FLORIDA SPACEPORT SYSTEM PLAN 2013

Proven. Responsive. Ready. Safe.

Space Florida

Table of Contents

EXECUTIVE SUMMARY

Space transportation has made great strides in the past 60 years. Motivated at first by defense concerns and national pride, the space industry has grown from the wonder of putting a man on the moon to touching the daily lives of billions of people across the globe.

Much of this innovation occurred in the United States, which has the most advanced and complex system of space transportation facilities and management in the world. Since the successful launch of the Bumper 8 in 1950, the heartbeat of the nation's space launch industry has been centered squarely on Florida. Over the past 60 years, thousands of rockets have launched from Cape Canaveral, including every operational Global Position System (GPS) satellite, hundreds of communication satellites, national-security remote sensing constellations and early warning weather systems.

The launch of these newer satellites hints at the shift occurring in the space industry. While national-defense and exploration missions will continue to dominate the launch landscape, the types of missions are growing increasingly diverse. Newer diverse missions will include providing zero-gravity environments for research, environmental monitoring, space tourism and small satellite development and launch. Although the government is still a major investor in the space transportation system, the market is expanding to commercial operators with different missions and needs.

FLORIDA SPACEPORT SYSTEM GOALS

- Create a stronger economy where Florida's spaceports and aerospace businesses can thrive.
- Guide public and private investment into emerging and growing aerospace enterprises and maximize the use of existing aerospace resources.
- Enrich our quality of life while providing responsible environmental stewardship.
- Advance a safer and secure spaceport transportation system for residents, businesses, and others.

Florida's leadership in the space industry continues with this 10-year Spaceport System Plan, the first of its kind in the country. The vision of this plan is to have the *right infrastructure* in place for the *right launch vehicle or spacecraft* at the *right time*, requiring flexibility and multiple launch, landing, and re-entry configurations. Through strategic infrastructure investments and the development of an effective, seamless-delivery space transportation system, Florida will continue to lead the world as the "Place for Aerospace."

EXISTING SPACEPORT SYSTEM

Space transportation is the newest mode of transportation. Although technology is constantly evolving, there are five definable components of a spaceport system: spaceports, control centers and airspace, payload processing facilities, launch vehicles and space craft, and intermodal connections. The chart below defines each of these elements, and describes Florida's existing system.

SYSTEM COMPONENT	DEFINITION	FLORIDA ASSETS
Spaceport 	A public gateway to space that typically provides both launch and re-entry sites. In the U.S., launch facilities that serve commercial, non-governmental customers must be licensed by the Federal Aviation Administration (FAA).	• **Cape Canaveral Spaceport**: commercial facilities at Kennedy Space Center (KSC) and the 45th Wing at Cape Canaveral Air Force Station (CCAFS), • **Cecil Spaceport**: a newly licensed facility in western Jacksonville.
Control Centers and Airspace 	Centers that coordinate the details for space flight operations. Airspace in space transportation is primarily concerned with *ranges*, a flight path area used for launching rockets, missiles, and vehicles designed to reach high altitudes.	• **Launch Control Center** (LCC) at KSC. • **Morrell Operations Center (MOC)** at CCAFS, manages the 15-million square mile Eastern Range. • **Dedicated Launch Vehicle Control Centers for the Atlas V, Delta IV, and Falcon 9,**
Launch Vehicles and Spacecraft 	A *launch vehicle* is a rocket used to launch a spacecraft or satellite into high altitude or orbit. Typically they are classified as reusable (RLVs) or expendable (ELVs). *Spacecraft* are manned or unmanned vehicles that are designed to operate in space to accomplish a specific mission.	• The **Atlas V**, **Delta IV**, and the **Falcon 9** that will launch from CCAFS. • Development of the **Space Launch System (SLS)** at KSC. • **Suborbital-ready facilities** at Cecil Spaceport.
Payload Processing Facilities 	Facilities that prepare payloads (the cargo necessary to complete a mission or flight's purpose) for launch, and processing following the flight.	• **12 major facilities at KSC and CCAFSs** with the capability to process a variety of payload types and sizes. • **Astrotech** in Titusville,
Intermodal Connections 	Transportation modes that enable the movement of people and goods to spaceports, including roadways, airports, seaports, and rail lines.	• **Strategic Intermodal System (SIS),** a system of key roadway, rail, airport, seaports, and spaceport infrastructure identified by the Florida Department of Transportation (FDOT).

DEMAND

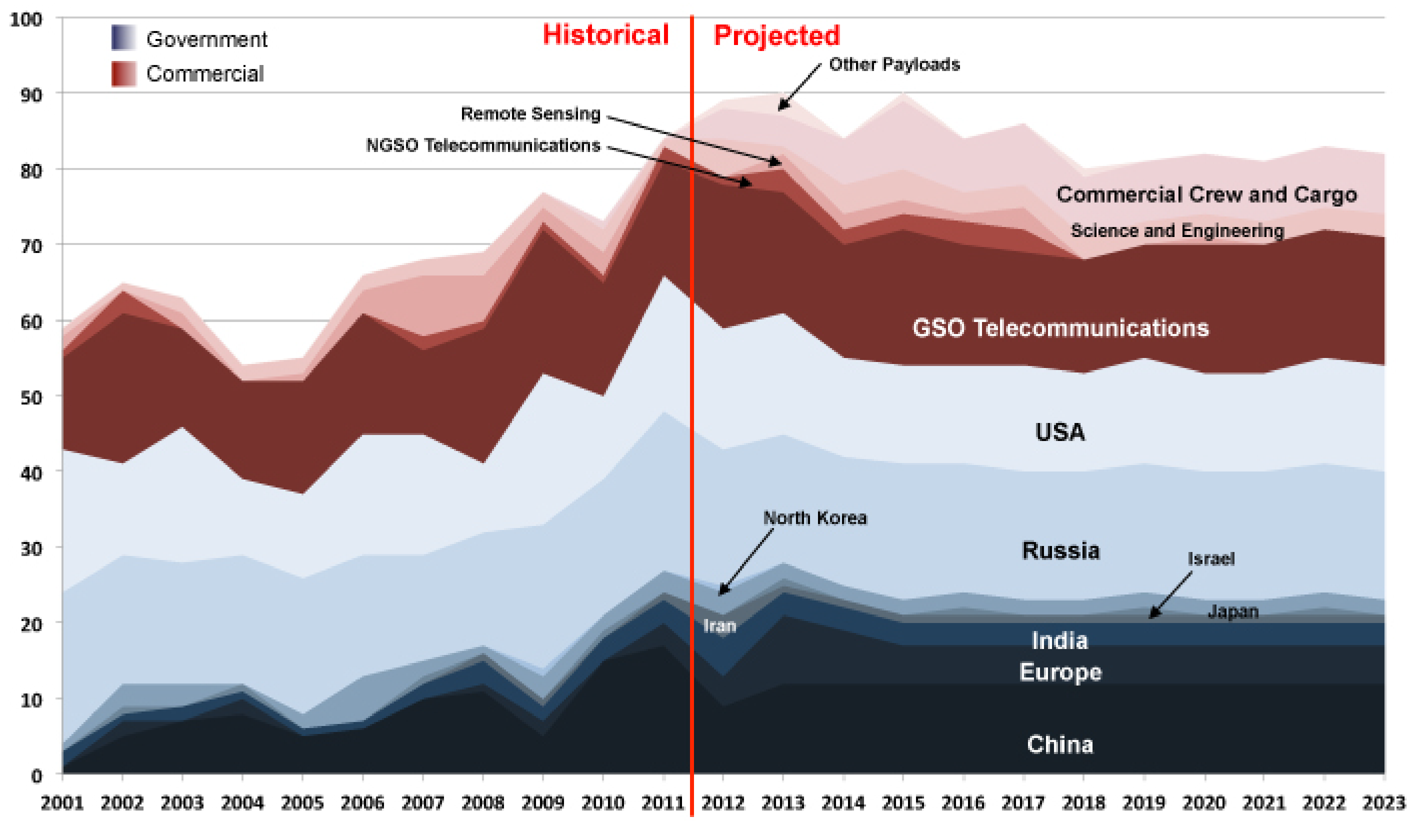
Because of the long lead-time required to develop launch vehicles, spacecraft, and other technologies, it is possible to accurately project market demand for space transportation over the next 10 years. From an infrastructure perspective, it is helpful to simplify these markets into two types: orbital and suborbital.

Orbital Launches

Orbital flights are those conducted by spacecraft that travel along a gravitationally governed path around the Earth. Between 2002 and 2011, a total of 118 orbital launches were conducted from Florida, averaging about 12 per year. During the next 10 years, the average number of orbital launches conducted from the Cape is expected to increase to 17 per year, with seven per year being commercial. This expected increase is due to new launch vehicles entering the market, and NASA's anticipated reliance on commercial vehicles to resupply the International Space Station (ISS).

Florida also has an opportunity to increase the number of orbital launches in the state. For example, commercially procured science and engineering flights currently launched in Russia could be launched from Florida using small vehicles, contingent on reliability and price competitiveness. Other opportunities include increased commercial telecommunication satellite launches if a Florida-based provider captures market share from launch providers in other countries. Additionally, cargo flights currently planned from Virginia's Mid-Atlantic Regional Spaceport (MARS) could be launched from CCAFS, either on and Antares vehicle (requiring a new or modification of existing pad) or on a Falcon 9 from SLC-40.

Actual and forecast worldwide orbital launches by country (2001-2023).



Suborbital Launches

Suborbital flights typically use less infrastructure than orbital launches. They reach space (at least 50 miles in altitude) but do not complete an orbit of the Earth because they do not achieve the necessary velocity. In the past, most suborbital launches were conducted by governments to test missiles. Since the Cold War, the number of suborbital launches declined greatly but the introduction of reusable launch vehicles (RLVs) during the next 10 years will likely spur a significant increase of suborbital launches. For example, nine RLVs by six companies are currently in active planning, development or operation. With multiple suborbital spaceports around the country, Florida is well-positioned to enable commercial and government suborbital operations. For example, XCOR recently announced it will conduct flights from KSC where the company plans to build support facilities. Cecil Spaceport also has the capabilities to meet the needs of sub-orbital flights.

Artist rendition of XCOR's Lynx. Source: XCOR

In the near-term, the two vehicles expected to conduct suborbital flights are Virgin Galactic's SpaceShip2 and XCOR's Lynx. These two vehicles will likely only require part-time operations at a few spaceports worldwide. If demand remains the same and more vehicles and spaceports are developed, the market for these launches will be further split.

NEEDS AND CHALLENGES

Florida currently has the capacity to launch any class of launch vehicle using its existing infrastructure (with infrastructure improvements or modifications), and the ability to launch a large number of flights per year. The challenge for Florida is largely not one of physical infrastructure, but of positioning itself to stay competitive in nurturing existing industry and attracting emerging markets. To maintain its place as the heart of space transportation, Florida must address the following five challenges:

1. Face the Market: Florida should draw on its historical strengths to stay competitive, leveraging the best from all partners to better meet national, state, and commercial needs.

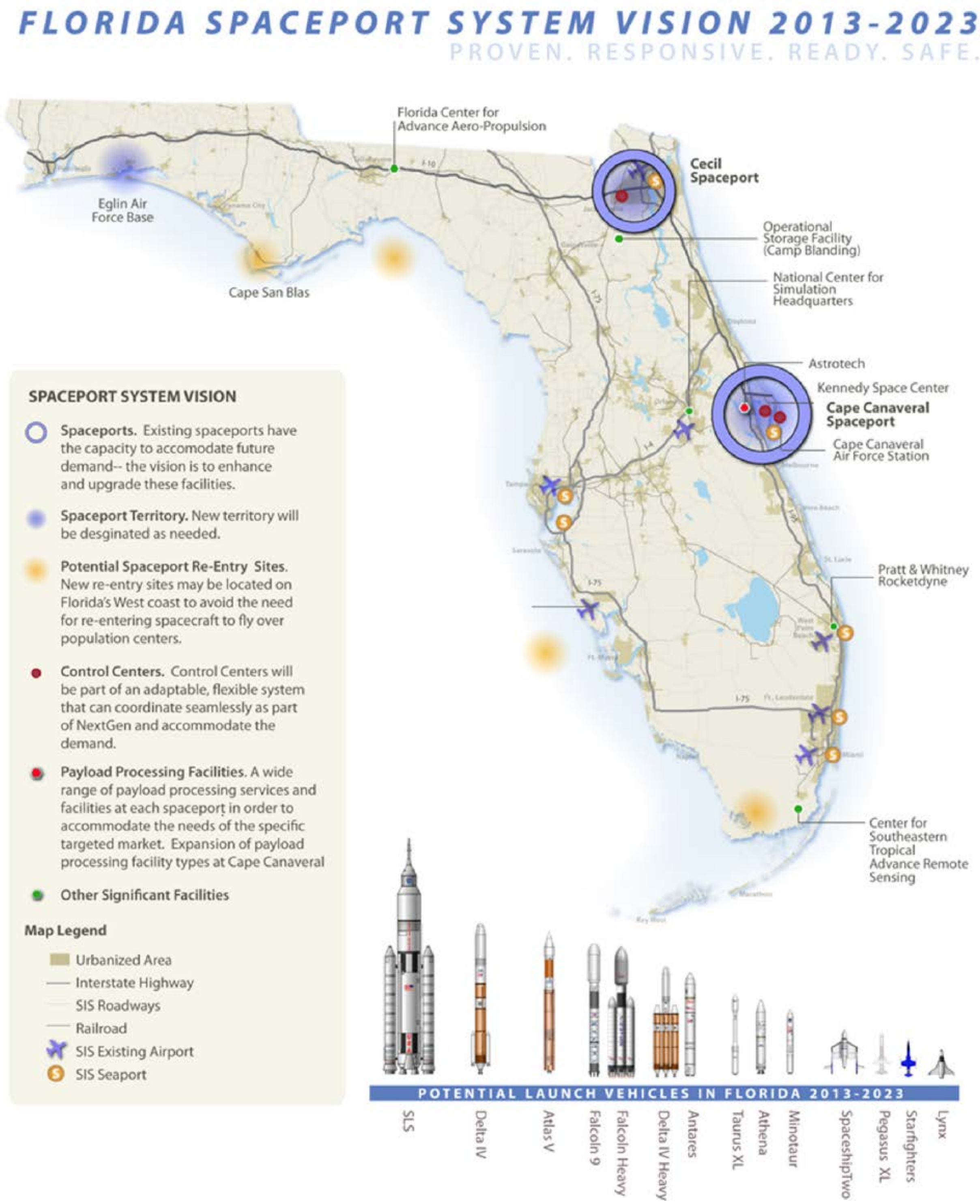
2. Provide great customer service (space-ready and space-friendly). To continue attracting new customers, Florida will need to promote its safety, low rates, and proven reliability at every opportunity.

3. Upgrade and maintain infrastructure: Florida has ample infrastructure to support almost any kind of launch, but some of the buildings and facilities need to be upgraded to compete with newer spaceport facilities. Other facilities need to be right-sized to serve launch demand.

4. Communicate the importance of Florida's Spaceport System. The aerospace industry touches nearly every county in Florida and impacts the daily lives of millions of residents via GPS, communications and weather satellites. The positive impacts of the system must be communicated strongly and consistently to ensure public support.

5. Maintain strong governance, management and partnerships. All of the managing entities and partnerships of the Florida Spaceport System must work together to cooperatively manage system resources and serve a variety of customers.

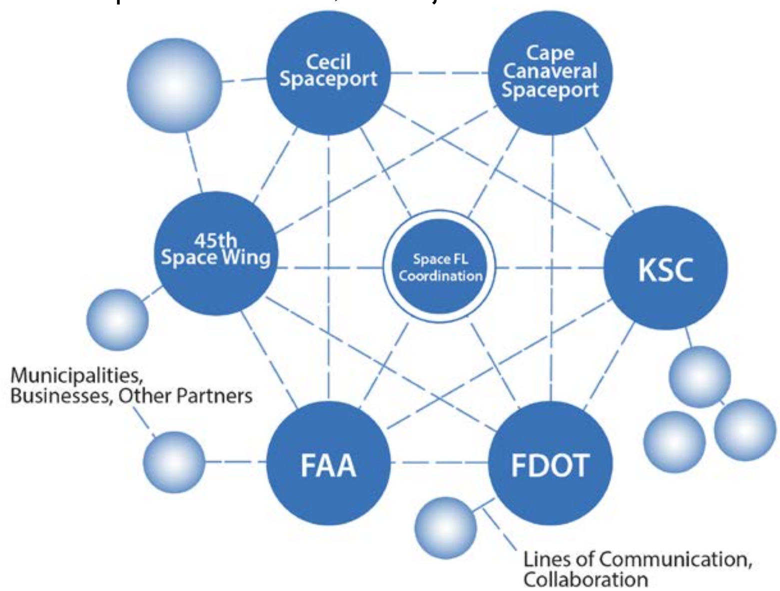
Florida's future Spaceport System will be leaner, more flexible and more agile. Simply put, it will have the *right infrastructure* in place for the *right launch vehicle or spacecraft* at the *right time*. It will also demand a higher level of communication, coordination and partnerships to maximize available resources to generate the greatest benefits for Florida residents.



IMPLEMENTATION

As Florida's Spaceport System continues to evolve, increased collaboration and decision-making will be necessary, particularly regarding recommendations for allocating funding for new or upgraded infrastructure. To meet the system's goals and implement the vision, five major initiatives are recommended:

1. Collaboration and decision-making structure. As the system matures, a more formal structure for collaboration and decision-making, particularly regarding recommendations for allocating funding for new or upgraded infrastructure will become necessary. Space Florida's responsibility is to facilitate this communication and act as a primary coordinator for multi-partner initiatives; the figure at right is a conceptual organization of this decision-making structure.



2. Implement system-wide program funding and prioritization criteria. Currently each partner agency uses its own prioritization criteria to determine which projects should be funded. There is an opportunity, when projects are in the best interest of multiple partners, for collaboration between the partners to realize the joint end. This plan proposes criteria based on anticipated market demand, economic impacts, committed funding sources, the ability of a project to meet a demonstrated need, alignment with Florida Spaceport System goals, and operational costs.

3. Upgrade and maintain essential infrastructure. Together, the partner agencies should identify essential infrastructure improvements and develop system-wide one-, five- and 10-year capital improvement plans (CIPs).

4. Enhance marketing and improve customer service. In light of reduced federal funding, as well as state and local emphasis on economic development and job creation, the successful growth of Florida's aerospace industry will rely heavily on the ability to attract and retain similar businesses and market. Initiatives include reducing the cost of launch and ensured launch dates, pursuit of increased commercial operations, and developing a comprehensive statewide industry-focused branding package.

5. Communicate the importance of Florida's spaceport system. Florida's Aerospace industry benefits virtually every county in the state. Space Florida and the state's aerospace industry should develop a public awareness campaign to promote the benefits of the aerospace industry to residents, visitors, business leaders, elected officials and policy-makers in order to attract new aerospace–related businesses; build support for increased levels of local and state aerospace infrastructure funding; and promote Florida as the best place in the world for aerospace.

Funding

Through State appropriations from various funding lines and its independent special district powers, Space Florida has invested more than $500 million in financial resources on infrastructure at the Cape Canaveral Spaceport. Space Florida has the authority to invest in aerospace infrastructure statewide through various financing mechanisms.

In the past, funding has been prioritized based on civil and defense needs rather than the growing and increasingly significant commercial market. Looking ahead, it will be critical for Space Florida to continue its win-win partnerships with the key players in Florida's Spaceport System to maintain its world-class spaceports system and benefit the public by providing space transportation services.

The Time is Now

The primary differences between today's spaceport system and the future system will be how the sites are managed and enhanced to meet changing market conditions. Obsolete infrastructure will be demolished to reduce overhead costs; new enhancements will be constructed to accommodate commercial needs using public and private partnerships; and improved coordination and collaboration procedures and processes will be developed to make it easier for the system to respond to changing needs. Increased marketing and promotional activities will inform Florida residents, businesses, elected officials and policy makers about the economic benefits of the spaceport system and the need to support it. Similarly, Florida's Spaceport System will be marketed to commercial manufacturers, operators, industries and customers as the premier place in the world to meet all of their aerospace needs.

The time to move forward is now. Florida's existing spaceport system is unrivaled in its history, infrastructure, and proven capabilities; but technology is evolving, and new markets are emerging. The state's 60-plus years of experience must be harnessed and adjusted to meet the needs of a growing suborbital market and continue the state's leadership in orbital launches. It is up to Space Florida and its partners to facilitate this change, communicate the industry's importance, and continually demonstrate the system's capabilities of being proven, responsive, safe and most importantly – ready.

Florida's Spaceport System, the *Place for Aerospace*: Proven. Responsive. Ready. Safe

PART I EXISTING SPACEPORT SYSTEM

1.1 Introduction

Space transportation has made great strides in the past 60 years. Whereas space exploration and discovery was funded by the federal government and driven by national security and exploration goals, the industry is now shifting to include commercial applications. For example, NASA has contracted with SpaceX and Orbital Sciences to commercially provide launch and spacecraft cargo missions to the International Space Station (ISS) and with SpaceX, Boeing, and Sierra Nevada to commercially provide spacecraft crew test missions to the ISS. The Air Force has also contracted with SpaceX to provide launch services for their payloads, along with other commercial spacecraft service providers. The commercial spacecraft capabilities include satellite telecommunication services, remote sensing, research and development, and emerging markets such as adventure tourism and private space missions.

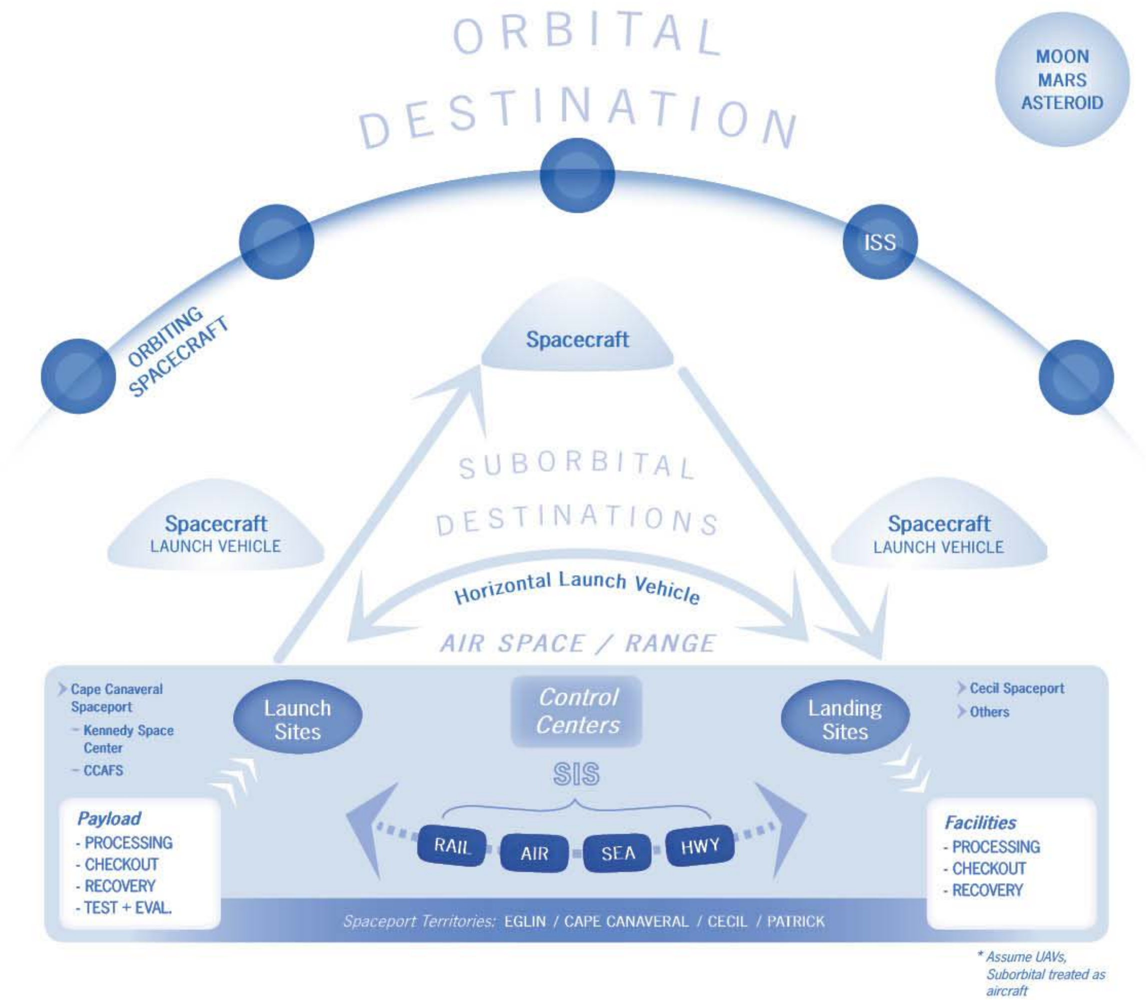
The first rocket launched from Cape Canaveral in 1950.

