participants agree that while cost is an important factor, in many cases, it is currently not the most important. In order to determine a launch facility, companies must first assess the orbit they need to reach. This first step automatically narrows the pool of spaceports down to one or two US spaceports at most, leaving companies with limited bargaining power. ▪ Analysts also note that most US commercial space activity is primarily contracted by the government, which is suggested to be less price sensitive, or large communication satellite owners under a time constraint. The majority of the expanding commercial satellite market appears to seek international launch sites for cost efficiency purposes. ▪ However, as more states develop launch sites in the US, purchasing power is expected to shift to companies given their larger supply base. If the market follows this trend, active states such as VA will face greater challenges to stay competitive and will need to consider investments allowing them to do so.					

Key: – Minimal – Low – Medium – High – Optimal

Sources: (1) "2011 Commercial Space Transportation Forecasts", FAA, 2011; (2) KPMG interview program, 2011.

- **Other potential competitive factors**

It is expected that many of the military satellites that will need to be launched in the next several years will be small satellites. The Authority currently has launch capabilities to support small to medium size launches such as these, thereby making the market for military satellites a viable market to pursue. The VCSFA also has close proximity to the Pentagon, military operations, the NRO and other federal government agencies in Washington DC, Maryland and Northern Virginia, and it may easily serve NASA, the DOD, and other government agencies in need of launch services.

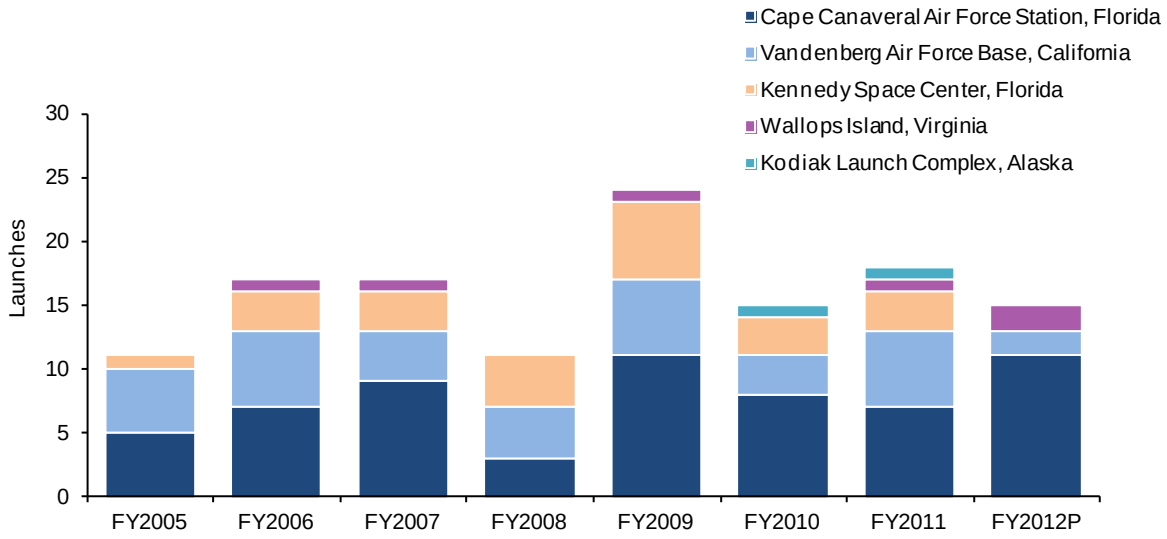
There is also an opportunity to enhance VCSFA's services and market share by making use of its horizontal launch runway for space tourism or other suborbital reusable launch vehicles. The horizontal runway at Wallops could provide for an opportunity to bring the space tourism business to Virginia. Currently, the majority of space tourism operations are based on the West Coast. When the West Coast market for space launch operations matures, launch providers may opt to take advantage of facilities on the East Coast, and VCSFA is well placed to take advantage of that potential opportunity.

4.2.2 Launch activity by facility

From 2005 through 2011, a total of 113 launches operated out of Alaska, California, Florida, and Virginia, and there are 15 scheduled launches through the end of 2012. As demonstrated by the graph below, the launch market has historically been held by Cape Canaveral, FL and Vandenberg Air Force Base, CA, operating over 75% of launches since 2005. While this trend is expected to continue going forward, facilities at Wallops Island and Kodiak are making efforts to further penetrate the market.

Figure 8 below shows completed launches by facility for the period 2005 to 2012.

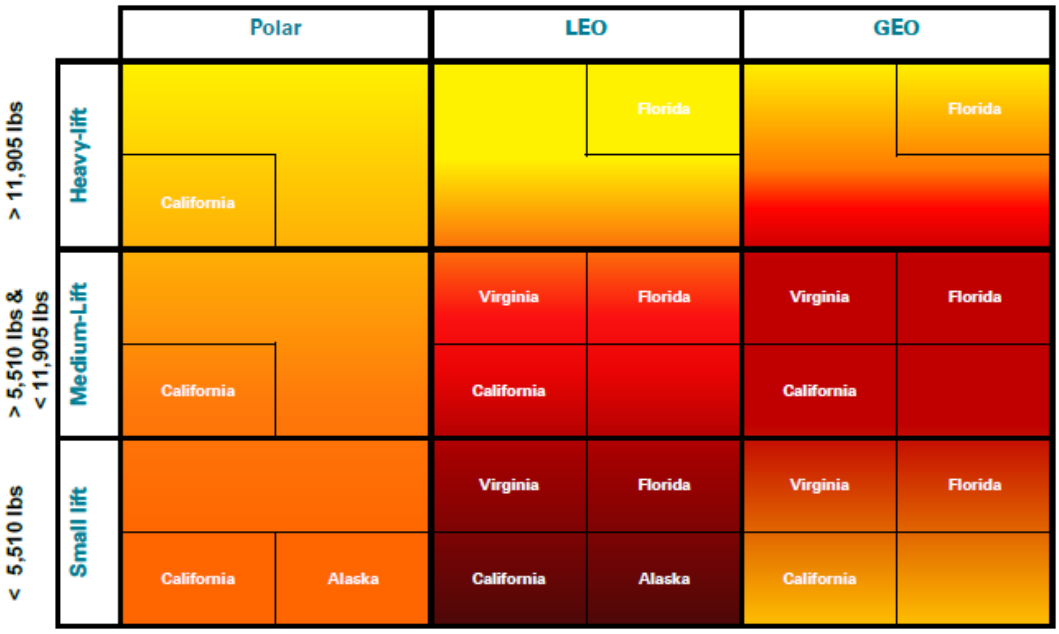
Figure 8. Completed Launches by Facility, 2005 to 2012



