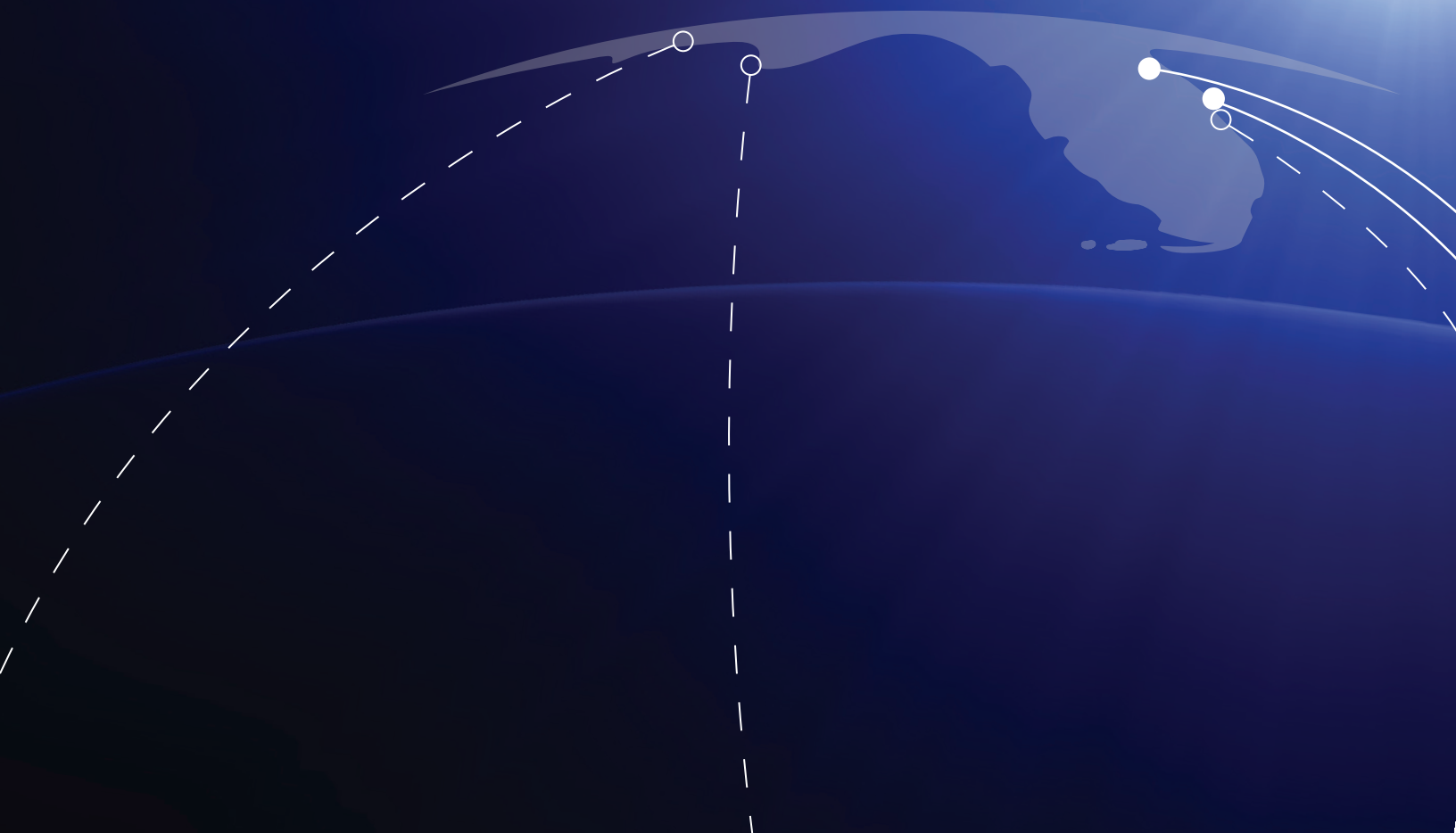
Florida Spaceport System Plan 2018

SPACE FLORIDA



Florida Spaceport System Plan 2018

SPACE FLORIDA

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FOREWORD

FOREWORD TO 2018 UPDATE

In April 2013, Florida published the nation's first Spaceport System Plan. The plan described the elements and functionality of Florida's current and future spaceport system. It included the evolving space transportation industry's place within the Florida Transportation Plan and its Strategic Intermodal System. Most importantly, it established system goals and an implementation approach for determining system-wide needs and identifying system-wide priorities for funding. Florida's Spaceport System Plan addresses the Legislative intent and requirements of Space Florida's authorizing statute – Chapter 331 Part II.