Space Transportation in the 21st Century
Whether a flight is funded by the government or a private interest, there are two major types of operational environments for spacecraft: orbital and suborbital. Orbital flights are conducted by spacecraft that travel along a gravitationally governed path around the Earth. Suborbital flights typically have simpler operations and use less infrastructure. They reach space (typically at least 50 miles in altitude) but do not complete an orbit of the Earth because they do not achieve the necessary velocity. From 1942 until the end of the Cold War, the vast majority of suborbital flights were performed to test ballistic missiles and conduct scientific missions using expendable booster stages.

Today, suborbital flights are less common, but companies are now building reusable launch vehicles (RLVs) to address existing and emerging markets. RLVs are vehicles that can be used multiple times; they are designed to reach and exceed 100 kilometers in altitude and provide customers with up to five minutes of microgravity. These vehicles can assume a variety of flight profiles, including taking off and landing like an airplane or lifting off like a conventional rocket and landing vertically on a pad. In the future, there may be point-to-point suborbital flights used for cargo and passenger transportation. For example, a 20-hour flight from Miami to Sydney could be reduced to a 2-hour suborbital flight.

In order for a space flight to even occur, there must be an entire system of infrastructure on the ground. This infrastructure is referred to as a spaceport system. Figure 1.1a below is a diagram of how the spaceport system in Florida works together to enable space flight. Components in the light blue box represent infrastructure on the ground. At the bottom are spaceport territories, which are the actual approved sites containing spaceport facilities. Within spaceport territories there are facilities for processing, integration, checkout and recovery of spacecraft and associated launch facilities. Depending on the type of mission, the processing of payloads (satellite or cargo to be transported aboard a spacecraft) may occur offsite at another facility. The spacecraft is then delivered to the launch site, where it will be launched either horizontally or vertically within or on an aircraft or launch vehicle.

Figure 1.1a. Conceptual Spaceport System in Florida



SPACEPORT SYSTEM INFRASTRUCTURE

Each component of the spaceport system has an important role to play. Following is a brief description of the major elements or "sub-systems" of a spaceport system: spaceports, control centers and airspace, launch vehicles and spacecraft, payload processing facilities, and intermodal connections.

Spaceports

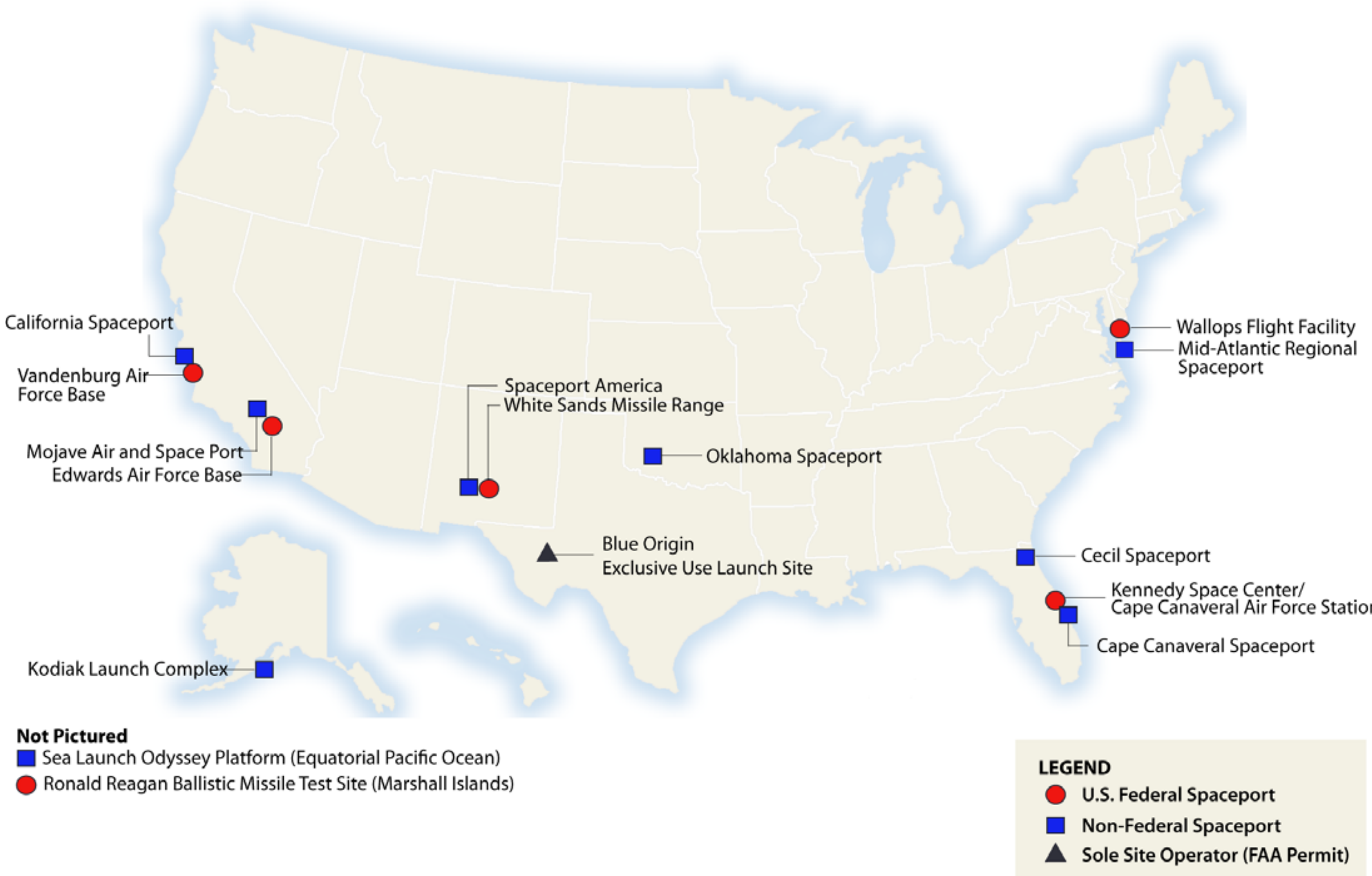
The term "spaceport" can have multiple meanings. For the purpose of this plan, the definition contained in Chapter 331, Florida Statutes, is used: "any area of land or water, or any man-made object or facility located therein, which is intended for public use or for the launching, takeoff, and landing of spacecraft and aircraft, and includes any appurtenant areas which are used or intended for public use, for spaceport buildings, or for other spaceport facilities, spaceport projects,

> *The major elements of a spaceport system are spaceports, control centers and airspace, launch vehicles and spacecraft, payload processing facilities, and intermodal connections.*

or rights-of way."[i] In a sense, spaceports are our national *public* gateways to space, providing places for both launch and re-entry. However, they are not just launch and re-entry sites. Typically, they also have a host of associated facilities such as user facilities, range assets, and ground control centers, which can be located away from launch/re-entry sites.

The United States is a world leader in the development of spaceports. Although other nations have made investments in their own systems, the U.S. has the most advanced system of space transportation facilities and management. Figure 1.1b illustrates the current U.S. spaceports.

Figure 1.1b U.S. Spaceports



Source: FAA[ii]

Commercial Spaceports

The Federal Aviation Administration Office of Commercial Space Transportation (FAA AST) issues licenses to U.S. companies for commercial launches. They also issue launch site licenses to Spaceports. Not to be confused with federal launches, commercial launches are conducted by private operators to fulfill a variety of missions. Although some of these missions may include launching satellites for government initiatives, the launch itself is managed by a private entity. Figures 1.1c lists the current spaceports licensed for commercial launches in the United States;

Figure 1.1c FAA-Licensed Commercial Spaceports in the United States[iii]

Spaceport Name	Location	Operator	Services	Commercial License First Issued	Orbital	Sub-Orbital
California Spaceport	Lompoc, CA	Spaceport Systems International	Payload processing; commercial launches in future	1996	Y	N
Mid-Atlantic Regional Spaceport (MARS)	Wallops Island, VA	Virginia Commercial Space Flight Authority	Commercial, governmental, scientific, academic	1997	Y	Y
Kodiak Launch Complex	Kodiak, AK	Alaska Aerospace Corporation	Commercial, governmental	1998	Y	Y
Cape Canaveral Spaceport	Cape Canaveral, FL	Space Florida	Governmental, commercial, payload processing, scientific	1999	Y	Y
Mojave Air and Space Port	Mojave, CA	East Kern Airport District	Research and testing, commercial	2004	N	Y
Oklahoma Spaceport	Burns Flat, OK	Oklahoma Space Industry Development Authority	Commercial	2006	N	Y
Spaceport America	Las Cruces, NM	New Mexico Spaceport Authority	Commercial (vertical and horizontal launch)	2008	N	Y
Cecil Spaceport	Jacksonville, FL	Jacksonville Aviation Authority	Commercial (horizontal launch)	2010	Y	Y

Control Centers and Airspace

Control centers coordinate the details for space flight operations, and are categorized into three groups: range control, launch vehicle control, and spacecraft in orbit. A range is the geographical area and surrounding airspace used for launching rockets, missiles, and vehicles designed to reach high altitudes, and it is composed of assets that encompass launch sites, such as runways and launch pads. Facilities designated as part of a range also include tracking and telemetry equipment that can be stationed quite far from the launch or re-entry site. One of the primary responsibilities of a range is to ensure public safety during all phases of a launch vehicles operations.

There is a hierarchy of control centers and associated controllers across the United States' spaceport facilities. These control centers are the primary means of communication between spaceports and the air traffic control system, and they must manage an enormous amount of data and coordination to prevent conflicts. Because of the complexity of data and decision-making, control centers are often supported by automated planning, scheduling and coordination systems that provide course-of-action options and recommendations. Additionally, data is provided through a variety of sensor systems that self-diagnose, self-reconfigure, and self-heal to provide situational awareness across the network.

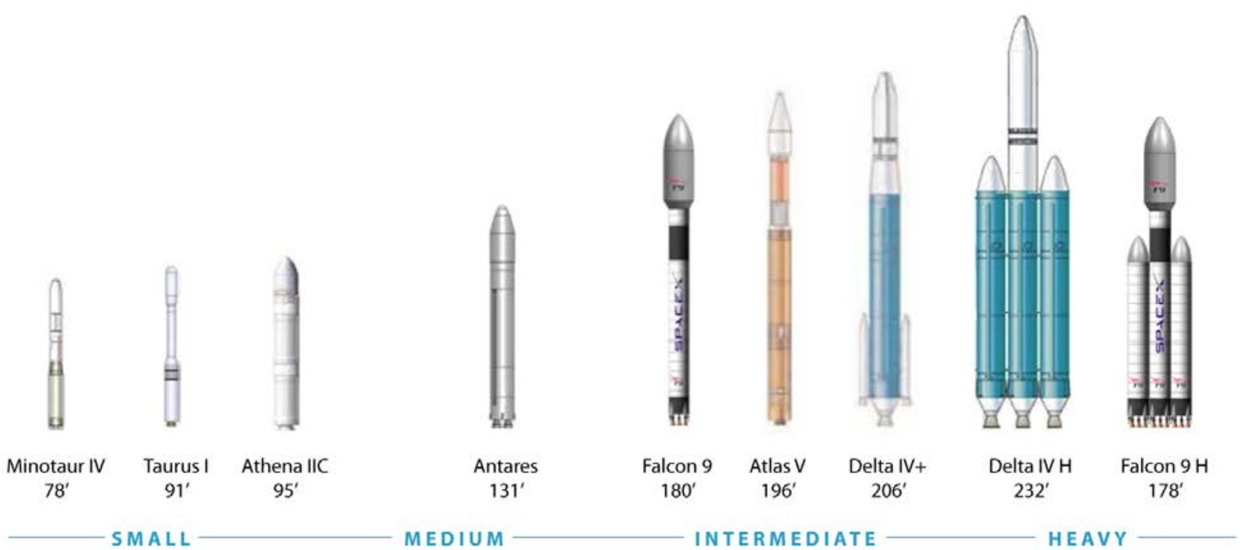
Control centers also monitor and coordinate the airspace needed for launches. Coordination and management of airspace is an integral part of a spaceport system. The airspace used for launch vehicles and spacecraft is part of a range. As space flight becomes more common, national airspace organization and coordination will become increasingly complex and will need to expand to include higher altitudes. The National Airspace System (NAS) is already one of the most intricate in the world, requiring thousands of people to monitor, manage, and coordinate activity among more than 19,000 airports. All space flights must be coordinated among the thousands of commercial, governmental, and private air flights that occur daily. The FAA is currently modernizing the NAS to rely less on ground infrastructure for aircraft navigation and more on satellites to accommodate commercial, general aviation and civil unmanned air systems (UAS).

Although technology changes quickly, in the near future it is possible that spaceport systems will function in close partnership with the commercial air transportation system. The operations will likely include the planning, scheduling, coordination, and management of space transportation activities, but also the shared use of spaceport/airport sites worldwide to accommodate multiple flights of different spacecraft to, through, and from outer space.

Launch Vehicles and Spacecraft

Because of their specificity and the large amount of investment required, launch vehicles and spacecraft can be thought of as mobile infrastructures. The variety of launch vehicles available at a spaceport has a great impact on the types of space flights that can be launched, and as a result, dictates the potential customer base. Launch vehicles come in many forms, but are typically classified as either being expendable launch vehicles (ELVs) or RLVs. Because of the great investment required, there is increasing interest in developing RLVs for both suborbital and orbital missions. RLVs tend to have less of an infrastructure requirement than orbital launch vehicles. Figure 1.1d below is an illustration of the main orbital launch vehicles and spacecrafts that are able to operate in the U.S. (Pegasus not pictured).

Figure 1.1d Current Launch Vehicles and Spacecraft in the United States



Source: The Tauri Group

A Reusable Launch Vehicle (RLV) is any orbital or suborbital vehicle designed to be launched into space more than once. This is distinguished from an expendable launch vehicle, which is designed to be used only once. Suborbital reusable vehicles (SRV) are a subset of RLVs that only address suborbital missions using reusable systems. The term "launch" implies the separation of a vehicle delivery system and a payload; in general, payloads remain within or part of an SRV from launch to landing.

New launch vehicles that are expected to be in operation in the U.S. this decade include:

- Athena, operated by Lockheed Martin Commercial Launch Services
- Liberty, operated by Alliant Techsystems (ATK) and EADS Astrium
- Space Launch System (SLS), operated by NASA
- Stratolaunch, operated by Stratolaunch Systems

ATK and EADS Astrium's Liberty launch vehicle.

New entrants this decade are expected to include:

- Hyperion, operated by Armadillo Aerospace
- Lynx, operated by XCOR
- New Shepard, operated by Blue Origin
- SpaceShipTwo, operated by Virgin Galactic
- STIG-B, operated by Armadillo Aerospace
- Xaero and Xogdor, operated by Masten Space Systems

Several orbital spacecraft designed to transport cargo and crew from earth to orbiting space stations are also expected to become operational during the next decade. Among these are CST-100, Dragon, and DreamChaser.

Payload Processing Facilities
Payload processing facilities are essential components of a spaceport system. In terms of a launch vehicle, the payload is defined as the cargo to be carried and may include equipment, satellite, people or a combination of these. Prior to flight, cargo typically goes through a preparation process and is integrated with the launch vehicle. For RLVs, payloads returning from space may require some degree of processing. All payload processes can happen at facilities on-site at spaceports or at separate locations, and vary considerably depending on the type of payload and mission.

Intermodal Connections
Intermodal connections refer to surface transportation, particularly highways, airports, seaports, and rail lines. This infrastructure enables the transportation of people and goods to the spaceports and provides an essential link between spaceports and other key facilities.

1.2 Florida's Existing Spaceport System

Florida is geographically well suited as a place for space launches. As the southernmost part of the continental U.S., launches can be directed over the ocean thereby minimizing safety risks. Recognizing this, the federal government selected Florida for its rocket launching. Space flights have been launching from Cape Canaveral for almost 60 years, including America's first manned mission in 1961.

FLORIDA SPACEPORTS AND SPACEPORT TERRITORIES

Florida is unique in that it has legislation that specifies areas where spaceport activity can occur. Designated as "spaceport territories," section 331.305, Florida Statutes (F.S.), enables Space Florida to "own, acquire, construct, reconstruct, equip, operate, maintain, extend, or improve transportation facilities appropriate to meet the transportation requirements of Space Florida and activities conducted within spaceport territory." Currently, there are four spaceport territories in Florida:

> "(1) Certain real property located in Brevard County that is included within the 1998 boundaries of Patrick Air Force Base, Cape Canaveral Air Force Station, or John F. Kennedy Space Center. The territory consisting of areas within the John F. Kennedy Space Center and the Cape Canaveral Air Force Station may be referred to as the "Cape Canaveral Spaceport."
>
> (2) Certain real property located in Santa Rosa, Okaloosa, Gulf, and Walton Counties which is included within the 1997 boundaries of Eglin Air Force Base.
>
> (3) Certain real property located in Duval County which is included within the boundaries of Cecil Airport and Cecil Commerce Center.
>
> (4) Real property within the state which is a spaceport licensed by the Federal Aviation Administration, as designated by the board of directors of Space Florida."[iv]

Two of these spaceport territories are active spaceports that have been licensed by the FAA: the Cape Canaveral Spaceport and Cecil Spaceport. Cape Canaveral Spaceport includes facilities from both Cape Canaveral Air Force Station (CCAFS) and Kennedy Space Center (KSC). With CCAFS and KSC combined, Cape Canaveral Spaceport currently has three active orbital launch complexes, two inactive orbital launch complexes and two active runways for horizontal takeoffs and landings at existing space launch complexes (SLCs).[1] Cecil Spaceport was licensed in 2010 and has suborbital horizontal launch capabilities. Figure 1.2.a shows the current and potential capabilities of Florida's spaceports:

Figure 1.2a Florida Spaceport Capabilities

Capability:	Orbital Vertical Launch	Sub-orbital Vertical Launch	Orbital Horizontal Launch	Suborbital Horizontal Launch	Vertical Test	Horizontal Test	UAS Test	Re-entry
Cape Canaveral Spaceport	X	X	X	X	X	X	X	X
Cecil Spaceport			X	X		X	X	X

Source: Space Florida

[1] It should be noted that Florida's Strategic Intermodal System includes all facilities at Cape Canaveral Spaceport, but Space Florida's SLC 46 has the only FAA/AST Active Launch Site Operator's License currently.

Kennedy Space Center is currently NASA's only launch site for human spaceflight. Located on Merritt Island, KSC occupies a site covering 352 square kilometers (219 square miles); the rest is managed by the Merritt Island National Wildlife Refuge and the Canaveral National Seashore. Since 1962, KSC and CCAFS have served as the place of departure for every American-manned mission and hundreds of advanced scientific spacecraft. With the cancellation of the NASA Space Shuttle Program in 2010, KSC is transitioning to a multi-use spaceport to serve government and commercial customers.

The Eastern Range operated by the 45th Space Wing has the capability to serve every current and projected launch vehicle in the US inventory.

The CCAFS is part of the Air Force Space Command's 45th Space Wing, headquartered at nearby Patrick Air Force Base. It is the primary launch site of the Eastern Range, which operated since 1954 and spans over 15 million miles to the Indian Ocean. Currently, CCAFS conducts launch operations and provides range support for military, civil, and commercial launches. The spaceport has a variety of facilities including four active orbital launch complexes and a Skid Strip with a 3,048-meter (10,000-foot) runway. It also has special vehicle re-entry corridors, operations control center, and launch pads.