Note: (a) 2012 reflects completed launches YTD and upcoming launches for the remainder of the year.
Source: (1) VCSFA "Governance, Organization and Competitive Landscape Review," November 7, 2011
(2) www.spaceflightnow.com, September 14, 2011

Figure 9, the heat map below characterizes commercial space activity by launch type and orbit for Virginia and competitor states Alaska, California and Florida. The color shows the concentration of projected demand for space launches by vehicle class and orbit. The darker the color indicates that the projected demand for small lift missions to LEO is higher as compared with the projected demand for heavy-lift for LEO and GEO. MARS is well positioned to serve its primary market of small and medium lift missions to LEO and GEO.

Figure 9. Commercial Space Activity by Launch Type and Orbit



Source: Space Industry Research for Projected Demand 2011

4.2.3 Launch service providers

The National Space Policy demonstrates the need for a shift in launch operations to the private sector, and as anticipation heightens for commercial opportunities, new and existing commercial launch service providers are developing, demonstrating, and improving their launch capabilities for application to commercial and government markets. There are several global launch service providers that could use MARS as a base of operations in addition to their normal international launch facilities. The U.S. based launch service providers for the VCSFA include:

- Orbital Sciences Corporation[41] – Orbital is a launch service provider and manufacturer of small to medium lift launch vehicles, satellites, and space systems for commercial, government, and military customers. Orbital manufactures satellites and spacecraft for travel to geosynchronous orbit, low earth orbit, and deep space. Orbital's satellites and launch vehicles typically serve the communications and broadcasting industries; perform remote sensing and scientific research; and, are used for national security and defense missions. NASA signed a $1.9 billion contract with Orbital to launch eight ISS resupply missions and two demonstration/test missions out of MARS on its Antares rocket. The first of these missions will be a demonstration mission expected to launch in late 2012 or early 2013. The company has stated that any missions flown on Antares would likely be launched from MARS.
- Space Exploration Technologies (SpaceX)[42] – SpaceX is a developer, manufacturer and launch service provider of small, medium, and heavy lift launch vehicles. SpaceX is focused on building reusable launch vehicles to reduce the cost of space flight. SpaceX is the first private company to complete a successful resupply mission to the ISS when it launched its Dragon spacecraft. The spacecraft attached to the ISS and returned to Earth to be used again in future resupply and human cargo missions. The mission was launched out of Space Florida's facilities at Cape Canaveral, and the contract with NASA is for a minimum of 12 missions.
- United Launch Alliance (ULA)[43] – ULA is a joint venture between Lockheed Martin and Boeing that specializes in manufacturing small, medium, and heavy lift launch vehicles and providing launch services for the U.S. government. Among the payloads ULA has launched are weather, telecommunications, and national security satellites as well as deep space exploration missions. The company is based in Denver, Colorado and has launch operations at Cape Canaveral, FL and Vandenberg, CA and claims to employ more rocket scientists than any other company in the world.
- Virgin Galactic – Appears to be focused on the sub-orbital space tourism business. However, they are planning to expand into launch vehicles in the future.
- Athena-Joint venture between Lockheed Martin and ATK for small and medium launch vehicles.
- Other industry participants – There are several other space industry participants that will have substantial decision making authorities in determining future launch sites for their missions. The focus of each company varies and includes satellites and space systems, resupply missions, suborbital reusable vehicles, orbiting laboratories, crew transportation, and more for civil, military, and commercial clients. Although new companies are springing up all the time, examples of these companies include:
  - Armadillo Aerospace
  - BAE Systems
  - Bigelow Aerospace
  - Boeing

[41] *Orbital Sciences Corporation, www.orbital.com*

[42] *Space Exploration Technologies, www.spacex.com*

[43] *United Launch Alliance, www.ulalaunch.com*

- Blue Origin
- Masten Space Systems
- Sierra Nevada

4.2.4 Education and research

Wallops Flight Facility was initially established as an aeronautics research facility; however, it presently serves as NASA's primary suborbital research facility. Virginia is fortunate to have several of the nation's top-ranked research institutions and universities that have aerospace engineering programs. Because of Virginia's relationships with education and research organizations such as NASA's Langley Research Center in Hampton, VA, Virginia Tech, University of Virginia, and Old Dominion University, Wallops has been a lead launch facility for suborbital scientific research missions.