Figure 1.2b. Florida's Existing Spaceport System

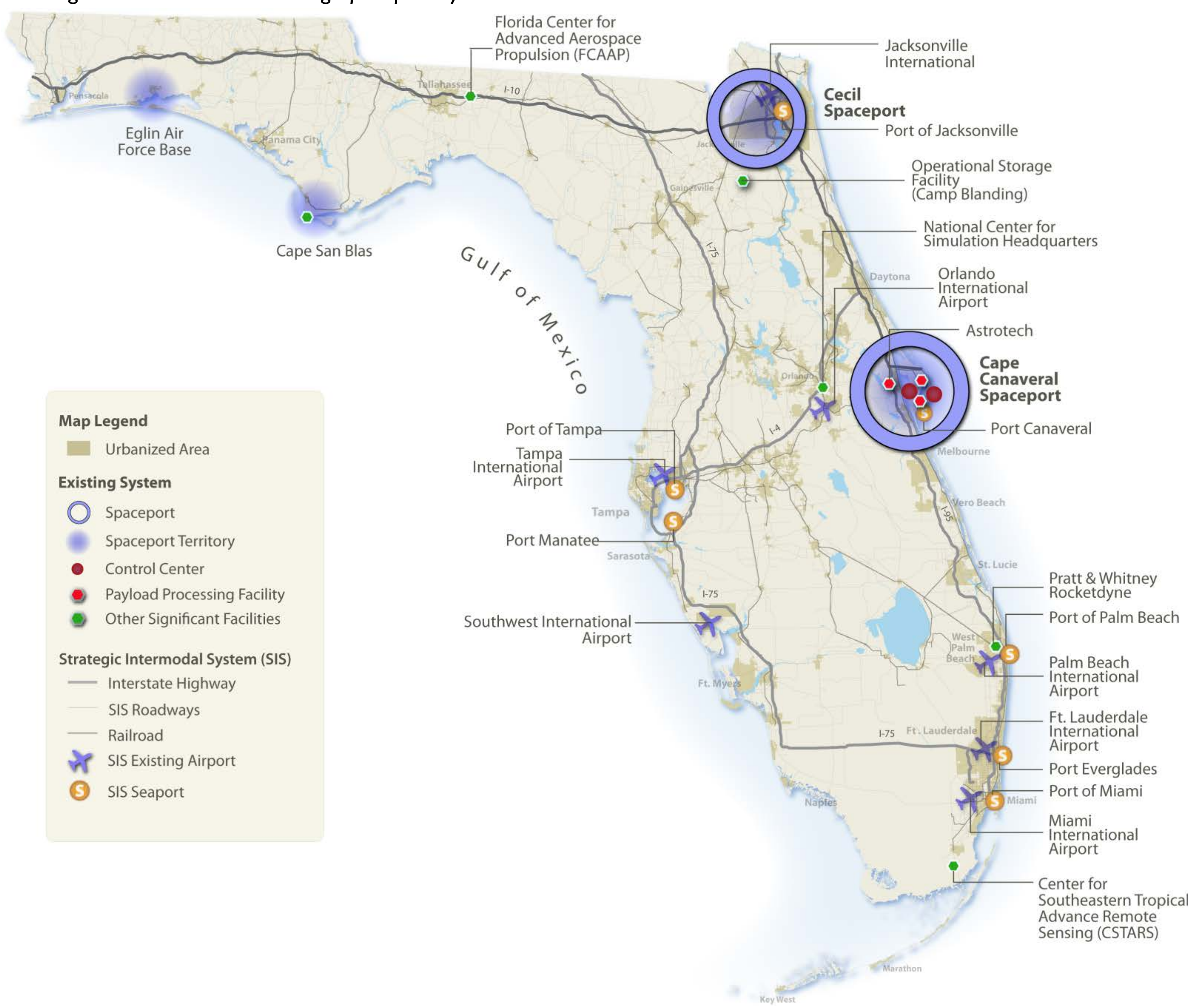
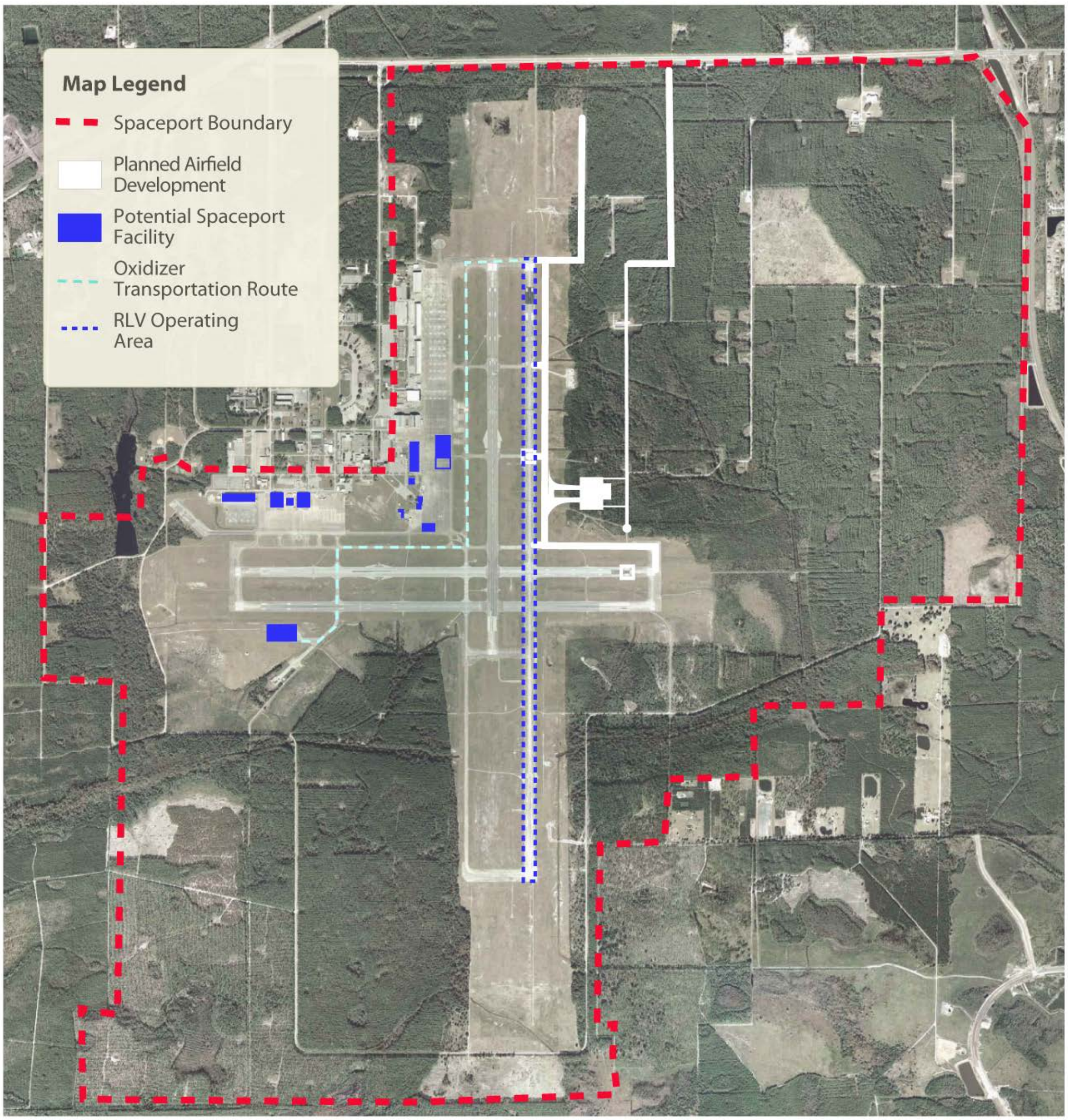


Figure 1.2c Cape Canaveral Orbital Space Launch Complexes and Payload Processing

Cecil Spaceport (Figure 1.2d), which is co-located with Cecil Airport in Jacksonville, is owned and operated by the Jacksonville Aviation Authority (JAA). The existing aeronautical infrastructure includes two runways measuring 8,000 feet in length and 200-feet in width, one runway measuring 4,440-feet in length and 100 feet in width and the primary, which measures 12,500 – feet in length and 200-feet in width. In addition to spaceport operations and general aviation activities, Cecil serves as a Maintenance, Repair and Overhaul facility for Boeing, Flightstar, Pratt and Whitney and the U.S. Navy.

Figure 1.2d Cecil Spaceport Planned Development



The Cecil Spaceport was granted a Commercial Launch Site Operator License by FAA/AST in January 2010. Combined with its existing infrastructure, the location of the spaceport relative to the coast makes the facility conducive to supporting and facilitating horizontal launch activities for RLVs.

As a result of the infrastructure currently in-place, JAA maintains the capability to accommodate the initial horizontal launches at Cecil Spaceport using existing facilities. In March 2012, JAA completed a Spaceport Master Plan, which outlines the recommendations for the development of new spaceport facilities. In the summer of 2012, JAA embarked upon the implementation of the Master Plan. The first phase of the project will include the design and construction of Taxiway 'E' and additional improvements, which will allow for the development of new spaceport facilities. While the majority of the projects included in the implementation plan are programmed for completion in the 2015 – 2018 timeframe, vehicle-specific projects such as assembly facilities and payload processing structures will require operator input prior to design and construction.

FLORIDA CONTROL CENTERS AND AIRSPACE

Currently, all existing launch control centers in Florida are at CCAFS and KSC. Within KSC, LC 39 features a four-story Launch Control Center (LCC) that contains a number of essential facilities, such as the Central Data Subsystem (CDS) computers, four firing rooms, telemetry, radio frequency tracking, instrumentation, and data reduction equipment.

KSC's Launch Control Center

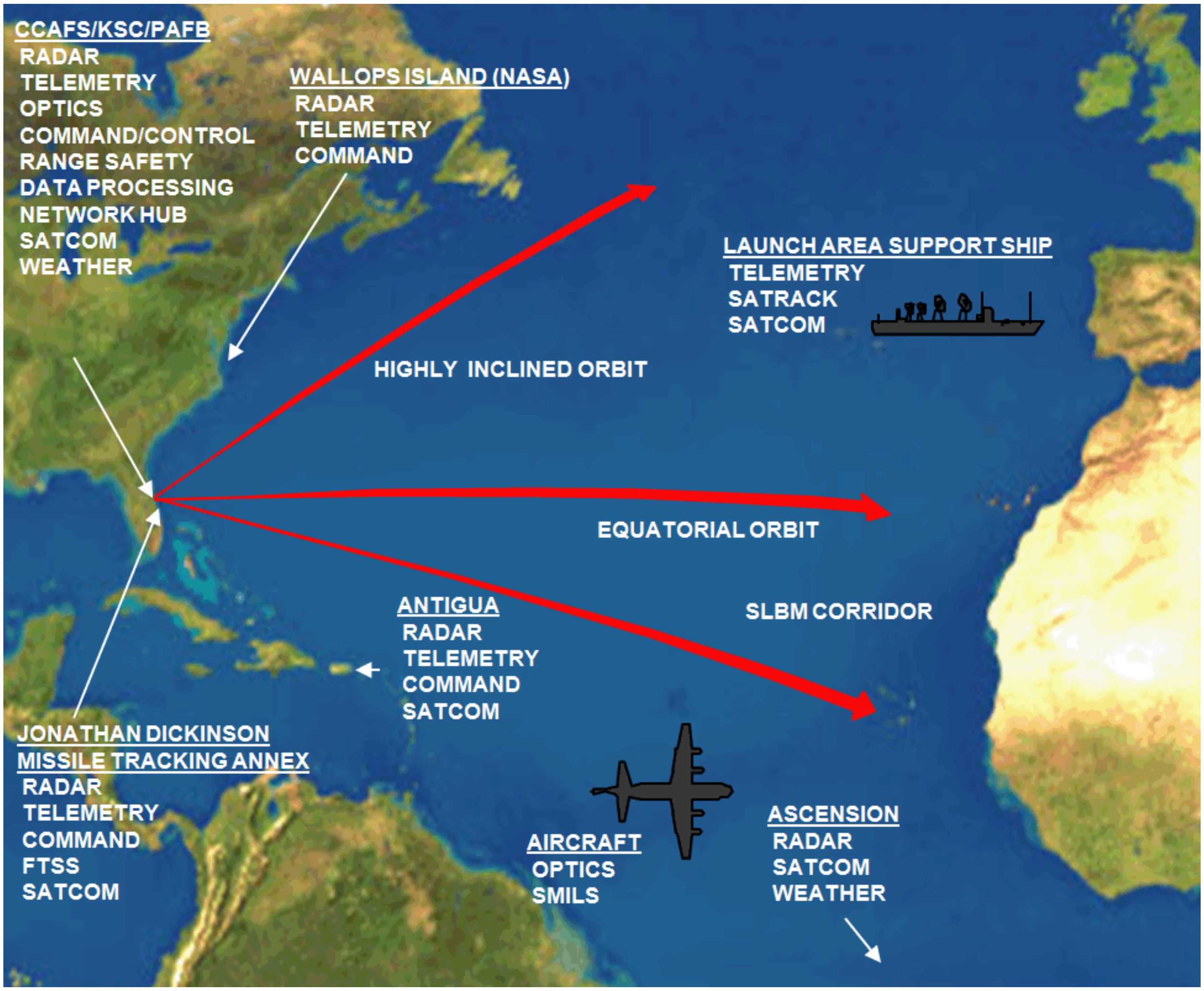
The Morrell Operations Center (MOC) at CCAFS is the hub of Eastern Range operations during launches of expendable vehicles and space shuttles, as well as ballistic missile tests.

The Eastern Range spans from the Atlantic coast of Florida east to the Indian Ocean, encompassing almost 15 million square miles of airspace. This vast airspace is monitored and managed by the MOC, and supplemented by an array of instrumentation systems along the range that tracks vehicles and monitors their performance. Not only is the Eastern Range extremely large, it has the capability to serve every current and projected launch vehicle in the U.S. inventory.

Commercial launch service providers operate control centers of their own. For example, ULA operates an Atlas V Spaceflight Operations Center (ASOC) for Atlas V launches from SLC-41 and a Delta Operations Center near SLC-37 for Delta IV launches. SpaceX has a control center used for Falcon 9 launches from SLC-40 just outside the security gate of CCAFS.

During launch operations, the range control centers must interact constantly with the state's aviation system. Florida has over 125 airports, including 19 commercial service airports that handle about 120 million passengers every year. High volumes of general aviation and commercial passenger service flights within the region present a significant impact to operations at or near the spaceports. During space flight operations from the Cape Canaveral Spaceport, the 45th Space Wing coordinates airspace for the controlled airspace around Cape Canaveral. This airspace can be controlled to minimize impact to air operations while ensuring clear airspace for the flight path of the launch vehicle.

Figure 1.2e Eastern Range



Source: CCAFS

Several launch vehicles are currently launched from sites in Florida, though for the foreseeable future, orbital activity will be limited to CCAFS. Following retirement of the Space Shuttle Program in 2011, no crewed orbital launches are expected from KSC until about 2017, when the Space Launch System (SLS) is introduced. This Shuttle-derived vehicle will be capable of sending 70 metric tons to low Earth orbit and will consist of two versions: one for cargo and another that will carry the seven-person Orion-Multi-Purpose Crew Vehicle (MPCV).

Three orbital vehicles will dominate activity at CCAFS during the next decade. These include the Atlas V and Delta IV, both built and operated by United Launch Alliance, and the SpaceX Falcon 9. The Atlas V and Delta IV were developed in the late 1990s under the Air Force's Evolved Expendable Launch Vehicle (EELV) Program, and entered service in 2002. Eighteen versions of the Atlas V are theoretically available, though only nine have actually been used during the past decade. Five versions of the Delta IV are available, and all versions have flown. The Delta IV launches from SLC-37 and the Atlas V launches from SLC-41. The Falcon 9 has launched successfully three times and to entered operational service in late 2012 with the first commercial resupply mission to the International Space Station. The Falcon 9 is launched from SLC-40.

At CCAFS, there are currently five orbital Space Launch Complexes (both active and inactive).

ULA's Delta IV Heavy Launch Vehicle

- *Space Launch Complex 36 (SLC-36)* was built by NASA in the 1960s and upgraded by the Air Force to support the Atlas/Centaur program. The Atlas infrastructure was demolished in 2006; however, there are still utilities available at the pads. Currently, the complex is prepared for a future commercial launch complex for private companies such as Masten Space Systems using liquid-fuel vehicles.
- *Space Launch Complex 37 (SLC-37)* is currently used to support ULA Delta IV launches.
- *Space Launch Complex 40 (SLC-40)* is currently used to support SpaceX Falcon 9 launches.
- *Space Launch Complex 41 (SLC-41)*. Originally built to support the Titan III/IV program, it is currently used to support ULA Atlas V launches.
- *Space Launch Complex 46 (SLC-46)*. In 1984, this complex was designed to support the U.S. Navy's Trident II ballistic missile efforts. Spaceport Florida supported launches of the Athena I and II from SLC 46 in 1998/99. Currently, the complex could support solid-fueled launch vehicles such as Orbital Sciences' Minotaur vehicle and Lockheed Martin's Athena vehicle. Also, the Navy maintains the capability of resuming Trident missile testing as required.

At KSC, Launch Complex 39 is the launch site for NASA's civil space missions. The major components are the Vehicle Assembly Building (VAB) for launch processing, the LCC for Command and Control, and LC-39A and LC-39B for launch pads. LC-39B is currently undergoing major modifications to support the Space Launch System program for launches later this decade. LC-39A is currently inactive awaiting future disposition.

Additionally, a variety of RLVs are expected to be introduced in the near future. Cecil Spaceport and KSC's Shuttle Landing Facility, for example, are well suited as locations for the operation of suborbital vehicles that launch and land horizontally. Vertically launched suborbital vehicles, such as those offered by Armadillo Aerospace and Masten Space Systems, could also operate routinely from Florida.

FLORIDA PAYLOAD PROCESSING FACILITIES

The Cape Canaveral Spaceport is home to 12 major payload processing facilities, mapped above in Figure 1.2c.

Astrotech

- Operations and Checkout (O&C) Building
- Orbiter Processing Facility 1
- Orbiter Processing Facility 2
- Commercial Cargo and Crew Processing Facility (C3PF)
- Multi-Payload-Processing Facility (MPPF)
- Payload Hazardous Servicing Facility (PHSF)
- Space Station Processing Facility (SSPF)
- SpaceX Payload Encapsulation and Integration Facility

- Large Processing Facility (LPF)
- Eastern Processing Facility (EPF)
- CCAFS Satellite Processing and Storage Area (Area 59)
- Space Life Sciences Laboratory (SLSL)

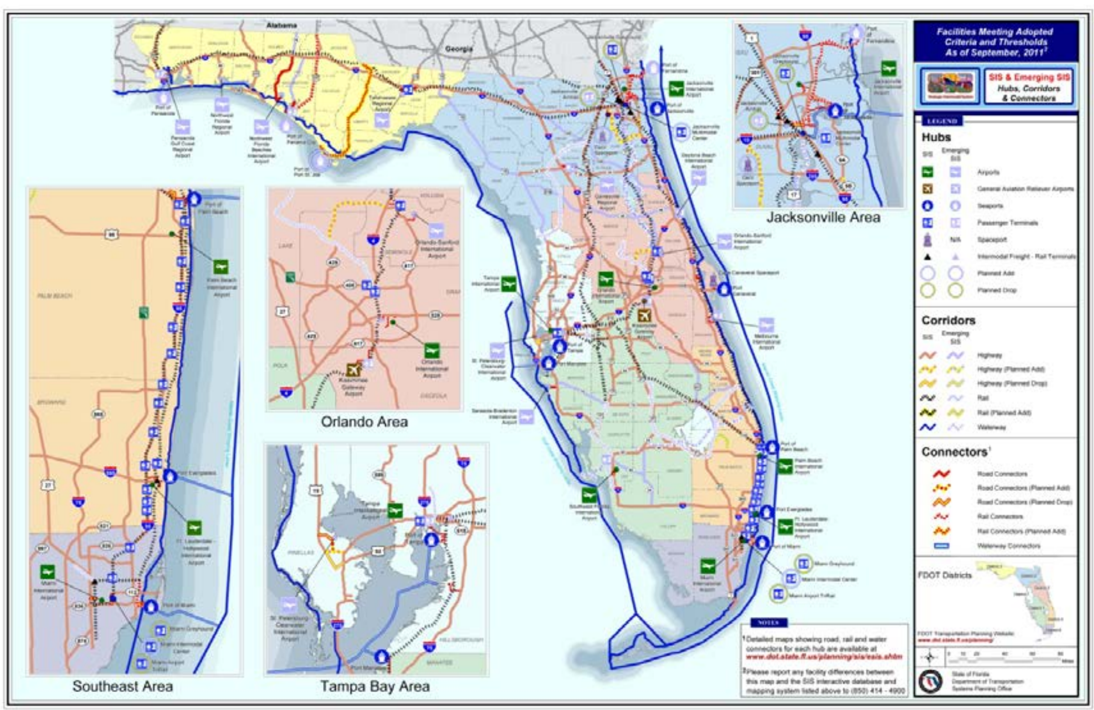
Astrotech is the only major payload processing company in Florida that is not located on the Cape Canaveral Spaceport. However, it is located very close to Spaceport and serves multiple DOD, civil and commercial customers with world-class satellite processing. Astrotech manages 10 buildings dedicated to payload processing. The company also supports payload processing at Vandenberg Air Force Base (VAFB).

FLORIDA INTERMODAL CONNECTIONS

Highway, waterway, and rail facilities are essential components of the spaceport system, particularly in the development and construction of spacecraft and aerospace facilities. The FDOT has identified a statewide network of high-priority transportation facilities, including Florida's most significant airports, seaports, rail, waterways, and highways. These facilities have been identified as the state's "Strategic Intermodal System" (SIS) and also include the most important transportation facilities for Florida's spaceport system.

The Cape Canaveral Spaceport provides easy access to all four modes of transportation from highway to rail to sea to air. The Cecil Spaceport also provides access to the State's SIS with easy access to roads, rail, and air. Figure 1.2f, below, is a map of Florida's SIS. The facilities illustrated in the map represent a full integration of individual facilities, services, and forms of transportation that create a complete network; it carries more than 99 percent of all commercial air passengers and cargo, almost all rail freight, 89 percent of interregional rail and bus passengers, 70 percent of all truck traffic, and 55 percent of all roadway traffic.

Figure 1.2f Florida's SIS



Source: FDOT

OTHER SIGNIFICANT FLORIDA FACILITIES

The 2010 Spaceport Master Plan identified a number of other major facilities in Florida's spaceport system: the Operational Storage Facility at Camp Blanding used for solid motor storage, and the inactive Cape San Blas Launch Site at Eglin Air Force Base, once used for sounding rocket launches. Other significant aerospace facilities exist in Florida, such as modeling and simulation laboratories, satellite data centers, wind tunnels, and propulsion test facilities. Representative samples of these types of facilities, shown in Figure 1.2b above, include:

- *Center for Southeastern Tropical Advance Remote Sensing (CSTARS).* Run by the University of Miami, the CSTAR in southern Dade County is a state-of-the-art ground station that gathers satellite imagery for monitoring major storm events such as hurricanes.

- *National Center for Simulation.* Headquartered in Orlando, the National Center for Simulation is a consortium of over 180 modeling, simulation, and training companies; part of its core mission is to enhance defense readiness and advance space exploration through simulation research and training.

- *Florida Center for Advanced Aerospace Propulsion (FCAAP).* Located in Tallahassee and associated with Florida State University, FCAAP has a number of highly advanced facilities, including three wind tunnels, sensor and actuator labs, combustion facilities, a propulsion and aerodynamics computational laboratory, and a short takeoff and vertical jet facility.

- *Pratt & Whitney Rocketdyne.* Pratt & Whitney is a global leader in the development of space propulsion systems, particularly rocket engines that use liquid propellants. It has been a key provider of engines to the U.S. space program since it began and was part of over 1,600 launches. Though headquartered in California, it has an operations center in West Palm Beach.

1.3 Governance and Funding

Florida's Spaceport System is predominantly owned and managed by six different partners:

- *NASA.* As the owner of Kennedy Space Center, NASA manages Space Launch Complex 39. It also runs the one of the largest control centers in Florida's system, the Launch Control Center (LCC) near LC 39. All launches from KSC use the Eastern Range.

- *U.S. Department of Defense (DOD)/United States Air Force.* As the owner of Cape Canaveral Air Force Station, the 45th Space Wing operates the Eastern Range in support of all launches from the Cape Canaveral Spaceport. It operates the Morrell Operations Control Center (MOC), launch complexes, and numerous payload processing facilities.

- *Federal Aviation Administration (FAA).* The FAA manages all U.S. airspace, licenses commercial operators, and manages airspace in support of Eastern Range launches.

- *Jacksonville Aviation Authority (JAA).* JAA owns and operates the commercial facilities at Cecil Spaceport.

- *Space Florida.* Space Florida is designated by the Florida Legislature to be "the single point of contact for state aerospace-related activities with federal agencies, the military, state agencies, businesses, and the private sector." In addition to promoting aerospace in Florida, Space Florida also manages a number of major facilities including Launch Complex 36, Launch Complex 46, the Space Life Science Lab (SLSL) and the Reusable Launch Vehicle Hangar. Space Florida also works very closely with other licensed spaceports in Florida (such as Cecil Spaceport) to facilitate spaceport infrastructure investment.

- *Florida Department of Transportation (FDOT).* FDOT plans and invests in the state's transportation system, with a growing emphasis on its Strategic Intermodal System (SIS), which includes the Cape Canaveral Spaceport.

The Spaceport System also includes facilities owned and managed by municipal and county governments, seaports and airports. Other agencies involved in Florida's Spaceport System include the Space Coast Metropolitan Planning Organization, Florida Department of Economic Opportunity, Enterprise Florida, Inc, Workforce Florida, Inc, Metropolitan Planning Organization (MPO) Advisory Council, Florida Department of Education and the Florida Commission on Tourism.

PROGRAM FUNDING

All Florida Spaceport System partners receive annual funding to accomplish their individual missions. NASA receives funding for space exploration from the United States Government as part of the annual federal budget approved by Congress each year. The U.S. DOD, U.S. Air Force funds the 45th Space Wing's mission to manage CCAFS and operate the Eastern Range. Space Florida receives annual operations funding from the Florida Legislature to foster the growth and development of the aerospace industry in Florida and capital funding for infrastructure improvements from FDOT.

As an independent special district of the state of Florida, Space Florida has unique financing capabilities that can reduce the overall cost of an infrastructure project for aerospace customers. Space Florida's tax-exempt status enables the organization to negotiate optimal terms on loans and reduce the overall tax burden associated with the construction of such facilities.

Figure 1.3a Principal state-facilitated funding investments to date

FACILITY	FUNDING/FINANCING	PROGRAM/PROJECT
Complex 41	$284,000,000 financed	EELV/Atlas V
Complex 40/Hangar AO	$7,500,000 funded	COTS/SpaceX Falcon9
Complex 37 IF	$24,000,000 financed	EELV/Delta IV
Complex 36	$1,200,000 funded	Cape Canaveral Spaceport
Complex 46	$5,800,000 funded	Cape Canaveral Spaceport
KSC O&C High Bay	$35,000,000 funded	NASA MPCV (Orion)
Space Life Sciences Lab	$30,000,000 funded	ISS & ISS National Lab
Space Commerce Way	$5,000,000 funded	KSC Institutional
RLV Support Complex SLF	$5,500,000 funded	Cape Canaveral Spaceport
OPF 3 Re-Purposing	$6,500,000 funded	Commercial Crew Program
Exploration Park	$7,500,000 funded	Cape Canaveral Spaceport
Apollo/Saturn V Center Shuttle Atlantis Exhibit	$25,000,000 financed $62,500,000 financed	KSC Public Visitor Program
TOTAL KSC AND CCAFS	**$509,000,000**	**NASA, USAF, Commercial**

Source: KSC

It works with the state of Florida, NASA, DOD, FAA and other important stakeholders and agencies to streamline the process of bringing space-related business to Florida. In support of this development, Space Florida is providing financial assistance, legislative support, customer assistance, and pre-negotiated access to launch complexes.[v] Through state appropriations from various funding lines and its independent special district powers, Space Florida has been able to bring more than $500 million in financial resources to the table (Figure 1.3a), leveraging the investments of industry and the U.S. Government to provide essential program and mission capabilities for both NASA and the DOD.

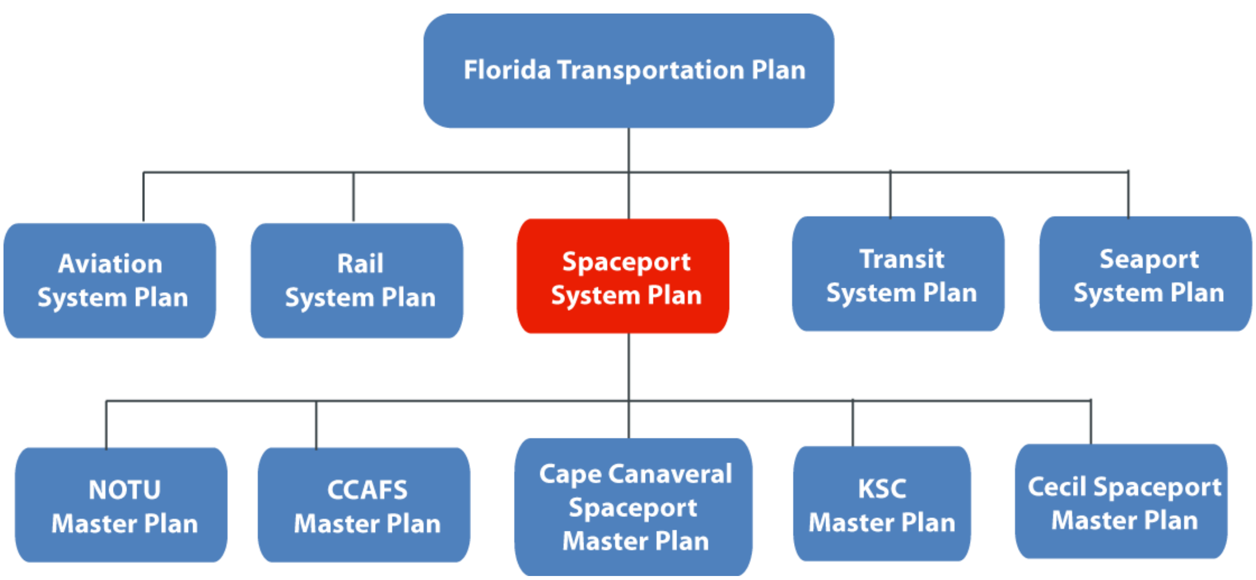
It is important to note that U.S. Code Titles 10 and 51 currently preclude Space Florida from contributing funds to operational federal facilities.

Additionally, funding may be available for spaceport infrastructure through FDOT grants to Space Florida. Infrastructure that is designated as part of the state's SIS gets priority consideration for funding. As part of the 2010 SIS plan, 75 percent of all discretionary capacity funding is targeted for SIS projects statewide.

In order to maximize the use of their individual funds, the partner agencies look for opportunities to collaborate on initiatives, programs and projects that serve their common interests with the statewide Spaceport System. It is important to note, however, that the U.S. Code Titles 10 and 51 preclude Space Florida from contributing funds to operational federal facilities. This may change in future legislation that would allow Space Florida to facilitate the development of facilities that could also support commercial ventures.

The Spaceport System Plan guides state infrastructure funding across the Spaceport System. Individual facility-specific Master Plans will inform the statewide System Plan. Figure 1.3b illustrates the relationship between the System Plan and the various Master Plans.

1.3b. Florida Spaceport System and Master Planning



1.4 Summary

Florida has a robust existing spaceport system. With the facilities at Cape Canaveral and the recent licensure of Cecil Spaceport, there is a substantial amount of investment already in the state's spaceports, control centers and airspace, launch vehicles, spacecraft, payload processing, and intermodal infrastructure. However, the market for spaceflight is changing, and the existing system must respond to these shifting needs and demands of new customers. Section 2 includes an analysis of projected market demand, needs, and issues particular to Florida's Spaceport System.

PART 2 DEMAND AND NEED

This section of the Florida Spaceport System Plan describes the demand for orbital and suborbital space transportation and the associated transportation needs that the state of Florida can expect as a result. It also describes several related issues related to how Florida can more effectively position itself to address markets reliant on space transportation.

2.1. Demand

Historically, Florida has been known as the home of U.S. human space flight, and it has the capacity to be the world leader in space industry growth. By identifying opportunities in the market and focusing its efforts on the 10 market segments outlined below, Florida can position itself to meet the demands of the industry:

- Space transportation and technologies support systems
- Satellite systems and payloads
- Ground and operations support systems
- Agriculture, climate and environmental monitoring
- Civil protection and emergency management
- International Space Station (ISS) and human life sciences
- Communications, cybersecurity and robotics
- Adventure tourism
- Clean energy
- Advanced materials and new products

On the following page, Figure 2.1a illustrates Space Florida's "Vision 2020" to target 10 commercial markets that will fully use Florida's space launch and processing capabilities, existing skilled workforce, and infrastructure assets statewide. These markets are expanding their use of space-based technologies every day, and Florida plans to become a critical part of the launch, processing, integration and supply chain opportunities that will result.

The expanding scope of space capabilities in Florida to include Cecil Spaceport and other initiatives necessitate detailed planning and investment in the relationship between the space industry and the 10 markets identified. Figure 2.1a illustrates the how the 10 industries fit within Space Florida's "Vision 2020." Three markets – space transportation and technologies support systems, satellite systems and payloads, and ground and operations support systems – are integral to the space industry. The other six markets use space technology and provide significant opportunities for continued growth.

To understand market demand, the following analysis examines these 10 markets in terms of orbital and suborbital markets, Florida's potential position in those markets, and how issues related to future demand will be addressed.

Figure 2.1a. Space Florida's Vision 2020[vi]

ORBITAL MARKET

Orbital space transportation involves the use of vehicle systems capable of sending payloads into orbit around the Earth, the Sun, or other celestial bodies. These vehicles can either be expendable or reusable, though the vast majority of systems used to date have been of the expendable variety. Nine countries currently have the capability to conduct orbital launches: United States, Russia, China, France, Japan, India, Israel, Iran, and recently North Korea.

In the United States, orbital launches are conducted from five federal launch sites and four commercial launch sites. Of the four commercial sites, three are co-located with federal sites. Alaska's Kodiak Launch Complex is the only commercial launch site not co-located on a federal site.

Global Activities

There is an average of approximately 70 orbital launches conducted worldwide each year. Of these, about 70 percent are government-procured launches, and 30 percent are commercial launches.[2] Since 2004, the annual number of orbital launches has increased from a low of 54 to a high of 84 in 2011. This increase is attributed mainly to a greater number of government launches, as the annual number of commercial launches has remained relatively flat during the past 10 years.

> *There are approximately 70 orbital launches conducted worldwide every year.*

[2] A commercial launch is one in which a customer shopped internationally for launch service providers. In addition, all launches licensed by the Federal Aviation Administration's Office of Commercial Space Transportation are classified as commercial.

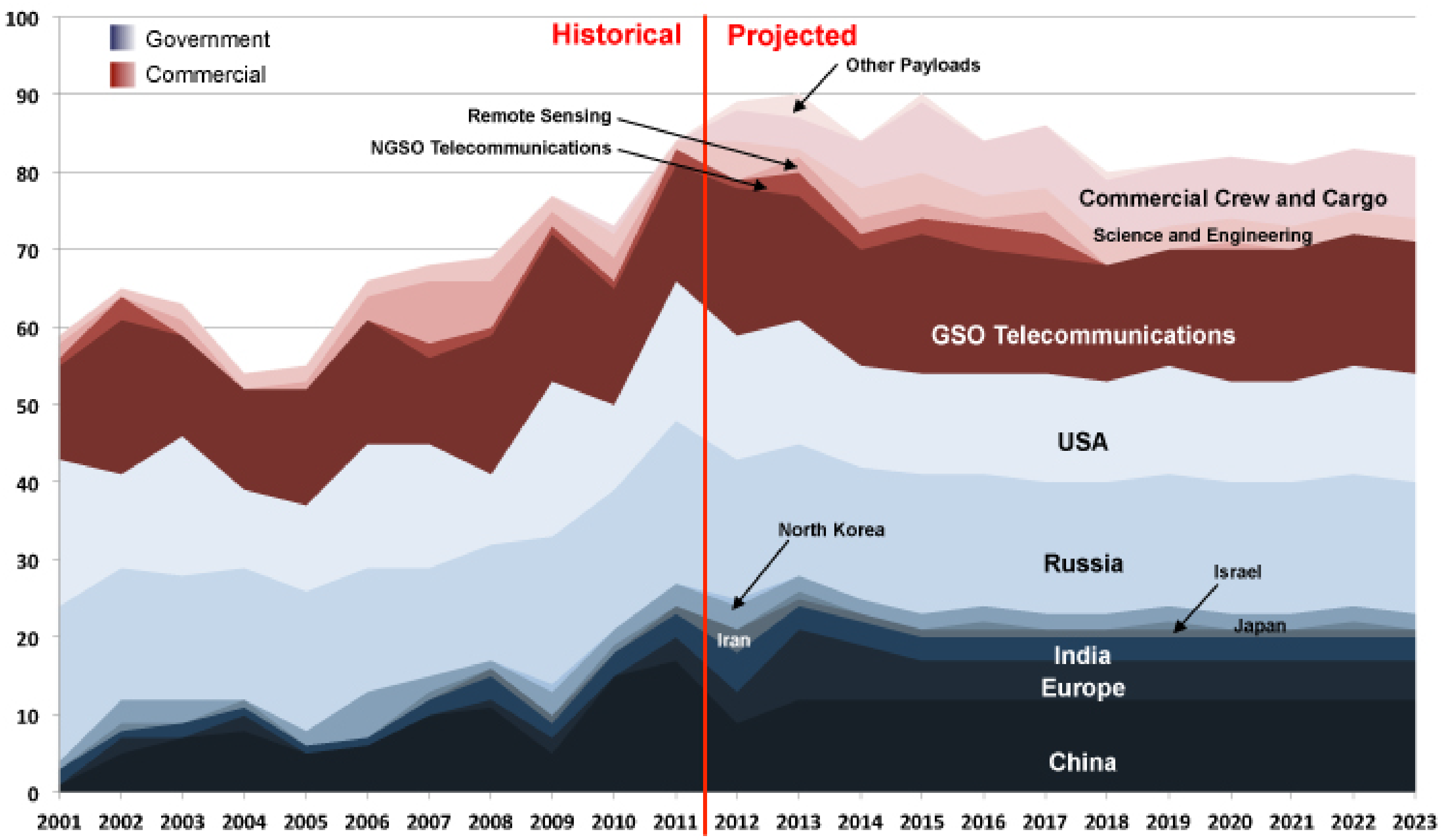
Figure 2.1b. Total number of orbital launches conducted by country (2002-2011)

	Total number of non-commercial orbital launches conducted from 2002-2011	Total number of commercial orbital launches conducted from 2002-2011
Russia	171	91
USA	141	36
China	89	3
Europe	10	51
Japan	25	0
India	18	1
Israel	4	0
TOTAL	**458**	**182**

Source: The Tauri Group

Figure 2.1b compares the total orbital non-commercial and commercial launches conducted by country. Russia has led the world in terms of the number of orbital launches conducted since 2002, with a total of 262, 91 of which were commercial. The United States launched 177 missions during the same time period, but only 36 of these were commercial. For the same 10-year period, China launched 92 missions (only three of which were commercial); Europe launched 61 (51 of which were commercial); Japan launched 25; India launched 19 (one of which was commercial); and Israel launched four.

Figure 2.1c. Actual and forecast worldwide orbital launches by country (2001-2023).



Source: The Tauri Group

A 10-year supply-based forecast of worldwide orbital launches is illustrated in Figure 2.1c. The blue fields indicate projected government launches and the red fields indicate commercial projections. Government launches are based on historical trends as well as announced plans. The commercial forecast is derived from the FAA's Commercial Space Transportation Forecasts published in May 2012. It is clear that worldwide orbital launches are projected to be relatively flat through the forecast period. However, because this is a supply-based forecast (i.e., a forecast based on what launch providers intend to do, rather than a forecast based on demand for space-based services translated into launches), changes in demand for satellite services could change the projections significantly. For example, emerging markets such as commercial human spaceflight represent a potential opportunity for growth beyond the existing, more mature markets.

U.S. Activities and Opportunities

The U.S. conducts an average of 18 orbital launches per year, most of which support U.S. Government missions. The majority of these (about 12 per year) launch from Cape Canaveral. The principal vehicles used by the U.S. have been the Atlas V, Delta II, Delta IV, and the Space Shuttle. Some launches also featured the Pegasus and Taurus vehicles offered by Orbital Sciences, the former having been launched a few times from Florida. The vehicle mix for the next 10 years will be significantly different due to the retirement of the Space Shuttle and Delta II, and the introduction of the Orbital Antares and the SpaceX Falcon 9.

U.S. historical and forecast launches by vehicle are provided in Figure 2.1c. Forecasted U.S. Government launches are based on public information combined with historical trends and NASA's projected launch manifest. Forecasted commercial launches are based on the May 2012 Commercial Space Transportation Forecasts report, released by the Federal Aviation Administration (FAA) Office of Commercial Space Transportation.

Commercial Launches Expected to Increase in the U.S.

The U.S. captures only a handful of commercial launches each year, with Russia and Europe having most of the market share. However, the number of commercial launches conducted by the U.S. is expected to increase during the next 10 years as commercial cargo services to the ISS take place provided by the Orbital Sciences Corp. (Orbital) Antares and the SpaceX Falcon 9. The first flight to the International Space Station (ISS), conducted by SpaceX from CCAFS, took place in October 2012. Orbital is expected to begin providing cargo transport from Virginia's Mid-Atlantic Regional Spaceport (MARS) in 2013. About five such flights will be conducted each year beginning in 2014. In addition, commercial crewed flights to ISS are expected to begin taking place by 2017, adding two more commercial flights per year from the United States. Boeing, Sierra Nevada Corporation, and SpaceX are competing to provide commercial crew transportation services. Finally, while United Launch Alliance (ULA) will continue to serve the U.S. Government market with its Atlas V and Delta IV, SpaceX and Orbital are already marketing their new vehicles to international customers. The initial market for the Antares and Falcon 9 will be NASA's commercial crew and cargo program, but both companies hope to capture the commercial communications satellite market. As of December 2012, the SpaceX manifest shows 27 commercial and foreign government missions. They also recently received launch contracts from the Air Force.

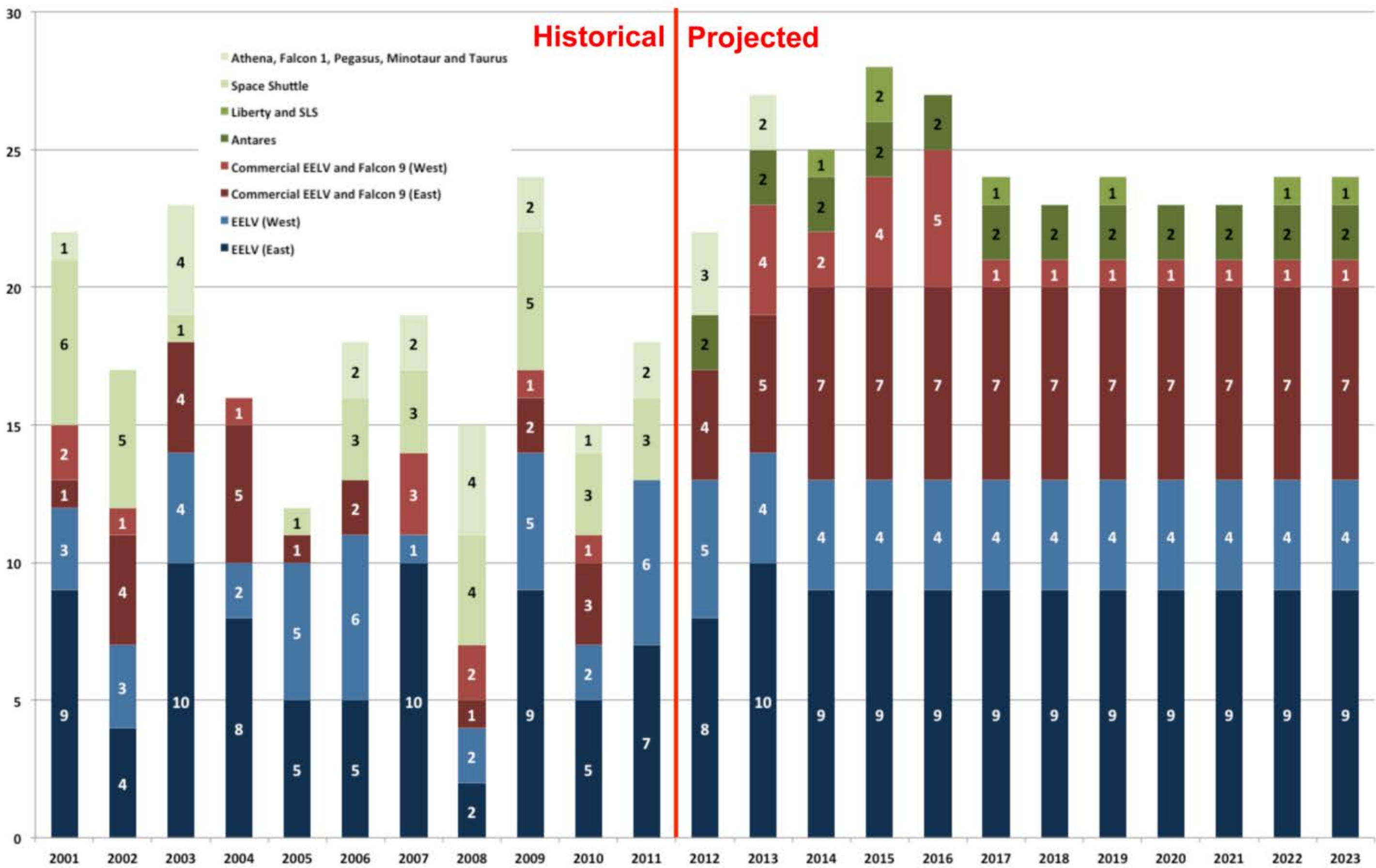


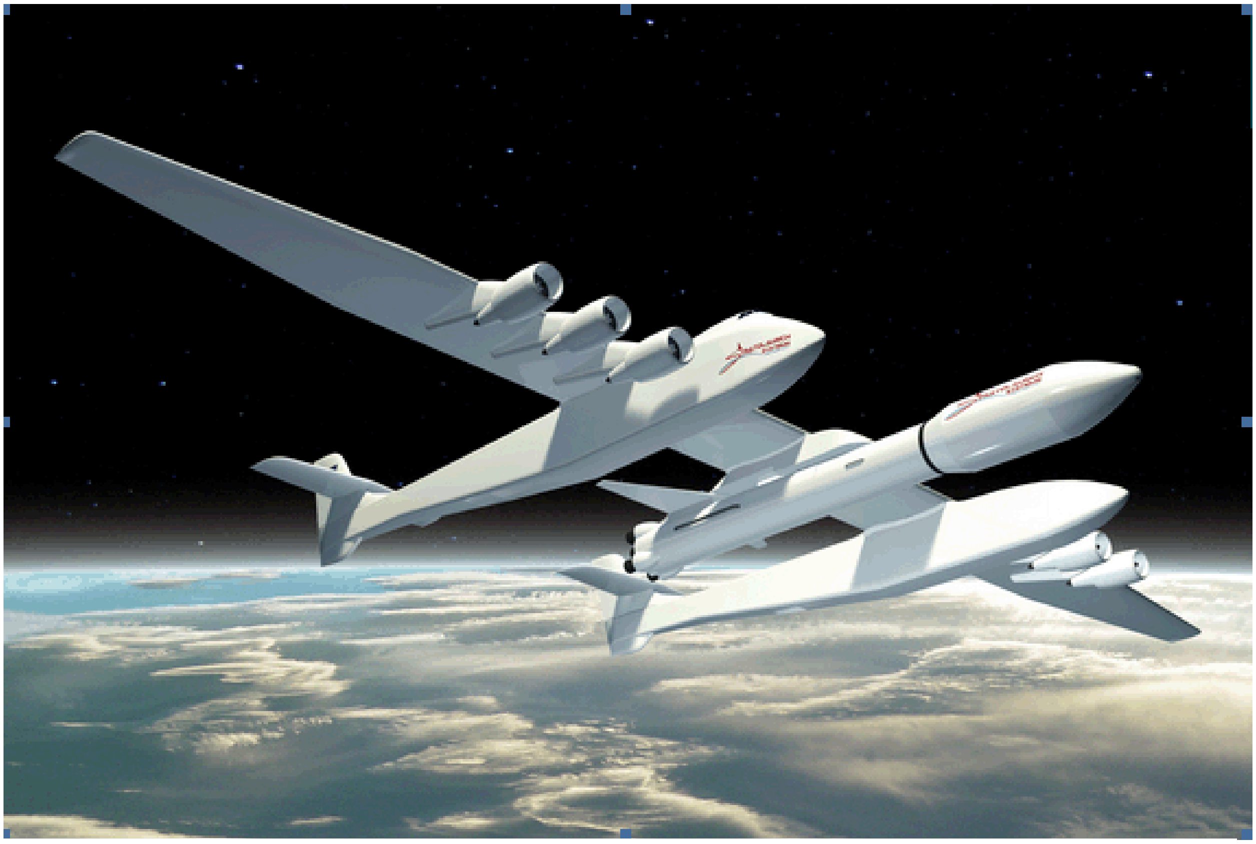
Figure 2.1d. Actual and forecast U.S. orbital launches by vehicle (2001-2023).

Florida Activities and Opportunities

A total of 118 orbital launches were conducted from Florida between 2002 and 2011, an average of about 12 per year. Twenty-two of these were commercial, an average of about two per year. During the next 10 years, the average number of orbital launches conducted from the Cape is expected to increase to 17, with seven per year being commercial. The increase is due mainly to the introduction of commercial cargo and crew services to the ISS beginning in 2012. Note, the number of small- and medium-class vehicles used to support government missions drops off after 2011. This is due in part to retirement of the Delta II. Government cargo and crew flights for some years beginning in 2017 are those taking place as part of NASA's Space Launch Initiative (SLS).

As new launch vehicles, such as the Antares, Athena, Falcon 9, Falcon Heavy, Stratolaunch, and potentially others, enter the launch market and NASA relies more on commercial vehicles to resupply the ISS, the next 10 years could see changes in the orbital launch industry. Currently, the Falcon 9 is the only newly introduced orbital vehicle launched from Florida. Of the 27 launches on the SpaceX manifest, 19 are planned for launch from CCAFS SLC-40 (eight flights will be conducted to support deployment of Iridium NEXT satellites, which are launched on polar trajectories from VAFB). However, Cape Canaveral Spaceport's SLC-46 is capable of supporting Athena launches, and SpaceX is currently exploring options to use existing infrastructure at the Cape to support Falcon Heavy flights. Though no public plans to launch Antares or Stratolaunch from Florida exist, it is possible these launch systems could be introduced to the state.

Source: The Tauri Group



An artist rendering of Stratolaunch, which could be introduced for launch in Florida.

Several assets located at KSC have been made available to various orbital launch vehicle providers and suppliers. Nevertheless, much of KSC's infrastructure will support NASA's SLS and Orion Multi-Purpose Crew Vehicle.

Implications

Florida has the capacity to launch any class of LV using its existing infrastructure. Almost any launch vehicle could be launched from Florida.