NASA Langley is one of the oldest field research facilities and provides many of the necessary research and supporting technologies that NASA uses in space flight missions. Langley is an important part of the nation's space program, and through the Langley Innovative Partnership Program, the facility strengthens relationships throughout the space industry by applying lab based research to real-life situations. In 2010, NASA Langley efforts generated a positive economic impact to the Commonwealth of $946.8 million and supported 8,624 jobs. Furthermore, the combined efforts of NASA Langley and Wallops generated $1.2 billion in economic benefits and supported 10,458 jobs.[44]

Together, NASA, Virginia universities and educational agencies, Virginia's Center for Innovative Technology, and other institutions representing diverse aerospace education and research make up the Virginia Space Grant Consortium (VSGC). The VSGC mission is to "coordinate and develop aerospace-related and high technology education and research efforts throughout the Commonwealth."[45] The VSGC provides significant economic and educational benefit to Virginia by "leveraging each dollar of NASA support with more than five dollars of state and other funding" in order to provide a network between Virginia research institutions and universities enrich the space industry and space knowledge throughout the state. Virginia has a strong connection to educational and research based space operations, and will continue to position itself to partner with these valuable organizations.

4.3 SWOT Analysis

Based on the above assessments, a SWOT (strengths, weaknesses, opportunities, and threats) analysis was performed for VCSFA. The findings of this analysis are summarized below.

4.3.1 Strengths

- MARS' geographic location is ideal for launch to orbit and the ISS (orbital inclinations between 38 and 60 degrees).
- MARS' distance from heavily populated areas allows for safe launches and the ability to securely control the environment surrounding the facility.
- The facility is FAA licensed for orbital launches.
- The VCSFA's main customer, Orbital, is one of two

Virginia ranks:

***1st** in the **number of scientist and engineers** as a percentage of the workforce*

***3rd** in **concentration of high-tech jobs** as a percentage of the workforce*

Source: Information technology innovation foundation, Keynote Speech – 15th Annual FAA Commercial Space Transportation Conference

[44] NASA Langley Research Center, "Innovation: Our Legacy, Our Future", http://www.nasa.gov/centers/langley/pdf/513798main_2010LaRC-AnnualReport.pdf (accessed September 14, 2012)

[45] Virginia Space Grant Consortium, www.vsgc.odu.edu, accessed September 14, 2012

commercial companies that has a contract with NASA for ISS resupply missions.

- NASA owns WFF and has a large stake in its success, so the agency has an interest in seeing successful launches take place at the facility.
- Wallops Research Park provides an excellent location and resources for commercial space companies.
- Virginia is a leader in passing state legislation to offer tax and financial incentives to commercial space companies that settle and conduct operations within its borders.
- Virginia has several well known and reputable research and technical universities that work with MARS for educational and research opportunities to benefit MARS customers.
- Space companies are exempt from import duties when importing equipment for the purposes of launching out of Wallops as the facility is designated as foreign trade zone by the Commonwealth.

4.3.2 Weaknesses

- Limited physical space is available to build a large lift launch pad should the Authority want to expand beyond current medium lift launch capability.
- Reliance on NASA contracts may provide for periods of inactivity should NASA prefer a different launch site for certain missions.
- Lack of institutional capacity at Wallops – the Authority is in early stages of building institutional and organizational capabilities.
- Dependence on state funding may make it difficult to expand Wallops operations in the short term.
- Aged infrastructure surrounding the facility reduces ease of access.

4.3.3 Opportunities

- New VCSFA management structure and funding will allow the Authority to improve the infrastructure and technical capabilities to support current customers and attract new customers.
- The shift in the National Space Policy to the private sector may increase future demand and provide VCSFA with new launch opportunities.
- Expansion of Wallops Research Park, positioned close to the launch facility, provides an attractive environment for commercial space companies to conduct operations at MARS.
- New customers and funding would allow the VCSFA to expand its staff and services (e.g. logistical and consulting services).
- NASA's existing 8,750 feet horizontal runway has potential for attracting other types of commercial space flight, specifically space tourism and suborbital vehicles.
- MARS being a multi-user launch facility could attract more business and increase economic benefits to the region.
- An attractive legal framework provides incentives for new commercial space companies to locate their business in Virginia and launch from MARS.
- An apparent emerging market for smaller and less expensive missions for research, experiments, and quick reaction capabilities (e.g. CubeSats) presents a potential opportunity for MARS.
- Consistent with the State Vision, a future site plan should be agreed to with NASA and the surrounding community which will set aside land and resources to accommodate future expansion.
- VCSFA/MARS can become another scientific and technical hub in the Commonwealth where industry, federal government agencies, the Virginia educational system, and the Department of

Transportation (VA) can provide the impetus to move to the next level in the commercialization of space.

4.3.4 Threats

- Delays and setbacks in launch preparation in the past may make it more difficult to attract new customers.
- Finite land area for expansion could hinder VCSFA's ability to build a new launch pad to service other customers.
- The evolving political landscape, U.S. national priorities, and current economic environment could put new pressure on the commercial space industry or reduce its projected growth.
- Current U.S. and global economy may make it difficult to secure financial investment in commercial space launch projects.
- Saturation of the telecommunications market would cause less satellite launch opportunities from that industry.
- Additional competition from other states and/or countries could make VCSFA's job of attracting other commercial space companies to launch from MARS more difficult.