Forecasted worldwide launch activity can be analyzed further in terms of likelihood of occurring from Florida. Existing launches include those that have been manifested to launch from the Cape, or those that have historically taken place from the Cape. Probable launches are based on payload projections from FAA's May 2012 Commercial Space Transportation Forecasts and other similar sources. Payloads destined for launch within the next two to three years are typically assigned to a specific launch vehicle. However, after this time, assumptions must be made based on vehicle capacity, historical data, and public statements. In addition, NASA's SLS launches are considered probable (as opposed to existing) because the system will not be introduced until 2017 and is subject to changes.

Possible launches are more difficult to determine, since theoretically almost any launch vehicle could be launched from Florida. However, the following considerations were made in this regard:

- Commercially procured science and engineering flights (and some foreign military payloads) currently captured by Russia using small- and medium-class vehicles could be captured by Florida using small vehicles, contingent on reliability and price competitiveness.

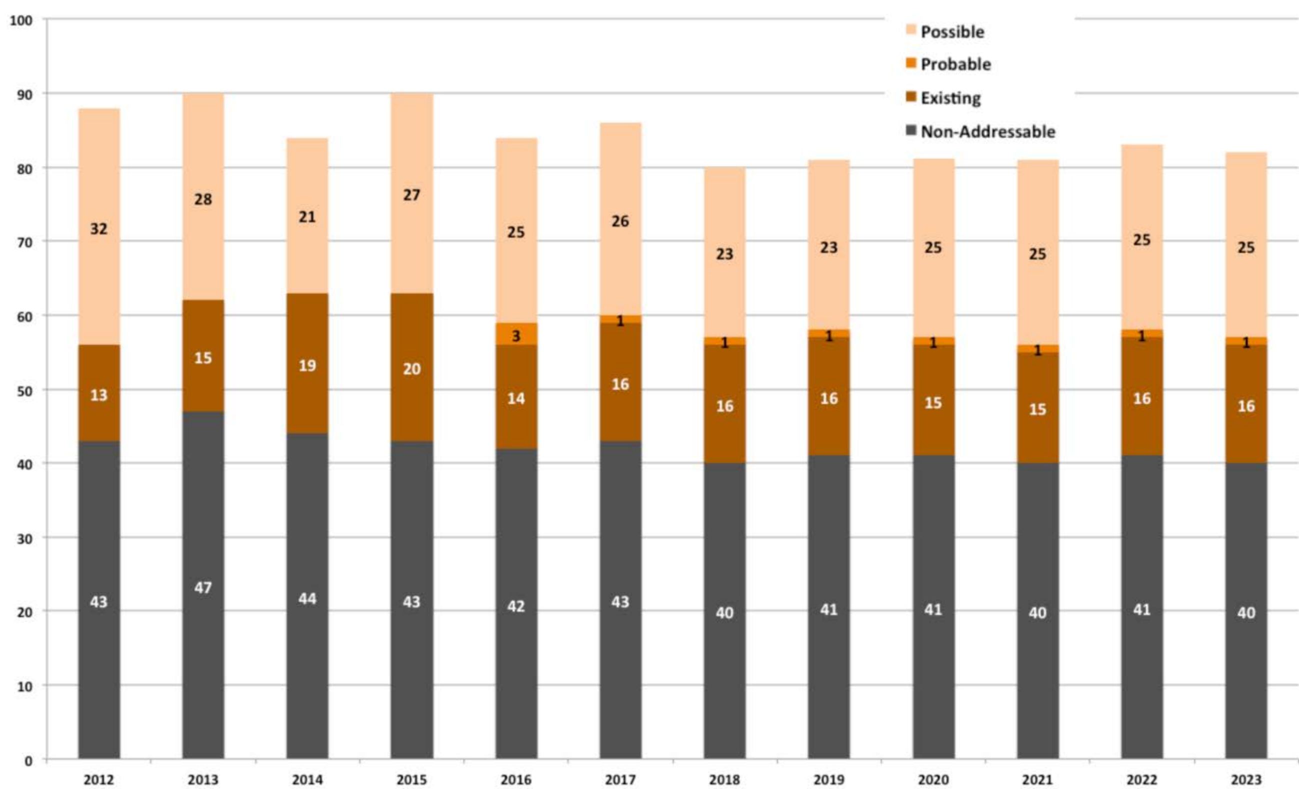
- Commercial telecommunication satellite launches to geosynchronous orbit (GEO) could increase significantly if a Florida-based provider captured market share from dominant Arianespace and International Launch Services.

- Cargo flights currently planned from Virginia's Mid-Atlantic Regional Spaceport (MARS) using the Antares vehicle could be launched from CCAFS, either on and Antares vehicle (requiring a new or modification of existing pad) or on a Falcon 9 from SLC-40.

- SpaceX is evaluating an additional commercial launch site. Commercial missions from CCAFS to the ISS will remain in Florida; other commercial heavy lift missions could be conducted at an additional launch site.

- Although few are currently manifested, non-polar U.S. Government launches using small vehicles like Athena, Minotaur, Pegasus, and Taurus from Kwajalein, VAFB, and Wallops Flight Facility could be launched from Florida. These decisions would be primarily driven by mission considerations and other factors.

Figure 2.1e Possible, probable, existing, and non-addressable orbital missions projected for the state of Florida based on worldwide orbital launch forecast (2012-2023).



Source: The Tauri Group

Figure 2.1e shows the breakdown by year of existing, probable, possible and non-addressable launches based on worldwide orbital launch forecasts. Florida can expect continued robust numbers of government launches. Government launch activity during 2012-2023 is projected to include about 84 Atlas V launches and 24 Delta IV launches. However, only one small-class vehicle launch is manifested for the 2012 to 2013 timeframe. In terms of commercial activity, Florida can expect about 11 launches of GEO telecommunication satellites (two Atlas V launches, eight Falcon 9 launches, and one Falcon Heavy launch). For non-GEO missions, Florida can expect three ORBCOMM launches aboard Falcon 9 vehicles and one uncrewed DragonLab mission launched aboard Falcon 9 vehicles in 2014 and 2015. A Falcon 9 is also manifested to send a Canadian satellite, CASSIOPE, into orbit during the forecast period, and an Atlas V is projected to support the launch of a Bigelow inflatable module around 2015.

SUBORBITAL MARKET

In terms of suborbital launches, the number of sounding rocket launches conducted worldwide that reached an altitude of 81 kilometers (50 miles) has dropped precipitously since the end of the Cold War in 1991, from a high of 730 to fewer than 100 per year since 1991. An average of 32 sounding rocket launches has been annually conducted worldwide since 2002, with most taking place from Anodya Rocket Range in Norway, and White Sands Missile Range, New Mexico.[3] A spike in the number of sounding rocket launches does occur in some years, and this is mainly due to a particular research program requiring multiple launches within a short launch opportunity window. An example would be in 2003 when 53 sounding rocket launches were conducted from Kiruna, Sweden.

The introduction of RLVs during the next 10 years will likely spur a significant increase in the number of suborbital launches.

The number of sounding rocket launches is not expected to increase during the next decade, with fewer than 100 launches being conducted each year. However, the introduction of RLVs during the next 10 years will likely spur a significant increase in the number of suborbital launches. Because the number of sounding rocket flights is expected to remain essentially unchanged during the next 10 years, and RLVs represent a potentially significant emerging market, emphasis will be on RLVs in this section.

Global activities

Nine RLVs by six companies are currently in active planning, development, or operation. The payload capacity of these RLVs ranges from tens of kilograms to hundreds, with the largest currently planned vehicle capacity being about 700 kilograms (1,543 pounds). RLVs are expected to address at least six individual markets, including commercial human spaceflight, basic and applied research, aerospace technology test and demonstration, media and public relations, education, and satellite deployment. Remote sensing does not appear to be a significant market for RLVs, and point-to-point transportation appears an unlikely capability in the near term. A number of RLVs can carry humans, with current designs for one to six spaceflight participants in addition to one or two crewmembers.

Total projected demand for RLVs, across all six markets, grows from around 370 seat/cargo equivalents in Year 1 to over 500 seat/cargo equivalents in the tenth year of the baseline case. Demand under the growth scenario, which reflects increases due to factors such as marketing, research successes, and flight operations, grows from about 1,100 to more than 1,500 seat/cargo equivalents over 10 years. The constrained scenario, which reflects significantly reduced consumer spending and government budgets, shows demand from about 200 to 250 seat/cargo equivalents per year. [vii]

[3] This number does not include missile defense tests conducted from the Kodiak Launch Complex, Alaska; the Ronald Reagan Ballistic Missile Defense Test Site, Kwajalein Atoll in the Republic of the Marshall Islands; or the Vandenberg Air Force Base (VAFB), California. When these are included, the average number of suborbital launches jumps to about 44.

2.1f 10-year RLV demand forecast

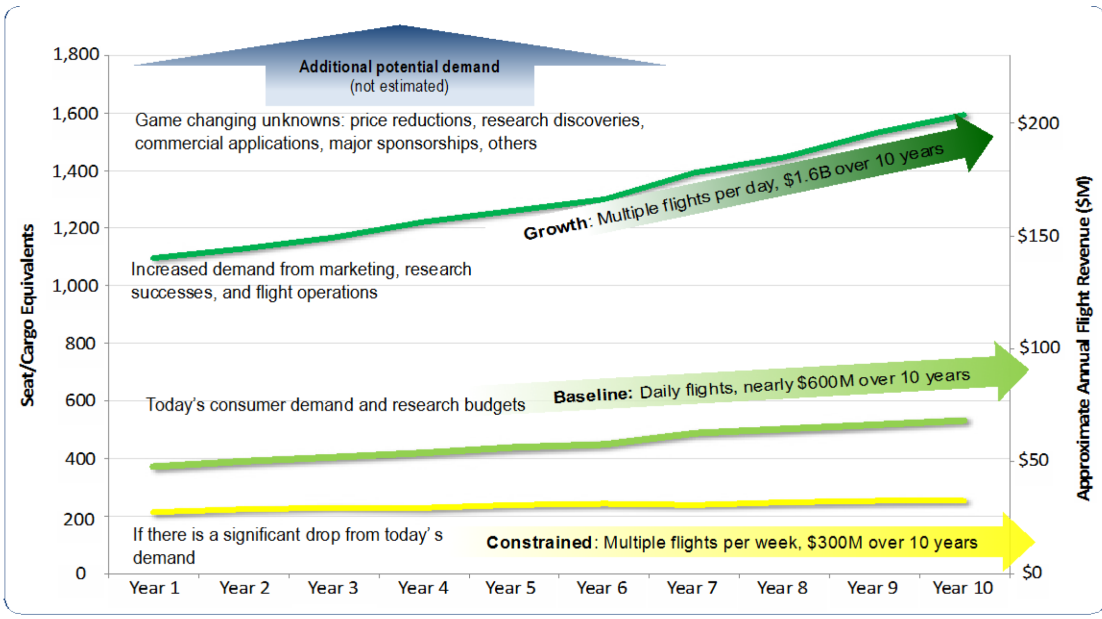


Figure 9: 10-year SRV demand forecast

Source: The Tauri Group

Figure 2.1g. Total projected demand for SRVs across all markets, in seat/cargo equivalents per year

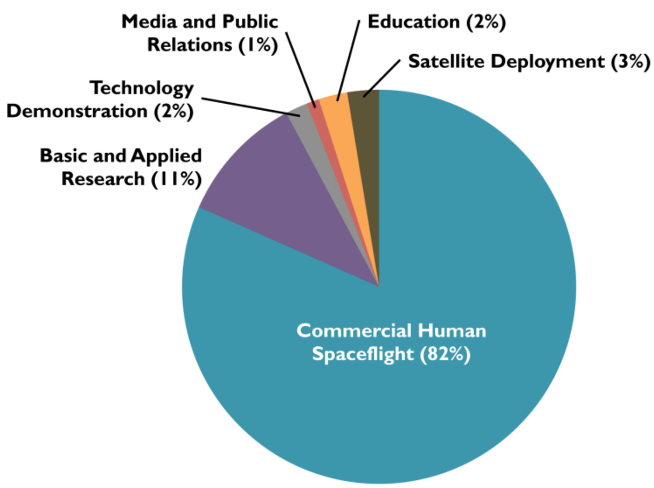
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total
Baseline Scenario	373	390	405	421	438	451	489	501	517	533	4,518
Growth Scenario	1,096	1,127	1,169	1,223	1,260	1,299	1,394	1,445	1,529	1,592	13,134
Constrained Scenario	213	226	232	229	239	243	241	247	252	255	2,378

Source: The Tauri Group

Worldwide demand for suborbital flights is sustained and appears sufficient to support multiple providers. Total baseline demand over 10 years exceeds $600 million in SRV flight revenue, supporting daily flight activity. The baseline reflects predictable demand based on current trends and consumer interest. In the growth scenario, reflecting increased marketing, demonstrated research successes, increasing awareness, and greater consumer uptake, multiple flights per day generate $1.6 billion in revenue over 10 years. In a constrained scenario, where consumer and enterprise spending drop relative to today's trends, multiple weekly flights generate about $300 million over 10 years. Further potential could be realized through price reductions and unpredictable achievements such as major research discoveries, the identification of new commercial applications, the emergence of global brand value, and new government (especially military) uses for SRVs. Given that these markets are worldwide, Florida's share of that market will likely be a smaller subset.

In Figure 2.1h, it is clear that demand for RLVs is dominated by the commercial human space flight market. About 8,000 high net worth individuals from across the globe are sufficiently interested and have spending patterns likely to result in the purchase of a suborbital flight with one-third from the United States (based on global wealth distribution). The interested population will grow at the same rate as the high net worth population (about 2 percent annually). It is estimated that about 40 percent of the interested, high net worth population, or 3,600 individuals, will fly within the 10-year forecast period. The resulting baseline forecast is 335 seats in the first year, growing to nearly 400 seats by year 10, totaling about 4,000 over 10 years. The growth scenario predicts a total of 11,000 seats, the constrained scenario a total of 2,000. About 925 individuals currently have reservations on RLVs.

Figure 2.1h. Relative RLV market size over 10 years.



Source: The Tauri Group

The second largest area of demand focuses on the use of RLVs to support basic and applied research missions, funded primarily by government agencies and not-for-profits institutes, universities, and commercial firms. This segment accounts for about 11 percent of baseline demand. RLVs can support a wide range of possible activities, but offer unique capability primarily in four areas: atmospheric research, suborbital astronomy, longitudinal human research, and microgravity.

The remaining 10 percent of demand is generated by RLV missions related to aerospace technology test and demonstration, education, satellite deployment, and media and public relations. In the growth scenario, demand in these markets doubles or triples. In the constrained scenario, demand is about half or less of baseline levels. Note that the total percentage for Figure 2.1h exceeds 100 percent due to rounding.

Two potential markets sometimes described as being addressable by RLVs are not expected to drive launches, at least initially. RLVs can provide a platform for remote sensing activities, but do not offer a competitive advantage over competing satellites, aircraft, and unmanned aerial systems (UAS). Finally, in coming decades, RLVs could evolve into hypersonic airliners to support a market for point-to-point transportation. However, this technology will not likely be available anytime soon.

U.S. Activities and Opportunities

The majority of RLV development is occurring in the U.S. One company, UP Aerospace, has been providing flights aboard its reusable sounding rocket since 2006 from an area that is now part of Spaceport America in New Mexico. Figure 2.1g is a listing of existing RLV operators and status.

Florida activities and opportunities

In Florida, RLV operations are expected to occur using leased assets located at KSC and at the newly established launch site at Cecil Spaceport. Other launch and re-entry sites throughout the state are being considered for RLVs.

However, given the market size, and that there will be at least two types of vehicles conducting flights, e.g. Virgin Galactic's SpaceShip2 and XCOR's Lynx, the market may only require part-time operations at perhaps three or four spaceports worldwide. Without greater demand, as more vehicles and spaceports are developed, the market will be further split.

Figure 2.1g. . SRV operators and status

Company	SRV	Seats	Locker Equivalents	Cargo (kg.)	Price	Announced Operational Date
UP Aersopace	Spaceloft L	-	0.5	36	$350k per launch	2006 (actual)
Armadillo Aerospace	STIG A STIG B Hypersion	- - -	1 2 12	10 50 200	Not announced Not announced $102k per seat	2012 2013 2014
XCOR Aerospace	Lynx Mark I Lynx Mark II Lynx Mark III	1 1 1	3 3 28	120 120 770	$95k per seat $95k per seat $95k per seat, $500k for small sat. Launch	2013 2013 2017
Virgin Galactic	SpaceShipTwo	6	36	600	$200k per seat	2013
Masten Space Systems	Xaero Xogdor	-	4	25	Not announced	2012 2013
Blue Origin	New Shepherd	3+	5	120	Not announced	Not announced

Source: The Tauri Group

Most U.S.-based RLV flights are expected to take place from Mojave Air and Space Port and Spaceport America, at least initially. However, XCOR recently announced it will conduct flights from KSC, where the company plans to build an operations and assembly facility adjacent to the Shuttle Landing Facility (SLF) for its Lynx II vehicles. The SLF includes a 4,572-meter (15,000-foot) runway and a hangar designed to facilitate reusable launch vehicle operations. Meanwhile, the company plans to relocate its research and development capability from Mojave Air and Space Port to Midland International Airport in Texas. Masten intends to use SLC-36 for demonstration flights, and Space Florida intends to fly scientific payloads on Virgin Galactic's SpaceShip Two. Plans for launching RLVs from Florida's Cecil Spaceport have not been finalized by any company, although discussions between providers and Cecil are progressing. The 3,048-meter (10,000-foot) skid strip at CCAFS, used for UAS activity and aviation operations could also be used for suborbital flight operations.

Implications

Typically, RLVs will require little infrastructure, and in most cases this infrastructure is mobile. For example, fuel can be provided via a truck loaded with dewars (essentially large insulated flasks). Other equipment may include standard aircraft tugs, fire suppression units, crew vans, and power carts. In addition, access to fire and rescue equipment and personnel will be present. As an active airport, Cecil Spaceport has most of this kind of equipment and infrastructure. It is possible that Cecil Spaceport, which features a 3,811-meter (12,504-foot) runway, and proposed RLV launch sites in Florida may require installation of small liquid propellant and pressurant (nitrogen and helium) plants depending on the volume of traffic and access to these products. In addition, NASA KSC is currently seeking a partner to operate and maintain the SLF by October 2013. This facility has access to an RLV hangar, a parking ramp, and direct access to KSC's SLC-39 and the Industrial Area. Florida-based Starfighters, Inc., which operates F-104 jets as suborbital flight trainers and nanosatellite launch platforms, conducts flights from the facility. XCOR, which in August 2012 announced plans to establish an assembly facility in 2014 at the Cape for construction of Lynx vehicles, is considering the SLF as a production site.

Florida's existing space transportation infrastructure is fully capable of handling a large number of flight operations. Indeed, the Eastern Range is currently in the final stages of upgrade and will be supported through a more efficient, consolidated operations contract. SLC-41and SLC-37, built and operated to support the Evolved Expendable Launch Vehicle (EELV) Program begun in the late 1990s, has yet to experience the maximum number of launches they were designed to handle. The Cape also features a considerable amount of capability in the form of vehicle processing, payload processing, and hazardous materials processing. NASA, the Air Force, and Space Florida have worked together in an effort to make facilities available for commercial use, especially since the retirement of the Space Shuttle.

2.2 Needs

Florida appears exceptionally well placed to support existing and forecast launch activity. It also has much of the infrastructure necessary to attract additional capabilities that have recently been announced. Each orbital launch vehicle requires its own set of procedures relating to vehicle component transport from manufacturing site to launch site, component receipt at the launch site, vehicle processing, payload processing, vehicle and payload integration, and launch. Figures 2.2a and 2.2b illustrate the infrastructure elements typically required to support an orbital launch.

Florida's existing space transportation infrastructure is fully capable of handling a large number of flight operations. However, aging infrastructure needs to be modernized.

Completed vehicle subsystems, like the vehicle stages, interstages, and fairings, arrive at the launch site from the manufacturing facilities, usually by boat, rail, or plane. These subassemblies are integrated in a vehicle integration facility. Meanwhile, a payload is transported in a similar manner to the launch site, where it is delivered to a payload processing facility. Often, there are specialized payload facilities for hazardous activities like fueling, clean rooms for final checkout, and short-term storage. At some point, the vehicle and payload are integrated. Launch service providers pursue this process in a variety of ways, but typically the vehicle-payload integration is done in a separate facility. This facility may be a mobile enclosure located directly on the launch pad or mount, which protects the vehicle and its payload until final launch preparations. Once vehicle-payload integration is completed, the vehicle is prepared for launch and a countdown checklist is initiated. The vehicle is fueled; a final "go-no go" assessment is made; and if all systems are "go," including the launch range, the countdown proceeds toward launch. From receipt of subassemblies through launch and delivery of payload on-orbit, everything is monitored through launch and mission control centers.

Figure 2.2a. Generic launch vehicle and payload processing overview.