5. Strategic Objectives and Direction

5.1 Summary

The VCSFA has developed strategic objectives which encompass near and long term actions that reflect the priorities expressed by the Governor, the Department of Transportation and the Board of Directors. The VCSFA has developed the following eight strategic objectives and the indicated timeline:

Strategic Objectives Timeline

	2013	2014	2015	2016	2017
Objective 1: Provide a framework for Orbital's success as the "initial launch" customer					
Objective 2: Develop MARS infrastructure to satisfy customer needs and manage the business					
Objective 3: Position VCSFA as a leading launch service provider					
Objective 4: Develop VCSFA as a self sustaining entity					
Objective 5: Develop an efficient and competitive organization					
Objective 6: Establish partnerships to promote research and commercial opportunities					
Objective 7: Explore space tourism and other developing opportunities					
Objective 8: Stimulate economic growth and provide a positive impact to the Commonwealth					

5.2 State Vision

Virginia Governor Bob McDonnell and his Administration consider growing and expanding MARS (from a combination of commercial, civil, scientific, U.S. Government, NASA, and military customers) a strategic priority and are committed to MARS' success. This commitment aligns with Governor McDonnell's priority of creating an environment that attracts highly skilled and high-paying jobs to the Commonwealth and leading the country in STEM educational programs. Governor McDonnell's stated plans to make MARS America's best spaceport include:

- Supporting a substantial increase in base funding for the spaceport operations, and focusing a portion of the funding on a coordinated marketing strategy to attract more commercial space companies to invest in and create jobs in Virginia.

- Creating an aerospace business roundtable to bring experts together to plan for Spaceport development and future projects.
- Aggressively recruiting and growing new and existing aerospace companies.
- Promoting space tourism initiatives.
- Supporting scholarships and investment in aerospace related educational programs and workforce training opportunities.
- Putting "Virginia First" – leading the country in STEM educational programs and ensuring Virginia's workforce is highly skilled in career and technical skills, which the Spaceport relies on.

5.3 Actions to Meet Objectives

In order to meet the Commonwealth's vision for the VCSFA over the next five years, the strategic plan has two phases:

Phase 1 – Tactical: During the first 18 months, VCSFA and its new Board of Directors, will establish a set of business processes and create the necessary workforce to position MARS as an efficient and competitive organization, with the aim of giving potential customers confidence in the ability of VCSFA to provide effective infrastructure and platforms for successful launches in the future.

VCSFA will employ the necessary resources to market MARS' services to potential new customers and develop an understanding of the infrastructure requirements necessary for the future.

Phase 2 – Strategic: 18 months – 5 years: With the necessary organizational framework and team for success in place, VCSFA will develop partnerships with educational institutions, improve existing launch capability and work with new and existing customers to develop Wallops launch capability and assess potential areas for investment. The VCSFA will assess the market for growth areas and act quickly, under a more efficient structure, to take advantage of these opportunities.

The proposed objectives and key actions of this plan are described in detail below.

Objective 1: Provide a framework for Orbital's success as the "initial launch" customer

Orbital is currently the largest customer at MARS and one of the region's largest providers of jobs. The VCSFA will work closely with Orbital to ensure that it receives the appropriate level of support to be successful in its launch operations. As of October 2012, MARS had completed construction and testing on its launch complex Pad 0-A, one of the first all-new large-scale liquid fuel launch site to be built in the U.S. in many years.[46] Following four years of design, development, construction, testing and inspection processes, Orbital has begun on-pad operations with their Antares rocket that will be used to fulfill the company's $1.9 billion ISS re-supply contract with NASA. Over the next several months, Orbital will complete various milestones to prepare the launch vehicle for resupply launch out of Wallops. Over the course of the next several months and years, VCSFA is committed to providing support to help ensure Orbital's launches are successful.

Key Actions

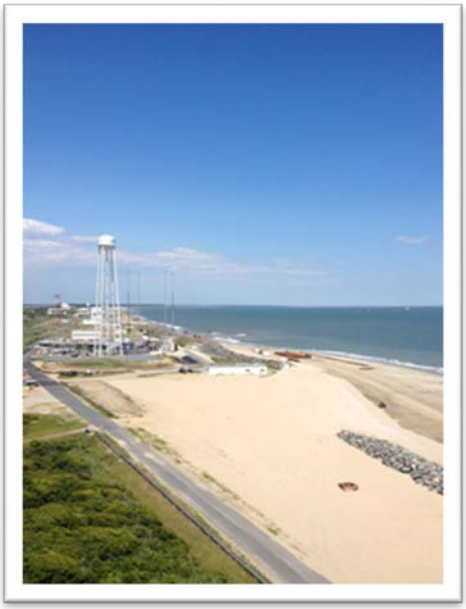
- Develop a contract with Orbital that provides an appropriate level of support for the current ISS contract and future missions.

[46] Orbital press release, "Orbital Begins Antares Rocket Operations at Mid-Atlantic Regional Spaceport," www.orbital.com, accessed October 1, 2012.

- Beyond ISS contracts, understand Orbital's launch business objectives with a view to providing the necessary support and balance with requirements of a multi user environment.

Objective 2: Develop MARS infrastructure to meet customer demand, manage the business, and enhance competition

The infrastructure of a spaceport is a significant driver in the decision for a customer to launch from a given launch facility. The VCSFA must make it a priority to provide its current and potential customers with launch facilities that are user-friendly, safe, and easily accessible. Both the physical infrastructure on Wallops and the governance infrastructure used to manage the VCSFA business by the executive team must be adequately developed for the multi-customer environment. The physical infrastructure needs of VCSFA range from updating range equipment with modern technology to implementing effective routes/modes of transportation to and from the spaceport and launch facilities. The governance infrastructure consists of the business development, scheduling, and financial, regulatory, and compliance rules required to manage a growing business while following applicable procurement regulations. It is important that VCSFA take the necessary steps to ensure its infrastructure planning is in line with the industry requirements to ensure longevity of the useful life of MARS assets and flexibility for customer needs and information requirements.