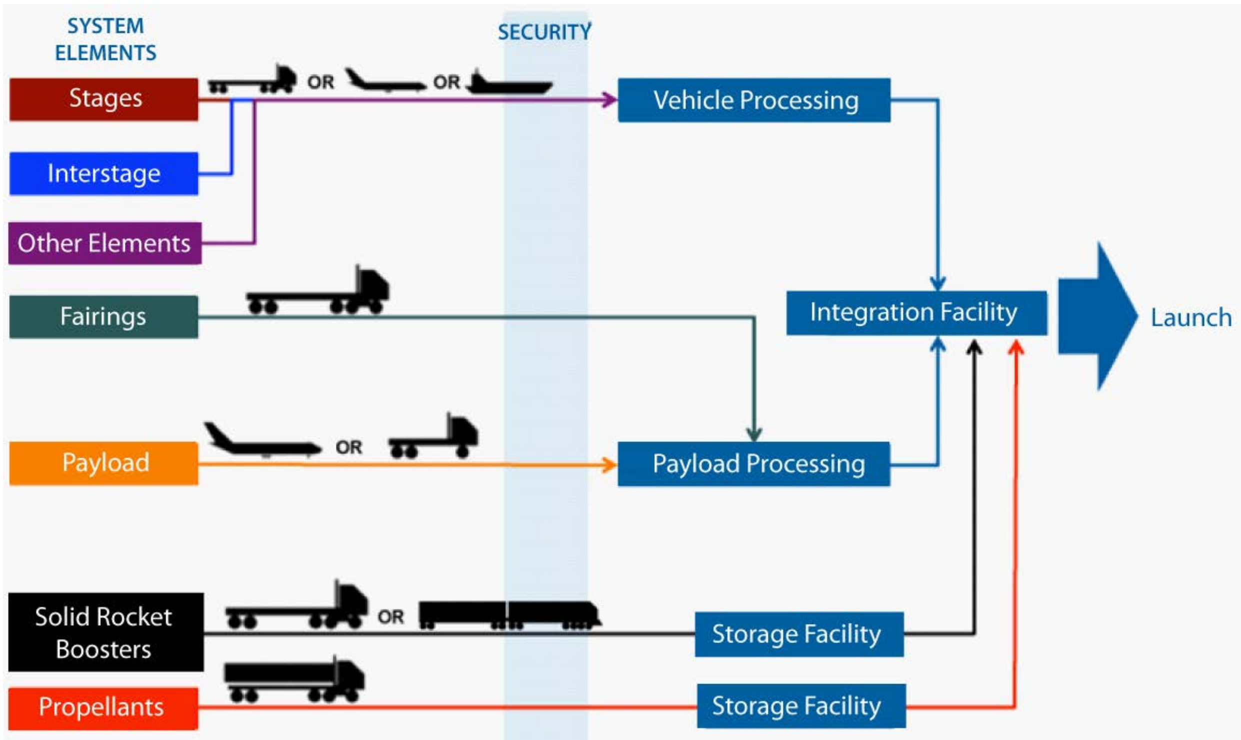
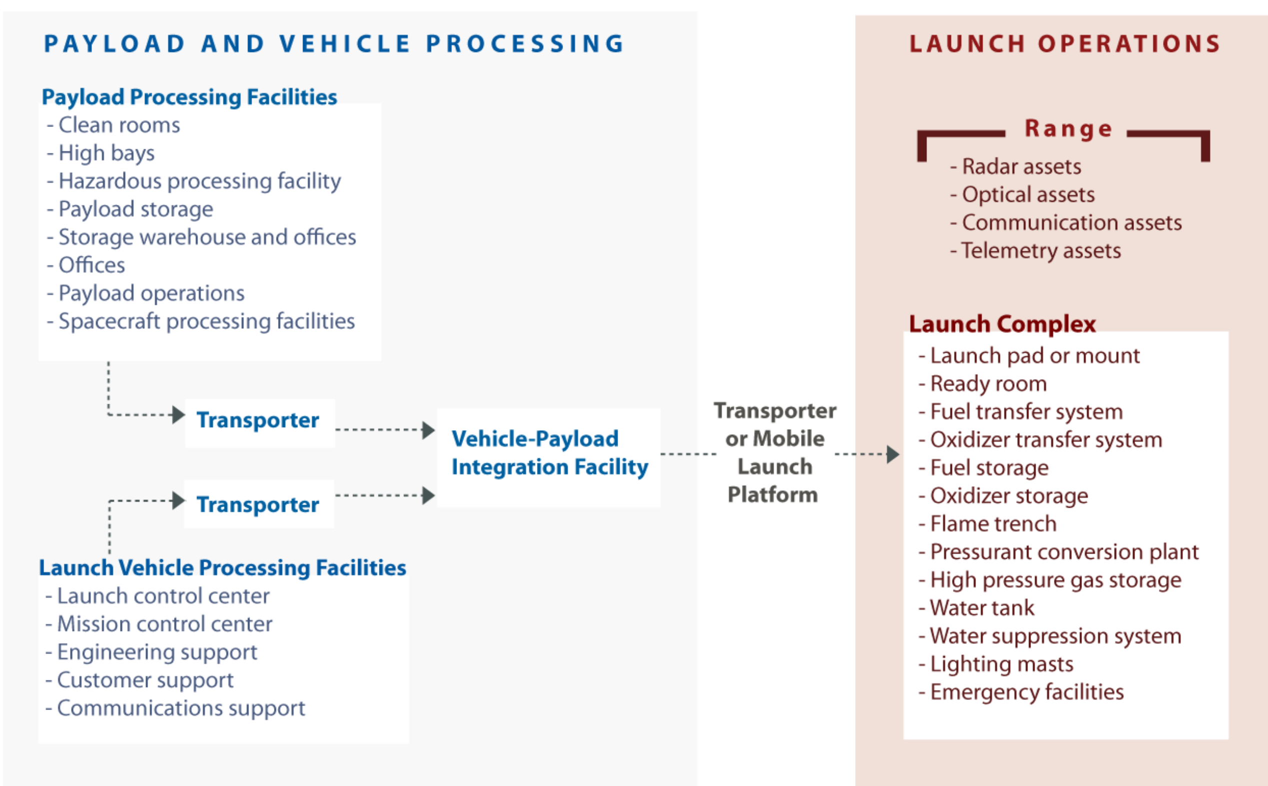


Figure 2.2b. Generic launch vehicle and payload processing detail for orbital flights.



Source: The Tauri Group

SUBORBITAL

Relative to orbital launch vehicles, infrastructure requirements for RLVs are much less complex. Indeed, they are specifically designed to reduce the amount of processing time and overall system complexity in order to reduce operating costs. While substantial facilities exist at KSC and Cecil Spaceport for RLV maintenance, storage, and processing, some operators may require construction of manufacturing facilities. XCOR, for example, intends to build such a facility adjacent to KSC's SLF.

Figure 2.2c. Generic launch vehicle and payload processing detail for suborbital flights

PAYLOAD AND VEHICLE PROCESSING

	Vehicle	Fixed Infrastructure Requirements	Mobile Infrastructure Requirements
	Lynx	~2,400 m runway	Kerosene supply and equipment LOX supply and equipment Vehicle tug
	New Shepard	TBD	TBD
	SpaceLoft XL	Final assembly building Launch pad Launch rail	Equipment and tool trailer Operations and Control Center Payload Processing Facility Vehicle trailer
	STIG (Tube)	Launch pad	Trailer
	Hyperion	Launch pad	TBD
	SpaceShip Two/ WhiteKnight Two	~ 2,400 m runway	Jet A fuel supply and equipment Nitrous oxide supply and equipment Vehicle tug
	Xaero	Launch pad	TBD
TBD	Hyperion	Launch pad	TBD

LAUNCH / REENTRY OPERATIONS

Eastern Range (USAF/NASA)
Radar, optical, communication, and telemetry assets

CCAFS
- 3,048m skid strip
- LC, possibly other pads

KSC Shuttle Landing Facility
- Aircraft ground equipment shed
- Ascent wind profiler
- C-band radar
- Convoy vehicle enclosure
- Fire/rescue vehicle building
- Former SLF control tower
- Landing aids central building
- Midfield parksite
- Orbiter mate/demate device
- Parking apron
- RLV hangar (50,000 sq. ft)
- Runway 15/33
- Runway viewing area
- SLF control tower
- SLF news building
- TACAN site
- Television tower
- Weather station
- Weather station B

Cecil Spaceport
- 1 spaceport-licensed runway
- Active tower

Source: The Tauri Group

2.3 Challenges

As the demand and needs analysis demonstrates, Florida has the inventory of infrastructure necessary to embrace the future market. Other areas of operation, however, can be improved in order for the state to maintain and reinforce its position as a leader in the aerospace industry. The five major challenges are:

- Facing the market
- Upgrading and maintaining infrastructure
- Communicating the importance of Florida's Spaceport System
- Maintaining strong governance, management and partnerships
- Providing great customer service (space-ready and space-friendly)

Florida should draw on its historical strengths to stay competitive, leveraging the best from government systems to better serve commercial markets.

FACING THE MARKET

Florida has been at the forefront of government space transportation since the beginning of the Space Age. CCAFS has been involved with advanced missile testing since 1949, while KSC has been the center of the nation's human spaceflight efforts since 1962.

When Cape Canaveral was built, there was only one customer to serve: the federal government. Now, with an increasing interest in commercial flight, the market has expanded to include a greater diversity of customers with different needs. Over the past few decades, other launch facilities have developed across the U.S., creating a competitive environment formerly unknown to the Cape. Although Florida is still the primary place for orbital launches, there are now multiple other facilities that compete for suborbital flights. To move forward, Florida's Spaceport System will need to strategically develop to face this new market. Florida should draw on its historical strengths to stay competitive, leveraging the best from government systems to better serve commercial markets.

UPGRADING AND MAINTAINING INFRASTRUCTURE

Florida's existing Spaceport System has more than adequate capacity to accommodate the anticipated increase in orbital and suborbital launches. One of the system's greatest challenges is to maintain the infrastructure, and/or retrofit it to meet the specific needs of civil, defense and/or commercial markets. Some of the buildings and facilities within the system are at least 50 years old, and maintenance of many facilities has been deferred for lack of funding. Other facilities need to be "right-sized" to serve launch demand.

Historically, funding has been prioritized based on civil and defense needs rather than the growing of an increasingly significant commercial market. As operations and maintenance funding decreases from historic sources such as NASA and the DOD, it is critical to not only differentiate between "essential" and "non-essential" facilities that must be maintained for the system to remain competitive, but also to identify other potential funding sources to make up the gap in funding.

Currently several studies are being conducted or proposed to determine infrastructure needs at specific facilities. These include:

- Kennedy Space Center Master Plan (on-going)
- Cape Canaveral Air Force Station General Plan (complete)
- Cape Canaveral Spaceport Master Plan 2013 and supporting strategic studies (on-going)
- Cecil Spaceport Master Plan (complete)

The Operations & Checkout Building was in major need of renovation. Pictured here are before and after images of the High Bay.

COMMUNICATE THE IMPORTANCE OF FLORIDA'S SPACEPORT SYSTEM

Aerospace is one of Florida's leading industries, along with tourism, agriculture and construction. Florida State University's recent report, "*The Economic Impact of Aerospace in Florida – 2010,*" found that for every dollar invested in aerospace in the state, Florida will realize a return of $3.54. Additionally, the industry creates 51,168 direct jobs, 46,766 indirect jobs, and 49,430 induced jobs for a total of 147,365 across the state.

Every operational GPS satellite, geosynchronous U.S. weather satellite, and geosynchronous U.S. Early Warning satellite has been launched from Florida.

Florida's Spaceport System has had an immense impact on Americans' daily lives as well—and not just Floridians. For example:

- Every currently operational GPS satellite has launched from Cape Canaveral Air Force Station.
- Every Geosynchronous U.S. weather satellite has launched from the Cape.
- Every Geosynchronous U.S. Early Warning satellite has launched from the Cape.

While those within the aerospace industry understand the economic benefits to the state, many people do not know the significance of the industry. For example, the FSU study reports that total aerospace industry sales/revenues benefit virtually every county in the state; the median sales/revenues was $20,631,500, and only one county had no sales/revenues. The chart can be found in Appendix A.

MAINTAIN STRONG GOVERNANCE, MANAGEMENT AND PARTNERSHIPS

Through the Space Florida Act, the Florida Legislature designated Space Florida as "the single point of contact for state aerospace-related activities with federal agencies, the military, state agencies, businesses, and the private sector." Chapter 331, Florida Statutes, establishes the extensive powers and duties of Space Florida, ranging from owning and maintaining launch pads and transportation facilities to developing new concepts and issuing revenue bonds.

All of the various partners must work together to enable the accomplishment of their missions along with the responsibility of maintaining the Spaceport infrastructure. See Section 4 For a discussion of governance models that would enable a more robust and responsive spaceport system.

Historically and for the foreseeable future, the federal government is the most predominant customer of Florida's Spaceport System, but Florida will need to continue to develop other partnerships as well.

PROVIDE GREAT CUSTOMER SERVICE: SPACE-READY AND SPACE-FRIENDLY

The Florida Spaceport System has a competitive advantage in the world due to its geographic location, extensive track record, multi-modal connections and superior work force; however, the system risks falling behind in the industry if it is not perceived as being customer friendly.

For example, while most launch vehicle providers consider NASA and DOD valued customers, there remains a lingering perception that launches for the DOD take priority over commercial launches due to national security needs. That perception is not accurate. There has never been a case where a national security mission pre-empted a commercial mission. Moreover, the Eastern Range has made significant strides to increase responsiveness and transformation of the Range. It routinely transitions from one launch vehicle to another within 48 hours. The Range supported over 18 launches in 2009, with a capacity to support many more.

> *Florida will continue attracting new customers, by promoting its safety and low rates, and proven reliability at every opportunity.*

Cecil Spaceport, a thriving general aviation airport, has established market perception for great customer service and is poised to secure additional RLV-related space activity.

Florida is making a paradigm shift to be competitive, including: considering the retirement of the Space Shuttle; NASA's use of commercial vehicles to resupply the ISS; the development of three new launch vehicles that are hoping to help the United States re-enter the commercial launch market; and, the emergence of two new potential markets, RLV's and UAV's. To date Florida's space industry has relied primarily on national security and the U.S. government, but those markets are flat or decreasing in civil space. The emergence of new commercial space markets represents an opportunity and a challenge for Florida.

In summary, Florida's Spaceport System will need to surmount this uncertainty. Shifting paradigms requires a combination of actions, including: an honest self-appraisal of strengths and weaknesses; a thorough understanding of customer needs and desires, including profitability; a willingness to make the changes necessary to meet customer needs and desires; and a process for communicating changes back to the customer. Some of these shifts have already occurred with positive results. Recently, Masten, XCOR, and Sierra Nevada have all signed agreements with Space Florida to move forward with projects at Cape Canaveral Spaceport. To continue attracting new customers, Florida will need to keep promoting its safety and low rates, and prove its reliability at every opportunity.

MOVING FORWARD

In order to overcome these five challenges, Florida's Spaceport System must remain flexible to better meet the future of space transportation. The following section outlines how the system will need to adapt to face the market, upgrade essential infrastructure, communicate its importance to the public, maintain strong governance, and provide excellent customer service.

PART 3 LONG-RANGE VISION

3.1 Introduction

> *Florida's Spaceport System is undergoing an unprecedented cultural shift since its inception over 50 years ago.*

No other region in the world has the aerospace infrastructure and talent, related target industries and position on the planet's surface as the state of Florida. The existing spaceport system has delivered unrivaled launch systems and operational assets with virtually every aerospace company and defense contractor, along with NASA, the Air Force, the Department of Defense and dozens of federal agencies. Florida's Spaceport System generates economic, social and environmental benefits that strengthen every Florida county, the state, the nation, and the world.

Yet Florida's Spaceport System is undergoing an unprecedented cultural shift. As discussed in Part 2, the market for aerospace services will heavily influence the system in the coming years. Other trends that may influence the planning, design, construction, maintenance and/or operations of the future system include:

- Changes in motivations from traditional motives of national pride, interest and defense to motives of economic development, job creation and profitability
- Shift from a willingness to fund the existing system's maintenance to "right-sizing" to fit market demand
- Increase in the commercial customer base
- Increase in the demand for unpredictable, just-in-time services for commercial operations and a decrease in the demand for predictable, long range, planned government missions
- Increased demand for federal facilities to accommodate non-federal uses
- Increased focus on diverse funding sources, return-on-investment
- Emphasis on maintaining and expanding capabilities while maintaining and operating a smaller physical "footprint"
- Increases in mobile launch platforms versus traditional stationary launch sites
- Shift from dedicated facilities to multi-use facilities

Together, these trends indicate that Florida's future Spaceport System will need to be leaner, more flexible and more agile than today's system in order to be competitive. It will also demand a higher level of communication, coordination and partnerships to maximize available resources to generate the greatest benefits for Florida residents.

VISION

The vision for Florida's Spaceport System is to have the *right infrastructure* in place for the *right launch vehicle or spacecraft* at the *right time*, requiring flexibility and multiple launch landing and re-entry configurations.

Representatives from Space Florida, NASA, the U.S. Air Force 45th Space Wing, the FAA, FDOT, and other partners met for two days in July 2012 to develop a long-range (approximately 10-year) vision to accomplish these goals and objectives. The vision was developed by focusing on each of the five subsystems of Florida's Spaceport System: spaceports, control centers and airspace, spacecraft and launch vehicles, payload processing facilities, and intermodal facilities.

While Florida's existing Spaceport System has the capacity and infrastructure to accommodate anticipated new launch vehicles over the next 10 years, improvements may need to be made to existing spaceports to accommodate changes in technologies. Both the public and private customers will continue to seek ways to lower the costs of spaceflight through new technologies. For example, commercial manufacturers and operators may request retrofits to existing spaceport system infrastructure to accommodate changes in propellant types or off-runway "recovery zones" for SRVs.

GOALS

To meet this bold vision, and in response to market trends, the primary goals for Florida's Spaceport System are to:

- Create a stronger economy where Florida's spaceports and aerospace businesses can thrive
- Guide public and private investment into emerging and growing aerospace enterprises and maximize the use of existing aerospace resources
- Enrich our quality of life while providing responsible environmental stewardship
- Advance a safer and secure spaceport transportation system for residents, businesses, and others

Atlas V launching from Cape Canaveral on June 20, 2012

3.2 Spaceports and Spaceport Territories

Based on the anticipated demand for both suborbital and orbital launches, Florida's existing Spaceport System has sufficient capacity to launch spacecraft for the next 10 years and likely beyond.

> *Rather than building new spaceports, the vision for the spaceport sub-system includes enhancements to existing spaceports.*

For the orbital market, the Cape Canaveral Spaceport and infrastructure are adequate to support current projected future launch rates. However, Space Florida has identified a potential opportunity to develop a new commercial launch site within the Cape Canaveral Spaceport at the north end of Kennedy Space Center land. If permitted, this will be a jurisdictionally independent launch site outside the boundaries of the current federal range.

For the suborbital market, it is important to note that it is unlikely that suborbital point-to-point will be operational within the next 10 years due to technical, logistical, legal/regulatory and economic barriers (see Section 2). However, as the RLV technology matures and the market expands, there may be opportunities for additional spaceports in Florida. It is imperative that proposed new spaceports in Florida develop a robust market-based business case with a full understanding of costs of licensing, costs of operations, and compliance with existing grant assurances. Moreover, as part of concept of operations development they should take into account the impacts of FAA safety criteria, and the needs of proposed commercial spacecraft, population densities, calculations of instantaneous impact point, and other siting factors. Space Florida has produced a Spaceport Licensing Lessons Learned document to assist potential future spaceports in Florida in their decision-making.

Space Florida has the authority per Section 331.305, Florida Statutes, to "own, acquire, construct, reconstruct, equip, operate, maintain, extend, or improve transportation facilities appropriate to meet the transportation requirements of Space Florida and activities conducted within spaceport territory." However, Florida's existing spaceports and launch facilities have more than adequate capacity to accommodate anticipated launch demands. Rather than building new spaceports at a high cost to taxpayers—news reports indicate that Spaceport America in New Mexico includes $209 million in public funding for construction[viii]—the vision for the spaceport sub-system includes enhancements to existing spaceports, including:

- "Right-sized" existing infrastructure, based on market demand, to decrease operations and maintenance (O&M) costs. This requires the evaluation and determination of "essential" and "non-essential" infrastructures.
- Adding new capabilities to existing facilities to accommodate customer needs in close proximity to launch sites, such as payload processing, research and development, and manufacturing.
- Adding facilities to accommodate new markets, such as space and space vehicle testing facilities and engine testing and development.
- Identification of additional revenue sources such as land leases and ground rents to help offset O&M costs.

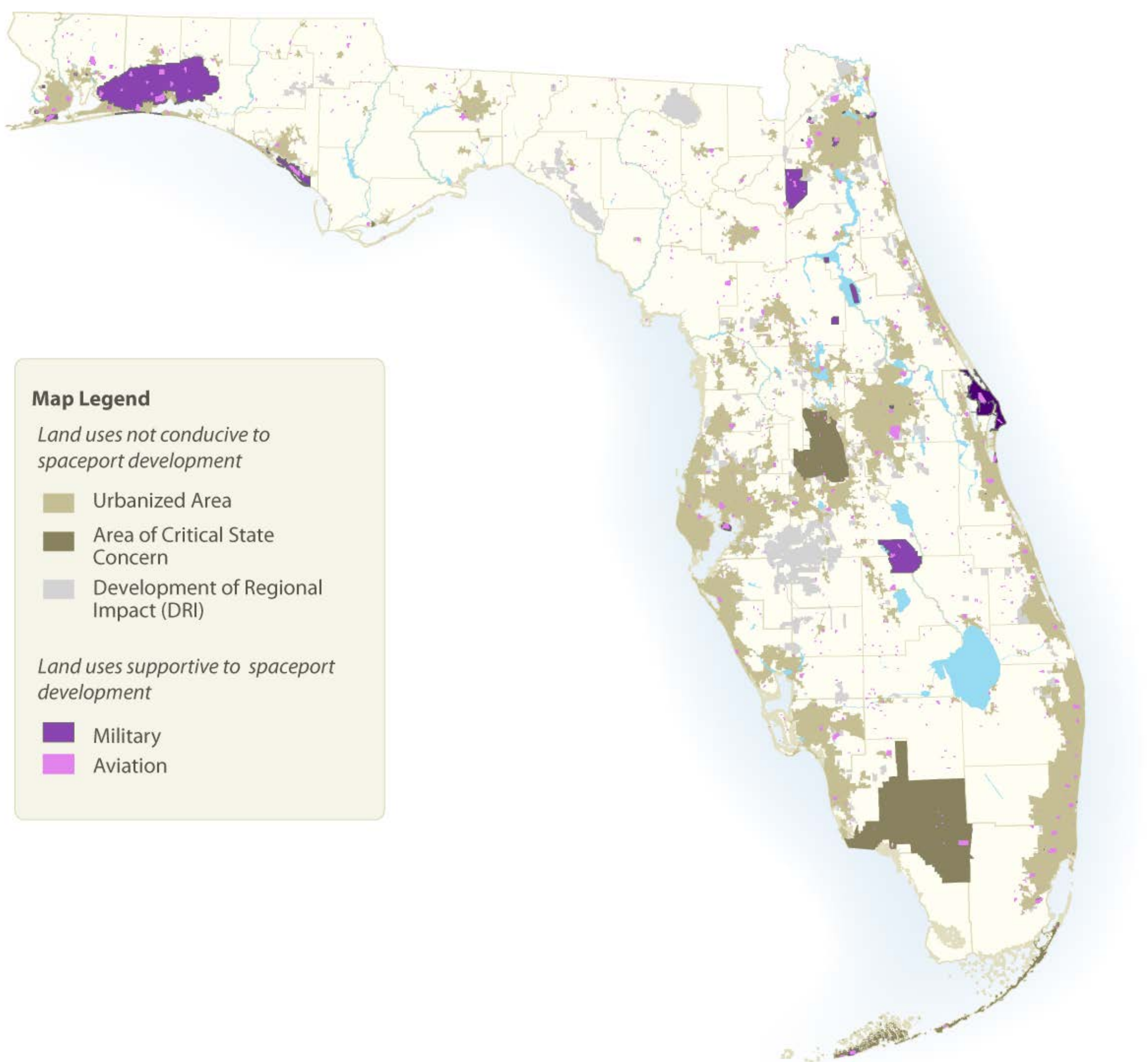
Although there is no demonstrated need for new launch site spaceports, there may be a demand for new sites to accommodate re-entering spacecraft. The specific location of any proposed re-entry site(s) will be based on orbital mechanics, FAA safety criteria, and the needs of proposed commercial spacecraft, population densities, calculations of instantaneous impact point, and other siting factors.

New re-entry sites may be located on Florida's west coast to avoid the need for re-entering spacecraft to fly over population centers. Based on the criteria outlined above, potential sites along the coast may include an off-shore water landing area in the Gulf of Mexico, and/or one or more sites in unpopulated areas along the northwest, west central or southwest areas of the Gulf coast. Further study will be required to determine the most appropriate, feasible sites for re-entry.

Map 3.2a also shows land uses that are not conducive to spaceport development. Although there may be exceptions, in general the development of future spaceport infrastructure is not recommended in urbanized areas due to concerns about safety. Future urbanized areas can be anticipated due to the presence of Florida's program that oversees Developments of Regional Impact (DRIs). These represent large scale, new developments that are likely to come online in the coming years.