Wallops Flight Facility
Source: VCSFA

Key Actions

Make MARS a Multi-User Facility

- The VCSFA will explore the development of multi-user launch pad facilities. The Authority recognizes that this approach can be a challenge. However, cost effective management may require some sharing of facilities amongst customers because of the enormous cost of duplicate resources. This will require coordination by VCSFA with all of the customers.
- New contracts should be structured to allow both current and new customers to use MARS assets as well as any assets that Virginia has provided so that all parties are treated equally and fairly.
- Possibilities for a new launch pad or other assets for additional customers should be explored on an ongoing basis. The model of "if customers come to Wallops then VCSFA will build new facilities if the benefits match the costs" is most likely superior to the model of "build it and they will come."

Review and Update Current Infrastructure

- Physical infrastructure – Present facilities must be reviewed in the context of launch/mission safety combined with a reasonable expectation of growth in business from a multi customer business plan. Normal industry standard repair, maintenance, refurbishment programs for assets should be utilized.
- Governance infrastructure – Because of the recent changes in the structure of the Authority, much of the internal workings and business functions will need to be updated. These include the on-site operations and scheduling, back office administration, pricing, cost control, contract administration and legal, business development, IT structure, etc. There are many templates available in the contracting industry and in the Authority structure of the Commonwealth.

Objective 3: Position VCSFA as a leading launch service provider

In the near-term, MARS will focus primarily on its existing launch capability in the small and medium lift launch arena, but will assess the market for other opportunities deemed suitable for Wallops under its new organizational structure. The VCSFA will work with potential customers to establish a robust, yet competitive user fee structure, to establish its core capability and areas of potential improvement.

Key Actions

Focus on Small and Medium-lift launches

- The VCSFA's location and capabilities are ideal for small and medium-lift launches. Although ISS resupply missions are growing, VCSFA intends to look to additional commercial launches, including the areas of defense and national security. The near-term focus is on expanding medium-lift launches as the market outlook is favorable.

Create a Competitive Cost and User Fee Structure

- Market demand for services will take precedence for launch activity at MARS. To complement demand, VCSFA will develop a competitive cost and user fee structure that attracts additional customers and new market entrants.
- MARS will develop market based, competitive usage cost rates that reflect the MARS infrastructure plus the site, facilities, and range equipment.
- Pricing strategy will take into account long term self sustaining operations at MARS to cover recurring annual operational costs and provide for some portion of future investment.
- In general, these rates should be the baseline used for all customers; however, market pricing will most likely be used to acknowledge the competitive environment, costs, and investments required.
- Continued analysis of competitor user fee structures and benefits will be undertaken.

Increase Launch Preparation Efficiency and Expand Customer Service

- Launch preparation that includes clean facilities, warehouse, etc. is a critical factor that enables a successful launch program. Additionally, VCSFA will focus on recruitment of specialists (e.g. engineers and scientists) to support client needs.

Objective 4: Develop VCSFA as a self sustaining entity

The VCSFA is currently reliant on the funding from HB 813/SB 284, which must be appropriated each year, for the operations of the Authority. The objective of VCSFA is to gradually reduce reliance on this funding by increasing project revenues earned through launch services with an ultimate goal of becoming financially self-sufficient.

Key Actions

- The VCSFA will work to reduce dependency on state funding through optimal use of resources.
- The Authority will make best use of external contractors and internal management resources while maintaining schedules in a multi–user facility.
- An effective marketing strategy will be utilized to develop sustainable revenue streams from new and existing customers and initiatives.
- Partnerships may be developed with other states and educational institutions to share costs and benefits of launch facilities.

Objective 5: Develop an efficient and competitive organization

The VCSFA recognizes the need for a new approach to organizational management and has begun the process of reconfiguring the Board with members that have a deep understanding of this market and who recognize the potential areas of commercial opportunity for the Commonwealth. The next step is to converse with key industry players and market the "reenergized" VCSFA and MARS with the improvements and business processes the Commonwealth has implemented to position the Authority for commercial success.

Key Actions

- VCSFA will aggressively develop and engage in a new business development strategy.
- A proactive management and governance structure at the operational level should be provided to establish core values that focus on efficiency and mission success.
- The Authority will work to build strategic alliances, seek sustainable investment resources, and negotiate optimal business agreements with key industry players. Additionally, efforts are underway to open a new marketing and business development office in Northern Virginia to be able to gain greater access to more customers.

"We really are sitting on a gold mine,"
Donna Bozza, director of the Eastern Shore of Virginia Tourism Commission

Source: The Washington Post, "Virginia aims to claim the next Space Coast," July 9, 2011

Objective 6: Establish partnerships to promote research and commercial opportunities

The space industry is growing, and with it is an increased market for research opportunities and industry specialists. Several leading educational and commercial research and development organizations in the nation have roots in or around Virginia. VCSFA will use their proximity to these organizations to establish partnerships to promote research and commercial opportunities for space launch participation.

Key Actions

Promote Aerospace Science and Research

- With increases in commercial space flight, opportunities are expanding for many fields of research. The following disciplines will have an opportunity to use commercial space flight to expand their field of knowledge.[47]
  - Biological and physical research: Experimental payloads to investigate biological and physical responses of living things in space
  - Earth Science: Observations and measurements of Earth and its systems from a new perspective that has not been intensely studied
  - Space Science: Observations and measurements of space environment
  - Human Research: Investigating human physiological and psychological responses to space travel
- Additional opportunities for military research exist with military aircraft and launch vehicles.