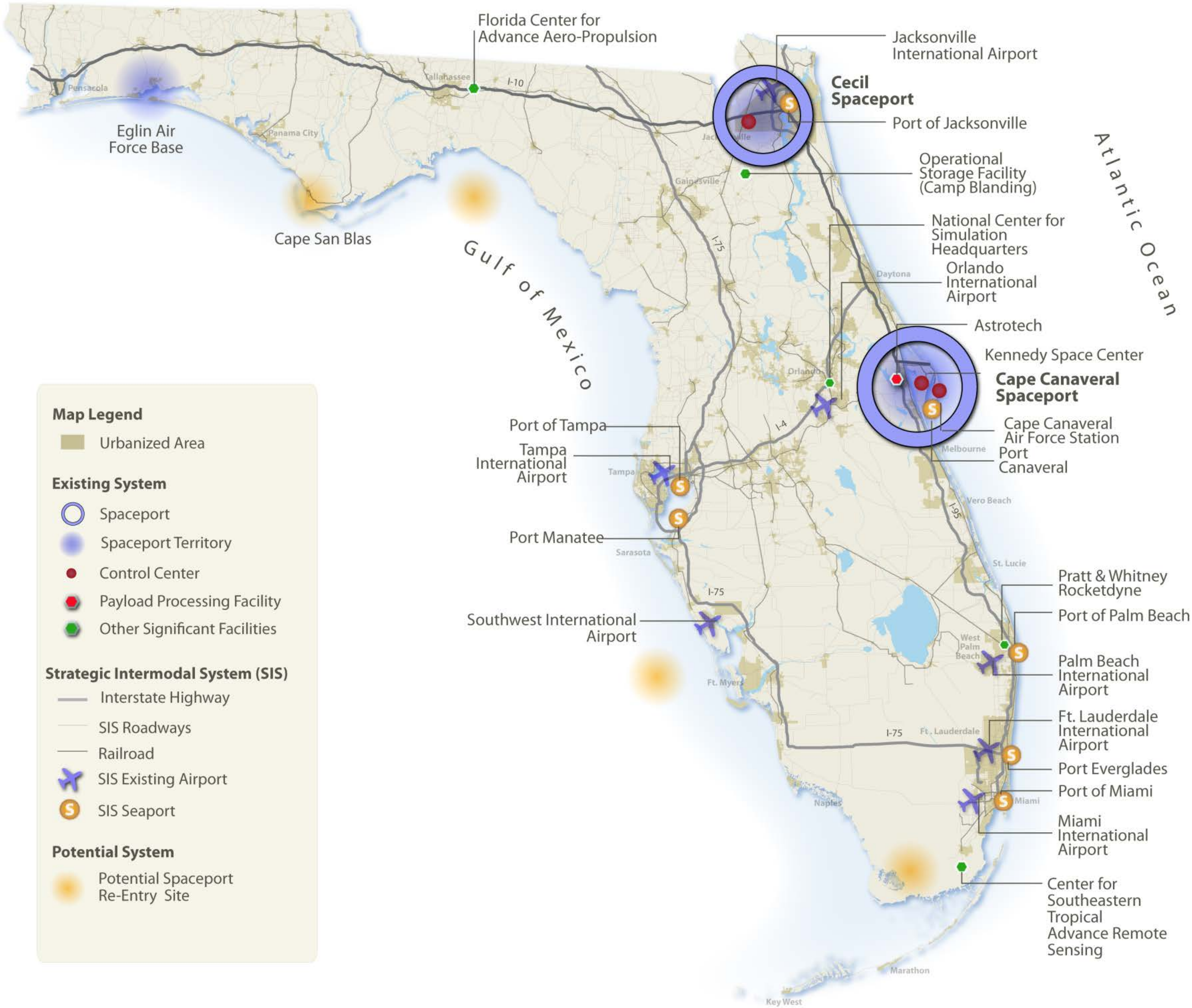
Cities and future cities are not the only concerns. Environmentally, Florida is a state of diverse—and vulnerable—natural resources, many of which are regulated and closely monitored. The most important have been designated Areas of Critical State Concern, which are defined as areas "containing, or having significant impact upon, environmental or natural resources of regional or statewide importance."[ix] These can also extend to protect historic and archeological resources. Only four places in Florida have been designated: the City of Apalachicola, the Green Swamp, Big Cypress, and the Florida Keys; any future spaceport development will need to be mindful of these resources.

Map 3.2a. Florida Land Uses that Impact Spaceport System Planning



With these limitations considered, Map 3.2b shows the vision for Florida's future spaceport subsystem including major urban airports and conceptual locations for potential re-entry sites.

Map 3.2b Future Florida Spaceport System Concept



Summary of needed infrastructure improvements – spaceports

- *Continued development of facilities on Spaceports to meet market demand.*

3.3 Control Centers and Airspace

While it is not anticipated that the fundamental structure of Florida's control center system will change over the next 20 years, continued increases in air traffic and the introduction of new spacecraft, launch vehicles and technologies will continue to present challenges to the system.

The vision for Florida's control centers and airspace is to grow into an adaptable, flexible system that can coordinate seamlessly as part of NextGen and accommodate the demand of all launch types and aerospace services.

The FAA is working on a plan "to make the best use of new and existing technology, infrastructure, and employees to handle the doubling and tripling of air traffic expected in the coming decades. The Next Generation Air Transportation System, or NextGen, is proposed to transform the national airspace system from one that is based on ground radars to one that uses satellite technology."[x] It is anticipated that NextGen will be active in 2020-2022, providing for greater aviation and aerospace capacity.

Florida is a leader in facilitating the development of NextGen through various activities around the state, including Embry Riddle Aeronautical University NextGen Testbed. Moreover, as Florida continues to attract RLVs, UAS and orbital launch vehicles to Cape Canaveral Spaceport and Cecil Spaceport, there will be increasing opportunities to develop training, techniques and procedures for managing and controlling multiple technologies within the same airspace domain.

One of the greatest challenges to the control center system is accommodating an increasing number of commercial aerospace launches and landings without disrupting air traffic, which is also increasing. Each launch or landing requires the re-routing of aircraft around designated restricted areas (based on the launch characteristics). Another challenge is to develop the technologies and processes to manage new UASs, RLVs and other new launch platforms, vehicles and spacecraft.

Anticipated issues that will need to be addressed in the future include:

- Prioritization of air and space flights + UAS Flights
- Accommodating demand
- Designation (size, location, time frame) of restricted areas
- Assessment of "re-routing" costs
- Control of UAV flights

With these uncertainties in mind, the vision for Florida's control centers and airspace is to grow into an adaptable, flexible system that can coordinate seamlessly as part of NextGen and accommodate the demand of all launch types and aerospace services.

Summary of needed infrastructure improvements – control centers and airspace

- *Refinement and improvements to NextGen to accommodate increased traffic and new vehicle types*
- *Potential new private commercial control centers*
- *Facilities necessary to accommodate expanded capabilities*

3.4 Spacecraft and Launch Vehicles

The vision for Florida's spacecraft and launch vehicles is to continue being the primary place for orbital launches in the U.S. and to capture a number of new vehicle launches currently in the planning stages. Figure 3.4a on the following page illustrates historic, current, and future launch vehicles relevant to Florida's Spaceport System.

The vision for Florida's spacecraft and launch vehicles is to continue being the primary place for orbital launches in the U.S. and to capture a number of new vehicle launches currently in the planning stages.

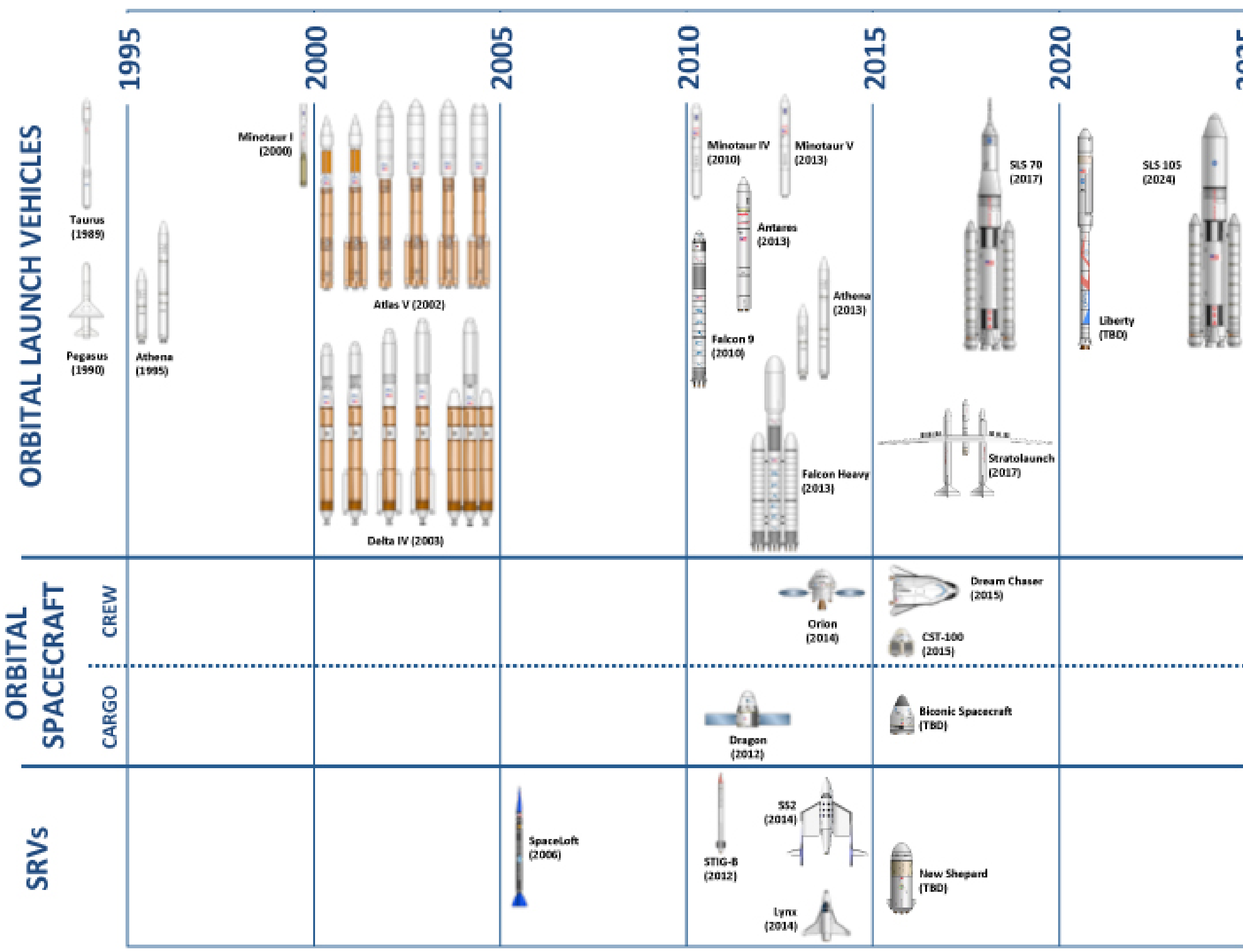
There will likely be no significant changes in the types of small- to heavy-class orbital launch vehicles and spacecraft used in Florida during the next 10 years. Existing ELVs such as ULA's Atlas V and Delta IV are dependable and meet current and anticipated needs for the foreseeable future.[4] SpaceX's Falcon 9 has begun operational flights and is expected to become a significant contributor to orbital flights from Florida. This vehicle will also launch the reusable Dragon cargo capsule, which launched for the first time on a test flight in May 2012. The company will introduce the Falcon Heavy with its inaugural launch from Vandenberg Air Force Base in 2013 and may launch this vehicle from Florida. Other orbital vehicles that can be launched from Florida include the Pegasus XL and, possibly in the near future, the Minotaur and Athena. This vehicle mix is likely to remain available for customers for at least 10 years. The Liberty vehicle being developed by Alliant Techsystems (ATK) and EADS Astrium is expected to undergo flight tests late in the decade, but it is not yet clear if the system will become operational.[5]

In terms of the following decade, NASA expects the SLS, capable of sending 70 tons to low Earth orbit, to be operational following test flights around the 2018-2020 timeframe. The agency has plans to develop an SLS variant capable of handling payloads up to 130 tons, although if this vehicle system were developed, it would not enter service until well into the 2020s. A newer generation of orbital launch vehicles, primarily focused on reusability, may be introduced later this decade or in the early 2020s. It's possible that these vehicles could launch from Florida sites. Among those announced are the Stratolauncher, Blue Origin's proposed booster system and biconic spacecraft. Masten Space Systems may develop an orbital vehicle called the XA-1.0, although development seems to have slowed as the company focuses on its suborbital vehicle development. Interorbital Systems is developing the NEPTUNE, an orbital system featuring a modular propulsion system.

Florida has the capabilities to launch the Pegasus XL

[4] ULA does have a few Delta II vehicles remaining, although all are planned for launch from VAFB during the next few years.
[5] Additional uncertainty stems from NASA's recent Commercial Crew Integrated Capability awards announced in July 2012. Boeing, SpaceX, and Sierra Nevada Corp. will receive milestone-dependent funding through space act agreements. ATK and EADS Astrium were not selected for continued development of the Liberty, but both companies have indicated they will continue to pursue the program.

3.4a Timeline of spacecraft and launch vehicles, 1995 - 2025



Source: The Tauri Group

Some companies are also exploring orbital launches of nanosatellites from aircraft or suborbital platforms, including Virgin Galactic, XCOR, Starfighters (based in Florida), and Generation Orbit, among others. Several orbital spacecraft will be introduced late in this decade and may be operational in the 2020s. All of these will be launched from Florida. The spacecraft include a crewed version of SpaceX's Dragon, Boeing's CST-100, and Sierra Nevada Corporation's Dream Chaser. The latter two will launch aboard the Atlas V. NASA's Orion Multi-Purpose Crew vehicle will launch for the first time on a test flight aboard a Delta IV Heavy from Florida in 2014. Ultimately, this spacecraft will be launched by the SLS. Other spacecraft, such as one being developed by ATK and Lockheed Martin for launch aboard the Liberty vehicle, are also planned.

In terms of suborbital flight, UP Aerospace will continue launching its Spaceloft vehicle for several years to come, and the company has plans to provide a larger vehicle in the future. The Spaceship Company, based in California, is contracted to produce five suborbital vehicles to be operated by Virgin Galactic, with the first scheduled to enter commercial service in 2013.[6] XCOR's Lynx vehicles will begin operations by 2013, and it is expected the company will continue operating the vehicle well into the 2020s. Armadillo Aerospace has plans to develop a two-person vehicle that can launch and land vertically. Masten Space Systems is developing the Xogdor vehicle, which will likely enter service within the next few years. Blue Origin is expected to continue developing its New Shepard vehicle. In most of these cases, the infrastructure support is less complex than that for orbital vehicles, and all the operators could launch from the state.

In addition to those already planned, the Cape Canaveral Spaceport has the ability to launch other launch vehicles. Among these are the Pegasus XL, the air launched small-capacity vehicle operated by Orbital Sciences and the Minotaur vehicle, also offered by Orbital. The Pegasus XL is carried by an L-1011 TriStar aircraft that can take off from either the Shuttle Landing Facility at KSC or the CCAFS Skid Strip. Lockheed Martin Commercial Launch Services plans to provide an upgraded version of its Athena small- and medium-class vehicle, and this system may be launched from Space Florida's SLC-46. The Minotaur can also launch from SLC-46 and Space Florida currently holds a Spaceports 3 contract with the Air Force to support launches of the Minotaur from SLC-46.

Summary of needed infrastructure improvements – spacecraft and launch vehicles

- *Enhancements to existing and proposed facilities in response to new commercial technologies and needs*

FLORIDA's SUBORBITAL FUTURE

Two companies are positioned to have an impact on suborbital launch in Florida's near future: Virgin Galactic and XCOR Aerospace.

Virgin Galactic

Virgin Galactic was founded in 2004 by Sir Richard Branson as part of parent company Virgin Group. The company will offer commercial suborbital flights with SpaceShipTwo, air-launched from a carrier vehicle called WhiteKnightTwo. SpaceShipTwo is a horizontal takeoff, horizontal landing (HTHL) piloted vehicle, with the capacity for 600 kilograms (1,323 pounds) of payload or six passengers and two pilots. SpaceShipTwo will fly to a maximum altitude of 110 kilometers (68 miles), enabling about three to four minutes of microgravity. The WhiteKnightTwo will also be capable of air dropping a small microsatellite launch vehicle called LauncherOne.

The WhiteKnightTwo requires a runway of less than 1,000 meters (3,280 feet) for takeoff and landing. After two days of preparation time with the flight crew, spaceflight participants will enter SpaceShipTwo and strap in for the flight. The flight crew for WhiteKnightTwo will board, taxi the vehicle combination to the runway, takeoff and climb to an altitude of 15,240 meters (50,000 feet). Following a countdown, SpaceShipTwo will release from the carrier aircraft. SpaceShipTwo's rocket engine will ignite, and like a missile the vehicle will climb straight up to an altitude of about 110 kilometers (68 miles). At the apogee, the vehicle will experience about four minutes of microgravity. The vehicle will then enter its feather mode for controlled re-entry, descending like a conventional airplane until landing on a runway. The flight duration is expected to be about two hours.

[6] Tier 1 was represented by SpaceShipTwo and WhiteKnightOne, both of which were used to win the Ansari X Prize in 2004.

(FLORIDA'S SUBORBITAL FUTURE, continued)

XCOR Aerospace
XCOR Aerospace, headquartered in Mojave, California, is a design and manufacturing firm specializing in rocket engines, high performance valves, and a suborbital reusable vehicle called Lynx. The Lynx has been in development for several years, and XCOR expects to conduct initial test flights of the prototype from Mojave Air and Space Port beginning in late 2013 or early 2014. In 2012, XCOR announced it will open two new locations: a research and development center headquarters in Midland, Texas in late 2013 and an operations and manufacturing base in Florida in late 2014.

XCOR is developing three versions of their Lynx suborbital vehicle: the Mark I (prototype), Mark II (production vehicle), and Mark III (production vehicle with a dorsal pod). The Lynx vehicles will takeoff much like a conventional airplane, but instead of using a jet engine it will employ a rocket engine. In order to provide maximum flexibility during flight operations, this necessitated development of an in-flight, restartable engine. A smaller vehicle than SpaceShipTwo, it will only have two seats, one for the pilot and the other for the spaceflight participant or an instrument package. A typical flight will last approximately 30 minutes, with a microgravity duration time at the apogee of about 1.5 minutes.

3.5 Payload Processing Facilities

The vision for payload processing facilities in Florida's Spaceport System includes a wide range of payload processing services and facilities at each spaceport in order to accommodate the needs of the specific targeted market. To be successful, payload processing will need to continue at existing spaceport facilities and expand to include larger processing centers, smaller centers for small cube satellite payloads, and support facilities for space tourism.

To be successful, payload processing will need to continue at existing spaceport facilities and expand to include larger processing centers, smaller centers for small cube satellite payloads, and support facilities for space tourism.

Over the next 10 to 15 years, these existing payload processing facilities at Cape Canaveral Spaceport are envisioned to change in the following ways.

- *Operations and Checkout (O&C) Building*: The O&C Building was originally used for integration of the Apollo spacecraft (Command Module, Service Module, and Lunar Excursion Module). Beginning in 2005, the building was renovated for $55M in order to receive and assemble the Orion spacecraft under the Constellation Program, but will be used for receipt and assembly of other spacecraft.

- *Multi-Payload Processing Facility (MPPF):* This facility is used for processing several payloads at once within a clean room environment. The facility has been renovated to accommodate Orion/MPCV processing, and thus will be in service at least through the mid-2030s. No other future use is projected beyond Orion.

- *Orbiter Processing Facilities (OPF):* There are three OPFs at KSC. OPF-3, the largest facility, has been renamed the Commercial Crew and Processing Facility and is intended to be used to manufacture, assemble, and test Boeing's CST-100 spacecraft. OPFs 1 and 2 remain available for development.

- *Payload Hazardous Servicing Facility (PHSF):* This facility is used primarily for the integration of payloads with solid motors and/or payload liquid fueling. The facility is in use today and is expected to remain in service for some time for processing of NASA payloads under the Launch Services Program (LSP).

- *Space Station Processing Facility (SSPF):* Part of this facility will be used to process cargo for the ISS launched by SpaceX and other providers. In this regard, it is likely the facility will remain in service until at least the end of the decade; future plans for ISS beyond 2020 remain uncertain.

- *Large Processing Facility (LPF):* This facility was built in 1964 for the United States Air Force to assemble the solid motor sections of military rockets for the U.S. Department of Defense (DOD). The west side is referred to as the Satellite Processing Integration Facility (SPIF) and includes a North and South Integration Cell providing 100,000 class cleanroom capability and allowing for fueling ops, The LPF is currently inactive awaiting future disposition.

- *Eastern Processing Facility (EPF):* A new National Reconnaissance Office (NRO) space vehicle processing facility currently being built at CCAFS. The facility will provide the necessary support for final preparations, testing and status monitoring just prior to launch.[xi]

- *Space Life Sciences Laboratory (SLSL):* The Space Life Sciences Lab (SLSL) serves as the primary gateway for payloads bound for the International Space Station (ISS). The 109,000 sq. ft. facility was built in 2003 and houses state-of-the-art laboratories, controlled environment chambers, and an upgraded Animal Care Facility. It also houses cutting-edge companies serving markets from clean energy to advanced materials and life sciences. The facility will enable testing and development of small payloads for launch on all of the Cape Canaveral Spaceport based launch vehicles.

In addition to the changes at these facilities, larger processing centers will also need to be available. Among these are facilities operated by Astrotech in Titusville, just west of KSC across the NASA Causeway.

Commercial operators processing a small cube satellite payload may be willing to pay only a small daily fee for a small processing center that may include a clean room, thermal vacuum, vibration table, acoustic chamber, radio frequency chamber, and an electronic bench. Such a small processing center may be constructed in a trailer or other mobile platform so that it can easily be moved as needed to accommodate multiple users' needs. With the anticipated increase in space tourism, new processing facilities may also need to be developed to accommodate spaceflight participants. These facilities may include a training area, a media center, spectator facilities, a medical center, and a quarantine area.

Technicians at Astrotech processing a payload.

Finally, it is anticipated that the Florida Spaceport System may also include additional commercially operated payload processing centers or university-operated centers involved in aerospace research.

Summary of needed infrastructure improvements – payload processing facilities

- *A variety of large and small payload processing capabilities and facilities at each spaceport, based on targeted markets*
- *Introduction of mobile processing units that could be moved around and between spaceports as needed*
- *New commercial and university-based processing facilities*

3.6 Intermodal Connections

Highway, waterway, and rail facilities are essential components of the spaceport system, particularly in the development and construction of spacecraft and other aerospace facilities. The existing highway, rail, airport, and seaport infrastructure is adequate to support all projected demand.

With the addition of new spaceports in the future, specific intermodal connections should be examined while these sites are being planned and developed. For potential landing sites on the west coast, particular attention will need to be paid to studying highway and rail linkages from west to east and ensuring that oversized cargo can be transported effectively across the state.

Summary of needed infrastructure improvements – intermodal connections

- *Evaluate routes for transport of spacecraft and launch vehicles from northwest Florida to Cape Canaveral Spaceport*
- *Study feasibility of routes from future landing sites on the west coast to launch sites on the east coast*

A Delta Mariner arriving at Port Canaveral.

3.7 Summary

At a glance, Florida's Spaceport System in the year 2023 may look very similar to the 2013 system. Existing spaceports will continue to meet demand for launches and payload processing; the classes of launch vehicles and spacecraft will look similar; airspace will continue to be managed and coordinated by the Air Force, NASA, FAA and commercial operators; and only limited improvements to the intermodal system will be needed to accommodate aerospace needs.

The primary differences between today's spaceport system and the future system will be how the sites are managed and enhanced to meet changing market conditions. Obsolete infrastructure will be demolished to reduce overhead costs; new enhancements will be constructed to accommodate commercial needs using public and private partnerships; and improved coordination and collaboration procedures and processes will be developed to make it easier for the system to respond to changing needs. Increased marketing and promotional activities will inform Florida residents, businesses, elected officials and policy makers about the economic benefits of the spaceport system and the need to support it. Similarly, Florida's Spaceport System will be marketed to commercial manufacturers, operators, industries and customers as the premier place in the world to meet all of their aerospace needs.

Florida's Spaceport System, the *Place for Aerospace*: Proven. Ready. Responsive. Safe.

PART 4 IMPLEMENTATION

Implementing the future spaceport system vision will require a comprehensive, multi-faceted approach, including:

- A collaboration and decision-making structure
- Establish system-wide program funding and prioritization criteria
- Upgrade and maintain essential infrastructure
- Enhance marketing and improve customer service
- Communicate the importance of Florida's Spaceport System

4.1 Collaboration and Decision-Making Structure

The five key partner agencies of Florida's Spaceport System—Space Florida, NASA, the 45th Space Wing, the FDOT and the FAA/Commercial Space Office—actively collaborate on numerous initiatives, programs and capital investments. The partners also collaborate with municipal and county governments, seaports, airports, aerospace industry, the Department of Economic Opportunity, Enterprise Florida and others. For example, all of the proposed spaceport system transportation improvements are coordinated with the local Transportation Planning Organizations, such as the Space Coast TPO in Brevard County.

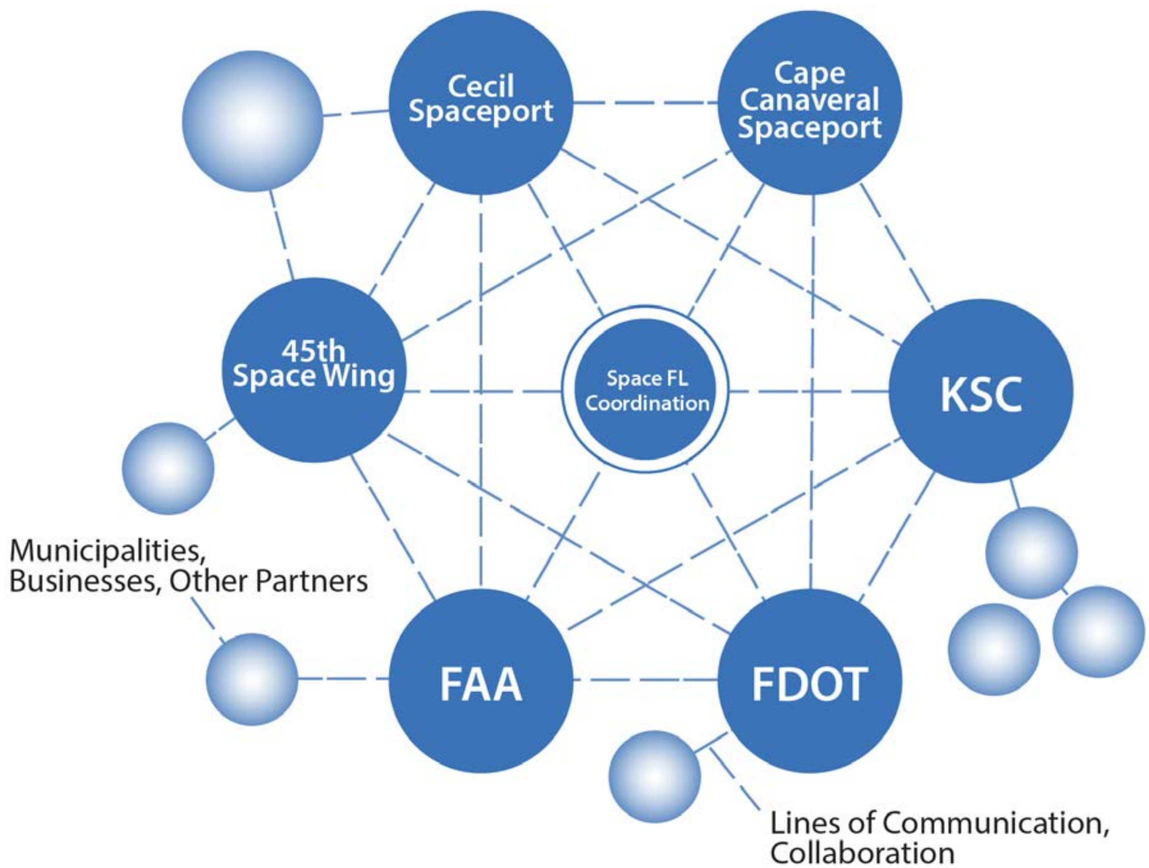
As the spaceport system matures, increased collaboration and decision-making will be necessary to better prioritize projects and guide investment.

While it is anticipated that the agencies will continue to actively collaborate to implement the vision, there is no formalized governance or decision-making model for the envisioned Florida Spaceport System. All of the key partner agencies are independent, autonomous agencies, with their own hierarchical organizational structure, legislative mandates, funding mechanisms and decision-making processes. This is true for the other partner agencies as well, including municipal and county governments, seaports, airports and aerospace businesses.

The current model of governance assumes that each partner organization has its own agreed-upon mission, hierarchy and decision-making processes. As the system matures, a more formal structure for collaboration and decision-making, particularly regarding recommendations for allocating funding for new or upgraded infrastructure will become necessary. A future model, graphically depicted in Figure 4.1a, shows the addition of a coordinating entity in the center of the autonomous organizations, which serves in the following roles:

- Coordinate monthly or quarterly meetings of the partner agencies to discuss current Spaceport System issues and opportunities
- Coordinate and compile an annual Spaceport System capital improvements program (CIP), based on the CIPs of each of the partner agencies
- Lead collaboration and partnerships between partners within the Spaceport System, as appropriate and/or requested
- Proactively identify key Spaceport System issues and opportunities that should be addressed by the partner agencies
- Develop, monitor and assist in the implementation of an annual strategic plan for the Spaceport System, including policies, programs, initiatives, operations and capital improvements

Figure 4.1a Governance Model of Florida Spaceport System



In many cases, Space Florida has played the role of coordinating entity. A key reason to add a coordinating entity to the model is to reduce the time needed for decisions, particularly regarding proposed partnerships and/or investments with commercial aerospace companies. Generally, three types of decisions need to be made:

- Opportunistic decisions, typically initiated by the commercial sector
- Reactive or proactive decisions to re-capitalize existing facilities, typically initiated by one of the partner agencies
- Proactive decisions to invest in new infrastructure and/or market sectors, e.g. telecommunications or life sciences, initiated by either the public or private sector

The coordinating entity facilitates action for decisions to be made more rapidly by spearheading the issue, convening collaborative meetings of agency decision-makers, and/or and working within each agency's decision-making process to reach consensus regarding a preferred direction.

Rather than create a new coordinating entity to serve in these roles, it was suggested that Space Florida continues to assume this responsibility. Through the Space Florida Act, the Florida Legislature designated Space Florida as "the single point of contact for state aerospace-related activities with federal agencies, the military, state agencies, businesses, and the private sector." Chapter 331, Florida Statutes, establishes the extensive powers and duties of Space Florida, ranging from owning and maintaining launch pads and transportation facilities to developing new concepts and issuing revenue bonds. Under this recommendation, Space Florida would still maintain its existing role as one of the five key partners in the Spaceport System, while assuming a second role as the coordinating entity for the System.

Space Florida and other industry representatives may wish to study comparable governance models to determine the best model to guide Florida's Spaceport System. Potential comparables have been documented in the KSC Governance Report produced by FDOT. It is assumed that the organizational structure for the System would remain non-hierarchical for the foreseeable future, and each organization would remain autonomous. But the addition of a coordinating entity would allow the Spaceport System to make the best use of available resources to accomplish its mission and to become pro-active regarding strategies for growing the system.

Actions to Improve the Collaboration and Decision-Making Structure:

1. Study and discuss comparable governance models as Space Florida becomes more operational
2. Determine if the addition of a "coordinating entity" is desirable
3. Determine if Space Florida is the appropriate coordinating entity; if so, determine if any changes are needed to Space Florida's organizational structure to serve in this role
4. Formalize the new collaborative and decision-making structure in some manner, such as a memo of understanding between agencies
5. Schedule and initiate regular Florida Spaceport System coordination meetings

4.2 Establish System-wide Program Funding and Prioritization Criteria

As discussed in Part 1, Florida Spaceport System partners receive annual funding to accomplish their individual missions. Space Florida receives annual operations funding from the Florida Legislature to foster the growth and development of the aerospace industry in Florida. It also facilitates capital funding for infrastructure improvements from the FDOT for Spaceport Transportation Projects. NASA receives funding for space exploration from the United States Government, as part of the annual federal budget approved by Congress each year. The U.S. Air Force funds the 45th Space Wing's mission to manage the Eastern Range.

Each partner agency uses its own Capital Improvement Plan to determine which projects or initiatives should be funded each year. There is an opportunity, when projects are in the best interest of multiple partners, for collaboration between the partners to realize the joint end. Based on previously developed criteria from the FDOT, Space Florida and other agencies, the following questions should be considered when prioritizing and deciding to invest in the Florida Spaceport System. These criteria are not prioritized or weighted, and should be reviewed, tested and refined:

- Will the proposed project foster the growth and development of the aerospace industry in Florida? (quantify)
- Will the proposed project directly or indirectly create high value jobs and/or help build, expand, attract and/or retain a science and technology-based workforce in Florida? (quantify)
- Is there non-state funding ***committed*** to match or exceed public funding for the project? (quantify)
- Will the project add a facility or program that is not currently part of the spaceport system but identified as a need?
- Will the proposed project enhance or modernize the existing spaceport system to increase ***needed*** capacity or capabilities for launching, landing, payload processing and manufacturing or related aerospace industry needs? (quantify)
- Will the proposed project help further the goals of Florida's Spaceport System?
- Will the proposed project help further the program requirements of one or more of the partner agencies?
- Will the proposed project increase Florida's competitive edge in the global aerospace market? (quantify)
- Will the proposed project have an adverse, neutral, or positive effect on Florida's natural environment? (quantify)
- Will the proposed project improve linkages or connections, to or within the Florida Intermodal Transportation System? (quantify)
- Will additional "spin-off" investments result from the proposed project? (quantify)
- Will the proposed project generate adequate revenues to offset continued operations and maintenance costs? (quantify)

Once the criteria is reviewed and refined, a scoring system should be created to provide a basis for quantitatively evaluating, ranking, and recommending top priority projects.

Actions to Establish System-wide Program Funding and Prioritization Criteria

1. Distribute proposed criteria to partner agencies
2. Meet to review, discuss and revise the criteria
3. Request that partner agencies "test" the criteria for funding priorities over a one-year trial period, e.g. the FDOT spaceport infrastructure grant program
4. Meet to review and discuss findings from the trial period, and revise the criteria as needed
5. Adopt the revised criteria as a basis for system-wide recommendations

4.3 Upgrade and Maintain Essential Infrastructure

The Florida Spaceport System Plan will guide which infrastructure upgrade projects are funded.

Florida's existing Spaceport System has more than adequate capacity to accommodate the anticipated increase in orbital and suborbital launches. Therefore, one of the system's greatest challenges is to maintain the infrastructure and/or retrofit it to meet the specific needs of civil, defense and/or commercial markets. Some of the buildings and facilities within the system are at least 50 years old, and maintenance of many facilities has been deferred for lack of funding. Other facilities need to be right-sized to serve launch demand.

Historically, funding has been prioritized based on civil and defense needs rather than the growing and increasingly significant commercial market. As operations and maintenance funding decreases from historic sources such as NASA and the DOD, it is critical to not only differentiate between essential and non-essential facilities that must be maintained for the system to remain competitive, but also to identify other potential funding sources to meet spaceport needs. Currently several studies are being conducted or proposed to determine infrastructure needs at specific facilities. These include:

- Kennedy Space Center Master Plan (on-going)
- Cape Canaveral Air Force Station General Plan (complete)
- Cape Canaveral Spaceport Master Plan 2013 and supporting strategic studies (on-going)
- Naval Ordnance Test Unit Master Plan (on-going)
- Cecil Spaceport Master Plan (complete)

Partner agencies should review, discuss and prioritize the specific projects identified in the individual master plans. Although a formal process has not been established for prioritizing project funding on a systemwide basis, such a process could easily be established with the guidance provided by the Florida Spaceport System Plan. Figure 4.3a below illustrates how such a process could work. Space Florida would use master plans to identify individual facility needs. Once needs are identified and project eligibility determined, Space Florida would then apply the prioritization criteria in order to rank order the project needs for potential state funding. Such funding could occur as part of the state's process to fund FDOT's SIS program.

Actions to Upgrade and Maintain Essential Infrastructure

1. Complete individual agency master plans, including the identification of needed infrastructure improvements
2. Differentiate between essential and non-essential system-wide infrastructure based on agency and system goals, available funding, existing and anticipated markets, and prioritization criteria
3. Develop system-wide one, five and 10-year capital improvement plans (CIPs) for essential infrastructure
4. Incorporate system-wide CIPs into the Florida Spaceport System Plan to comply with project review and submittal requirements in s. 331.360, F.S.
5. Re-purpose existing launch complexes and supporting facilities as necessary to accommodate civil and commercial flight
6. Define partner (public and private) roles in developing and maintaining infrastructure

4.4 Enhance Marketing and Improve Customer Service

Marketing and customer service will play a key role in the implementation of the Florida Spaceport System Plan. In light of reduced federal funding, as well as state and local emphasis on economic development and job creation, the successful growth of Florida's aerospace industry will rely heavily on the ability to attract and retain aerospace industries.

> *The successful growth of Florida's aerospace industry will rely heavily on the ability to attract and retain aerospace industries.*

Recommendations to attract and retain aerospace industries to Florida include:

- **Continue focusing on how to reduce the cost of launches and guarantee launch dates to attract more commercial operators**. In other words, establish the perception that Florida is customer friendly. This will naturally occur as the paradigm shifts to a 21st century commercial launch provider platform.

- **Continue to pursue new commercial space markets while decreasing reliance on federal programs**. Florida will need a paradigm shift to be competitive, considering the retirement of the Space Shuttle; NASA use of commercial vehicles to resupply ISS; the development of three new launch vehicles that are hoping to help the United States re-enter the commercial launch market; and, the emergence of two new potential markets, RLV's and UAV's. The emergence of new commercial space markets represents an opportunity and a challenge for Florida, specifically to overcome the perception that doing business on a federal facility is bureaucratic and cumbersome. Shifting paradigms requires a combination of actions, including an honest self-appraisal of strengths and weaknesses; a thorough understanding of customer needs and desires, including profitability; a willingness to make the changes necessary to meet customer needs and desires; and a process for communicating changes back to the customer. Some of these shifts have already occurred with positive results. Recently, Masten, XCOR, and Sierra Nevada have all signed agreements with Space Florida to move forward with projects at Cape Canaveral Spaceport. To continue attracting new customers, Florida will need to keep promoting its safety and low-government rates, and prove its reliability at every opportunity until the negative perception is gone.

- **Develop a new "brand" for the Florida Spaceport System so it is perceived as a valuable statewide asset rather than a collection of individual (mostly federal) facilities**. Decision makers and the public perceive the space program as predominantly federal programs located primarily at Cape Canaveral, and it is doubtful that anyone perceives the state highway system or municipal facilities as part of a larger state spaceport system. The partner agencies should discuss whether Florida's Spaceport System is simply a shared infrastructure system used by the agencies to help accomplish their individual missions or whether the Spaceport System has its own unique brand, identity and mission.

SpaceX's Falcon 9.

- **Continue collaborating on a new initiative with Workforce Florida.** The purpose of this initiative is to work with Florida universities and the business community to educate, attract and retain the engineers and technical professionals needed to build Florida's brand as the center for aerospace excellence in the world. This will also enhance Florida's reputation as a science and technology-based economy, fostering investments in allied fields.

- **Develop and share established metrics for measuring success.** This is particularly important in terms of economic development and job creation through payload processing, manufacturing and other aerospace-related industries. In our current economic environment, it is critical for public agencies to identify the benefits and returns generated by taxpayer investments in order to continue to receive public funding.

- **Improve responsiveness by continuing to survey customers**. Surveys are needed to identify perceived opportunities and constraints for doing business in Florida; modifying policies, processes and regulations that constrain commercial space operations (if possible); communicating improvements and changes back to customers; and promoting the economic and jobs-related benefits to local and state leaders and other elected officials.

Actions to Enhance Marketing and Improve Customer Service

1. Evaluate current launch costs; make recommendations for cost reductions
2. Identify alternatives for guaranteeing launch dates
3. Continue to identify and pursue new markets for the system
4. Develop a new brand for the Florida Spaceport System
5. Continue collaborating with Workforce Florida, Florida universities and the business community to educate, attract and retain engineers and technical professionals
6. Develop and monitor metrics that measure the Florida Spaceport System's success in meeting its goals; publish an annual report of the metrics
7. Conduct regularly scheduled/ annual customer surveys, round table discussions and other techniques to maintain close relationships with the system's customer base

4.5 Communicate the Importance of Florida's Spaceport System

Space Florida and the state's aerospace industry should develop a public awareness campaign to inform residents, visitors, business leaders and elected officials of the benefits of the aerospace industry.

The success of the NASA space programs, including the Space Shuttle Program and the programs that led to the moon landing, resulted in widespread public support for the U.S. space programs at Cape Canaveral Spaceport. The support was no doubt based on the federal government's ability and success in communicating the importance of space travel to the American public. Further, it was the public's knowledge of the NASA programs that led to widespread support over the years.

Space has become even more important to the lives of every Floridian. From GPS (Global Position System) to weather to international communications, to Google Earth and life science spinoffs, space and space-derived technology is more central to our lives than ever before. The importance of space remains but is not being communicated to the public to the extent that it used to be. This support is critical if Florida's Spaceport System is to be successful.

In addition to marketing Florida and providing good customer service to the aerospace industry, Space Florida and the state's aerospace industry should develop a public awareness campaign to promote the benefits of the aerospace industry to residents, visitors, business leaders, elected officials and policy-makers in order to attract new aerospace-related businesses; build support for increased levels of local and state aerospace infrastructure funding; and promote Florida as the best place in the world for aerospace.

Actions to Communicate the Importance of Florida's Spaceport System

1. Develop a succinct, compelling message regarding the economic, social and environmental importance of the aerospace industry for residents, businesses and local communities
2. Develop a public awareness campaign to promote the benefits of Florida's aerospace industry, building on the system's new brand
3. Include both traditional media (television, radio, print) as well as new social media technologies
4. Develop an annual program, including meetings and special events with federal, state and local officials and industry representatives, perhaps culminating with Space Day activities in Tallahassee and throughout Florida
5. Monitor and evaluate the effects of the campaign; adjust as necessary based on results

4.6 Summary

Florida's Spaceport System is poised to continue its global leadership in aerospace. In order to achieve the vision of a more agile, market-responsive system, the state will need to formalize its decision-making structure, establish system-wide criteria for project investments, upgrade its infrastructure, and communicate the importance of the system to current and future Floridians.

The time to move forward is now. Florida's existing Spaceport System is unrivaled in its history, infrastructure, and proven capabilities; but technology is evolving, and new markets are emerging. The state's 60-plus years of experience must be harnessed and adjusted to meet the needs of a growing suborbital market, and continue the state's leadership in orbital launches. It is up to Space Florida and its partners to facilitate this change, communicate the industry's importance, and continually demonstrate the system's capabilities of being safe, proven, responsive, and most importantly: ready.

REFERENCES

[i] Title XXV, Chapter 331, Part II, 331.204, Florida Statutes.
[ii] FAA. 2011 U.S. Commercial Space Transportation Developments and Concepts: Vehicles, Technologies, and Spaceports". Pg 47. January 2011. Online: http://www.faa.gov/about/office_org/headquarters_offices/ast/media/2011%20devcon%20report.pdf pg 47
[iii] FAA Office of Commercial Space Transportation (July 2012)
[iv] Title XXV. Chapter 331, Part I, 331.304. Florida Statutes.
[v] Excerpted from 2010 Spaceport Master Plan, RS&H, 2010. Page 25
[vi] Space Florida. Online: http://www.spaceflorida.gov/vision-2020
[vii] "Suborbital Reusable Vehicles: A 10-Year Forecast of Market Demand," study produced by The Tauri Group and funded by Space Florida and the Federal Aviation Administration Office of Commercial Space Transportation, July 2012. A seat/cargo equivalent can equal one seat or 3.3 lockers.
[viii] Redorbit.com. Online: http://www.redorbit.com/news/space/1112699191/spaceport-america-xcor-virgin-galactic-092312/
[ix] Title XXVIII, Chapter 380, Part I, 380.05, Florida Statutes.
[x] Federal Aviation Administration. NextGen Briefing; online: http://www.faa.gov/air_traffic/briefing. Accessed October, 2012
[xi] Federation of American Scientists. Online: https://www.fas.org/irp/nro/fy2011cbjb.pdf p. 452

APPENDIX A

ACRONYMS

ASOC	Atlas V Spaceflight Operations Center
ATK	Alliant Techsystems
CCAFS	Cape Canaveral Air Force Station
CIP	Capital Improvements Program
CSTARS	Center for Southeastern Tropical Advance Remote Sensing
DOD	Department of Defense
DOT	Department of Transportation
DRI	Development of Regional Impact
EELV	Evolved Expendable Launch Vehicle
ELV	Expendable Launch Vehicle
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCAAP	Florida Center for Advanced Aerospace Propulsion
FDOT	Florida Department of Transportation
GEO	geosynchronous orbit
ISS	International Space Station
KSC	Kennedy Space Center
LCC	Launch Control Center
MARS	Mid-Atlantic Regional Spaceport
MOC	Morrell Operations Center
MPO	Metropolitan Planning Organization
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
RLV	Reusable Launch Vehicle
SIS	Strategic Intermodal System
SLC	Space Launch Complex
SLF	Shuttle Landing Facility
SLS	Space Launch System
SLSL	Space Life Science Lab
UAS	Unmanned air systems
ULA	United Launch Alliance
VAFB	Vandenberg Air Force Base

APPENDIX B

Economic Impact of Space in Florida – 2010

With its vast aerospace infrastructure and talent pool, aerospace-related target industries, and geospatial position on the planet's surface, Florida has the aerospace services and marketplace edge like no other region in the world.

	Total # of Aerospace-Related Companies (reported)	Total # of Aerospace Industries Employees (reported)	Total Aerospace Industries Sales/ Revenues* (reported)
FLORIDA TOTAL	**10,681**	**183,523**	**$14,782,887,793**
FL COUNTY			
Alachua	176	1,524	$177,638
Baker	3	9	$654
Bay	133	6,110	$26,628
Bradford	6	24	$1,231
Brevard	408	14,113	$415,625
Broward	1,395	9,418	$1,374,866
Calhoun	2	3	$200
Charlotte	72	358	$47,288
Citrus	66	374	$9,768
Clay	78	689	$88,334
Collier	158	1,040	$98,885
Columbia	21	146	$9,749
DeSoto	16	448	$19,921
Dixie	4	12	$417
Duval	444	13,374	$392,249
Escambia	179	7,291	$168,737
Flagler	24	123	$9,587
Franklin	6	32	$1,744
Gadsden	11	242	$5,685
Gilchrist	4	35	$491
Glades	2	5	$591
Gulf	2	32	$100
Hamilton	2	3	$129
Hardee	4	157	$400
Hendry	13	699	$36,047
Hernando	69	280	$21,342
Highlands	28	204	$5,850
Hillsborough	649	9,263	$1,790,916
Holmes	5	20	$1,360
Indian River	63	283	$19,554
Jackson	24	210	$6,523
Jefferson	3	4	$68
Lafayette	2	8	$0
Lake	101	484	$28,914
Lee	274	1,612	$168,464
Leon	172	4,351	$157,636
Levy	12	56	$2,482
Liberty	2	4	$100
Madison	4	22	$1,649
Manatee	126	1,215	$109,608
Marion	148	1,281	$37,058
Martin	89	440	$39,306
Miami-Dade	1,775	11,862	$1,445,185
Monroe	83	3,615	$27,142
Nassau	18	86	$13,639
Okaloosa	194	52,330	$118,265
Okeechobee	15	183	$4,633
Orange	632	9,265	$698,819
Osceola	98	309	$17,178
Palm Beach	921	11,722	$2,648,400
Pasco	162	1,012	$82,022
Pinellas	522	4,072	$678,731
Polk	176	901	$50,335
Putnam	24	138	$6,799
Santa Rosa	79	3,548	$24,484
Sarasota	176	1,139	$105,588
Seminole	250	2,410	$88,838
Saint Johns	125	1,198	$40,200
Saint Lucie	125	629	$44,097
Sumter	23	67	$5,732
Suwannee	10	179	$15,809
Taylor	7	17	$754
Union	6	30	$1,591
Volusia	208	1,474	$146,718
Wakulla	7	58	$3,012
Walton	19	120	$4,593
Washington	12	238	$30,930
Other**	14	923	$520,192

***2010 Source*: Dun and Bradstreet (http://www.selectory.com) and compiled by The Florida State University Center for Economic Forecasting and Analysis (FSU CEFA)**

***The total aerospace industries sales and revenues for Florida counties are displayed in $Thousands and do not include NAICS 3364 and 334220.**

****Other county includes aerospace-related companies located in Florida with a mailing address listed outside of Florida.**

www.aecom.com

CORPORATE OFFICES

Los Angeles (Worldwide Headquarters)
555 South Flower Street
Suite 3700
Los Angeles, CA 90071-2300
United States
T +1 213 593 8000
F +1 213 593 8730

Atlanta
1360 Peachtree St. NE
Suite 500
Atlanta, GA 30309
United States
T +1 404 965 9600
F +1 404 965 9605

info@aecom.com

AECOM