[47] The Tauri Group, Suborbital Reusable Vehicles: A 10-Year Forecast of Market Demand

Enhance Research Capabilities to Position Virginia as the Leading Space Authority in the U.S.

- With the growing space industry, research is becoming increasingly important for gaining a competitive advantage in the field. The Authority will take action to enhance its facilities to support research on the ground and in space that comes as a result of increased demand for space knowledge and private sector involvement. By enhancing its research capabilities and leveraging the many organizations within the region that focus on research and development, VCSFA will work to position itself as the leading space authority in the U.S.

Expand Relationships with Educational Institutions

- The VCSFA has the unique opportunity of being located in a state that has several of the top educational institutions in the nation, and the Authority would like to proactively seek new partnerships with these universities to become leaders in research related launches. To expand its relationships with the universities and colleges of Virginia, VCSFA will market the assets and services of MARS that would provide Virginia's schools with necessary resources. A partnership among VCSFA and one or more of the research universities in Virginia would prove economically beneficial to the Commonwealth and mark Virginia as one of the top space states in the county.

Strengthen Relationships with Key Aerospace Industry, Military, and Research Establishments

- The Authority has a competitive advantage in respect to its location as many of the nation's largest aerospace, military and defense, and research organizations are headquartered or have offices in the region. Establishing and strengthening relationships with these organizations is essential to facilitating growth and demand at Wallops, and also positions the Authority to be familiar with current needs and plans of industry players.
- The Authority may also pursue partnerships with other states in the Mid-Atlantic region, in addition to Virginia and Maryland, for access to investment funds and congressional leaders.

Objective 7: Explore space tourism and other developing opportunities

The space tourism market is in the early stages of development, and it is expected that in the next several years citizens will be able to travel to space. Several companies exist and are developing means to advance commercial human space tourism, and many of these companies have partnered with launch facilities to provide launch services. The VCSFA recognizes the opportunities that exist and intends to monitor the development of the market for space tourism so that it may assess the potential for the Authority to provide such services at MARS.

Key Actions

- The VCSFA will assess developments in the market for space tourism and explore the potential to leverage MARS facilities in order to benefit from this developing market, and it will evaluate the potential benefits of providing this type of service, including cost benefit analysis in relation to other service capabilities.
- The market for 'sub-orbital' space flight continues to grow and may present opportunities for MARS in the near future using the NASA horizontal launch facilities (an existing 8,750 foot runway). The costs of such initiatives are likely to reduce dramatically over the coming years with increased competition and demand from the private sector. VCSFA will react quickly to take advantage of any such opportunities in the future, should they become a viable proposition at MARS.

Objective 8: Stimulate economic growth and provide a positive impact to the Commonwealth

The VCSFA will continue to seek and invest in key activities that enhance economic growth in the Mid-Atlantic Region. Today, the Commonwealth supports an advanced science and technology sector that attracts businesses in an industry which supports over 28,000[48] jobs in the Mid-Atlantic region. The growing commercial space transportation and related industries will address three main areas of economic growth including investment in jobs, businesses and education. VCSFA's approach will be to work closely with economic development organizations, government institutions, educational institutions, neighboring states and businesses to encourage investment in commercial space, research and development, and related industries.

Key Actions

Develop an Industrial Hub

- The goal of an industrial hub is to benefit businesses in the state through alliances and encourage investment through policies and incentives. Continued development of the Wallops Research Park will provide benefits for users of Wallops and MARS launch facilities. Furthermore, research centers can play an important role by helping businesses grow.
- As the Authority is tasked with operating MARS, there is opportunity to develop VCSFA's relationship with Maryland and to pursue partnerships with other states in the region to develop MARS as a regional economic engine. The VCSFA may leverage the resources of entities outside of Virginia to expand and operate the spaceport, which drives economic development for the region and create jobs in and alongside the space industry.
- In September 2012, VCSFA reached a new agreement with Orbital, governing their working relationship and the allocation of assets at MARS. Orbital has agreed to launch 10 Antares missions from Wallops Island, and Virginia will fund completion of MARS improvements to support Antares missions and future customers. The Authority is now the owner and operator for all non-Antares-specific hardware that can be used by future additional customers.

Create Highly Skilled Jobs in the Sector

- The presence of an experienced, skilled workforce is important for attracting CST&EI investment in the area. The VCSFA will focus on employer and industry needs that support increased business competitiveness.
- By working with educational institutions and providing a strong commercial environment, VCSFA will help to develop a strong platform for creating well paid and highly skilled jobs in the aerospace industry. Such a platform is needed to attract the highest quality candidates from engineering, aeronautics, and space technology colleges and institutions around the country and provide the Mid Atlantic region with improved job opportunities.
- VCSFA will continue to work with its existing customer, Orbital, to create new jobs through their own capital investments and work programs. The economic impact of Orbital choosing to base its cargo resupply and Antares Programs in Virginia has been substantial.

[48] "Competitive Analysis of Virginia's Space Industry," December 2011 (accessed September 14, 2012), Virginia Department of Transportation, page 3, http://www.transportation.virginia.gov/docs/SpaceCompAnalysis.pdf

Enhance Transportation Network

- VCSFA aims to connect launch facilities and industrial areas to improve its access and reliability. This could help support economic growth in the eastern shore and create additional growth, which will spill over to other sectors and local economies.
- VCSFA will work closely with business and regional and state transportation agencies to develop a plan that incorporates transportation improvements to the existing network.
- VCSFA will work closely with other stakeholders to create more efficient access to Wallops Island and enhance its transportation network supporting commercial space launches, including the U.S. Department of Transportation and the Virginia Port Authority.

Enhance Aerospace Education

- The presence of strong universities and research programs in Virginia can attract prospective commercial space industry employees and result in a highly educated and skilled workforce that is a foundation of the space industry, and there are a number of aerospace degrees offered at universities within the region.
- The Virginia Space Grant Consortium, a coalition of five Virginia colleges and universities, NASA, state educational agencies, Virginia's Center for Innovative Technology, and other institutions, coordinates and develops aerospace-related educational and research efforts and to promote the space industry within Virginia.
- Many of the smaller satellites launched from 2002-2011 were for universities in the United States. The university demand for satellites also continues to grow. With several universities in Virginia and many more in the region, there is a large addressable market for small satellite launches.
- Virginia has eight aviation and space-related magnet schools designed to offer students the opportunity to enroll in the high-tech space and related engineering fields. Graduates of these programs are awarded the Advanced Math and Technology seal on their diplomas to denote successful completion of advanced coursework.
- Virginia's existing educational institutions play a significant role in continuing to attract aviation and space business and research. The Commonwealth Center for Advanced Manufacturing (CCAM) was designed to bolster innovation in the aviation and space industries and advance the research efforts of Virginia's university system. Its facilities provide private enterprises with access to academia's intellectual capital in return for funding to advance university-affiliated research.

5.4 Strategic Direction

As part of the recent transition of the Authority during 2012, VCSFA continues to support the market for small and medium-lift launches. Significant investments have been made to assist with the development of launch Pad 0-A and these efforts will continue in the testing phase during 2012 – 2013 to support eight ISS resupply missions thru 2017.

The eight objectives described above consist of both tactical and strategic actions. The immediate steps will be to implement actions that are tactical over a 6-18 month period (e.g. establish business processes and partnerships). Simultaneously,

Opportunistic Midcourse:

Between the Status Quo and Full Speed Ahead options---in this strategy, all customers for Wallops launch services will be pursued with preference given to those customers with existing contracts or funding. If they are willing to make the commitment to launch from Wallops, then the Authority will provide the appropriate investments to assure their success provided the benefit to the Commonwealth is consistent with the investment required.

VCSFA will implement strategic actions that encourage a continuous review of the Authority's competitive landscape while also evaluating potential investments.

Three options have been considered for the future of VCSFA: *Status Quo*, *Full Speed Ahead*, and *Opportunistic Midcourse*. Given the relative immaturity of the market, the uncertain future for commercial space supply and demand, and large investment needed to facilitate development at Wallops, the *Opportunistic Midcourse* is the optimal path forward. This path can be scaled to be more or less aggressive for VCSFA's investment plans. While VCSFA is pursuing future business relationships with all potential customers, preference should be given to those customers who have existing contracts and/or funding. If potential customers are willing to make the commitment to launch from Wallops, then the Authority should consider appropriate investments to assure their success, provided the benefits to the Commonwealth are consistent with the investment required.

Data shows that U.S. demand for complex government and military launches, historically accommodated by California and Florida spaceport, will continue to increase and may exceed available capacity. This presents a significant opportunity for the Commonwealth and the Authority to serve this market and expand its services in new areas. Furthermore, a shift in national space policy has led commercial space flight companies to actively engage in developing and testing technology that reduces cost and increases reliability – this trend may warrant a focus on small and medium lift technology. In summary, there exists a rapidly evolving commercial space flight industry in which the Authority is well positioned to serve and flourish given its competitive position.

6. Conclusion

The U.S. space program, after nearly a century of space exploration and investment by the Federal Government, is currently undergoing radical change, evolving from an industry led by government objectives, to one which can be supported by the private sector. Against this backdrop, the next five years represent a once in a generation opportunity for VCSFA to consolidate its position at Wallops and attract those customers who will look to fill the initial vacuum of opportunity within the U.S. commercial space flight market and partner with suppliers such as VCSFA in the near future.

VCSFA is well placed to take advantage of the short term opportunity that has presented itself to allow a limited number of space sports, such as MARS, to attract new customers to its facilities. MARS has a unique heritage and a vibrant future because of the re-energizing efforts that have been completed by the Commonwealth and VCSFA during recent years, such as:

- The Governor and the General Assembly of the Commonwealth have committed that VCSFA will be given the opportunity to grow and benefit from the future of space exploration and exploitation as codified in the National Space Policy from the federal government.
- The Governor and the General Assembly have allocated funds for the next 5 years to support VCSFA's success;
- NASA assistance has been constructive in supporting VCSFA to provide launch vehicle suppliers and mission payload builders a new access to space;
- The Authority Board is being reconstituted to focus on the business and technical aspects of providing access to space for all customers;
- The Authority management is evolving and shifting focus from starting a new business to building a stronger base for winning new business and providing skilled technical expertise; and
- The Authority has a business arrangement with Orbital that will benefit both parties for at least the next 5 years. This arrangement allows Orbital to fulfill its obligations to NASA and provide a base for the Authority to attract new customers that may take advantage of the VCSFA assets and economies of scale.

All of these re-energizing activities for VCSFA are coming at the right time given the increased requirement for access to space from the U.S. government, military agencies, international users, and commercial space users. Based on the forecast growth of all of these segments, it appears there is less than adequate supply for launch facilities to accommodate all of the current and much of the future demand. However, many of these demand and supply models have not been accurate in the past because of the rapid movements in the space industry. The Authority expects that the situation in the near future will probably be the same. Therefore, the Authority will adhere to a policy of the Opportunistic Midcourse (which lies between the Status Quo and Full Speed Ahead options).

On this course, the Authority will give preference to customers who have existing needs for space launches. In return for those customers committing to utilizing the Wallops facility, VCSFA will make the investments required to assure success for that customer provided the benefits to the Commonwealth are appropriate. Beyond customers with existing contracts and/or funding, the Authority will carefully monitor the space market developments and launch capacity supplied by other states. Longer term

VCSFA investments will be balanced with the future benefits. In summary, the chosen course seeks to attract new customers with existing business and follow fast when we see other customers and/or the market expanding.

Accordingly, it is important for the Authority to continue to improve their offerings to the industry, as follows:

- Demonstrating a mission success and safety template to the industry through a successful launch record
- Continuing to offer a "red-tape" free launch availability and scheduling process
- Providing a cost competitive package in terms of launch costs and continued upgrades to the current advantageous tax and liability provisions

The results of this strategy should provide benefits to the Commonwealth through improvements in the following areas:

- Job creation – Utilization of current resources, such as the launch facilities at Wallops and Wallops Research Park, and new launch companies being attracted to the area will help induce job creation
- STEM benefits – When launch facilities are in your backyard, teachers, professors, and students will all want to learn more about something they can see every day
- Utilization and synergy with all Commonwealth resources – Using all educational and industry resources of the Commonwealth, Maryland, and federal agencies within the MARS boundaries should further scientific goals and assist the nation's access to space
- Space tourism initiatives – The space tourism market is in its infancy, therefore it is an area that has the greatest unknowns and predictability

Given the above, it is expected that a newly re-energized VCSFA will offer the space industry an exciting and newly updated alternative. This alternative will create a job magnet for the area, a new hub of scientific activity, and a potential tourist destination for the Commonwealth.

Appendix A – Business Development Plan

The detailed Business Development Plan is a separate document and will be made available to those individuals requiring this business sensitive information. A summary of the VCSFA Business Development Plan is presented below:

Short-term Action Items:

- Assess current partners market access – Pad 0A is optimized for Orbital's Antares launch vehicle. Can Antares compete against other launch vehicles and does it have the ability to grow into high weights and human space flight?
- Determine future partners business prospects – If MARS can be upgraded for other launch vehicles, is there enough high probability business to make an economic value proposition?
- Determine requirements for bringing in new customers – To bring in new customers, what is the cost to upgrade the MARS facilities? This should be determined by a direct input from potential new customers.
- Develop infrastructure for operational and administrative practices – Improve the marketing and sales functions of the Authority by new hires and industry standard processes.
- Evaluate how to work in a multi-customers environment – Quality, mission success, and scheduling procedures will have to be communicated to customers to assure their launch dates can be achieved.
- Determine the appropriate customers to work with in the future – From the items above, the future business potential of each launch vehicle compared to the modification costs of current facilities will determine the correct customer set.
- Develop a communication program – A plan that accommodates quick response notifications as well as longer term trade show information, PR announcements, advertising, and website communications will need to be developed and then updated on a regular basis.

Long-term Action Items:

- Evaluate the investment/benefits relationship – The costs should be compared to all the benefits to the Commonwealth (e.g., financial, jobs, STEM, making all Commonwealth resources more competitive, etc).
- Define a funding mechanism for investment required – Funding via the annual budget or via long term debt must be evaluated. Annual cash flows and risk profiles must be assessed by Commonwealth experts.
- Establish team relationship with other suppliers – Economic development and job creation will come from relocating some of the supply chain functions and operations associated with launch vehicle and payload suppliers to Virginia.
- Assess the ability to promote economic development and jobs creation in the Commonwealth – This will require both the Virginia Economic Development group and the Authority to work together to provide adequate incentives.
- Enhance communication and marketing strategies to meet industry needs – The Authority will need to set up an ongoing disciplined process to maintain a communications policy, PR methods, advertising, and a website strategy to inform customers, employees, and other stakeholders on the important issues affecting the Authority.

If additional information is required, please contact:

Dale Nash

Executive Director Virginia Commercial Space Flight Authority

dale.nash@vaspace.org

(757) 440-4020

7. Acknowledgements

The Virginia Commercial Space Flight Authority wishes to acknowledge many individuals who devoted much of their time and energy on this plan.

The Office of the Secretary of Transportation:

- The Honorable Sean T. Connaughton, Secretary of Transportation
- David Tyeryar, Deputy Secretary of Transportation and Chief Financial Officer
- Matt Strader, Assistant Secretary of Transportation

The Authority's Board of Directors:

- The Honorable Sean T. Connaughton
- Randy Burdett
- Robert Farquhar
- Vincent C. Boles (Chairman)
- Dennis K. McCarthy
- Jeffrey K. Windland
- John J. Stolte
- J. Jack Kennedy (Secretary)
- John N. Jester
- Keith R. Bull (Treasurer)
- Robert T. "Bob" Richards

The Authority's Staff:

- Dale Nash, Executive Director
- Billie Reed, Former Executive Director
- Zigmond 'Zig' Leszczynski, Deputy Executive Director

Firms representing Commercial Space Industry:

- Bigelow Aerospace
- Blue Origin
- The Boeing Company
- Lockheed Martin
- Masten Space Systems
- Orbital Science Corporation
- Sierra Nevada
- SpaceX
- United Launch Alliance

Comments and suggestions provided by the Office of the Secretary of Transportation, Authority's management, and industry representatives were instrumental in preparing this plan. Their support and cooperation is greatly appreciated.

KPMG staff involved in the project included: Declan McManus (Principal), Phil Duke (Managing Director), Raj Shelat (Director) as well as Richard Marsh, Patt Talvanna, and Tom Forrester.