The space transportation industry has seen rapid and dramatic developments since publication of the initial Florida Spaceport System Plan. This 2018 update is intended to address the most significant of those developments while recognizing the sound foundation of the original plan. At the same time, every component spaceport and federal launch facility included in the 2018 Florida Spaceport System Plan is currently undergoing significant revision of their respective long range plans. These revisions to the long range plans, coupled with a continuing dynamic evolution of the broader domestic and international spaceport environment, will soon require a more extensive revision of Florida's space transportation planning.

This 2018 update provides an interim update in preparation and expectation for a more comprehensive reassessment of the Florida Spaceport System Plan in 2019-2020.

Wherever practical and available, material and data regarding system elements and industry trends have been brought up to date. Planning information has been solicited from component spaceports and incorporated. New sections have been added to describe the anticipated evolution of Space Florida's system-wide spaceport authority roles, and provide a listing of identified unfunded needs.

The Florida Spaceport System Plan will continue to provide a forward looking vision and planning tool for strategically managing Florida's on-going initiative to be a world leader in global space transportation and the industries it supports.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Florida's transportation infrastructure is consistently ranked among the best in the nation, its space transportation capabilities widely recognized as the best on the planet.

Florida not only leads in its infrastructure, it leads in its vision, policy, and planning for how all its forms of transportation can be integrated into a single transportation network – a Strategic Intermodal System (SIS).

Florida's transportation leaders view space not as a program, but as a collection of high value destinations requiring the transport of people and goods originating from locations around the world to locations beyond earth's atmosphere. They view its two spaceports and related space transportation infrastructure as an integral element of Florida's SIS. Functioning as an integrated intermodal network, Florida's transportation system underpins its strength as the 19th largest economy in the world, and will facilitate its role as the leader in enabling global space commerce throughout the 21st Century and beyond.

Florida's Legislature has defined and designated five geographic areas of the State as spaceport territories. Existing, planned, and future space transportation facilities within these territories, together with the statewide industry and technology assets supporting space transportation, comprise the Florida Spaceport System.

Space Florida, an independent special district and political subdivision of the State, was created by the Legislature in 2006 via a statewide charter to develop a master plan for the modernization and growth of space transportation infrastructure in designated territories. Space Florida was directed to serve as a spaceport authority for purposes of identifying and planning a spaceport system to accommodate current and future commercial, national, and state space transportation requirements.

This Florida Spaceport System Plan (FSSP) is intended to satisfy that statutory responsibility by integrating the site-specific master plans of Florida's two existing spaceports – the Cape Canaveral Spaceport and Cecil Spaceport – as well as map potential future spaceport territory development that may be required to accommodate the needs of the space transportation industry. The State of Florida's FSSP is a first in the nation.

As determined in the development of the initial 2013 FSSP, this 2018 update concludes that there is ample existing capacity within the territories of the two existing Florida spaceports. That existing capacity and its growth potential will satisfy foreseeable launch and launch-related support operations as well as most, perhaps all, of the capabilities required for recovery and refurbishment of reusable space transportation systems.

While the FSSP describes trends in the national and international proliferation of space launch sites – an emerging global network of spaceports – it also highlights the commanding competitive position of Florida's Spaceport System. Cape Canaveral Spaceport is clearly the world's leading orbital spaceport in terms of diversity of operating systems, capacity for lifting metric tons of cargo, support for human spaceflight, and adaptability to the evolution of space transportation technologies. That competitive position is further strengthened by the complementary capacity and capability of Jacksonville's Cecil Spaceport, which provides the infrastructure necessary to support the needs of the horizontal launch industry.

The FSSP establishes clear system goals that align with those of the Florida Transportation Plan. It addresses the opportunities and challenges of a dynamic, evolving industry and global marketplace. It describes Space Florida's existing statewide spaceport authority role, and how that role is evolving to include:

- Space transportation and space policy engagement regionally, nationally, and internationally
- Active engagement with the National Aeronautics Space Administration (NASA), the United States Air Force (USAF), and the Federal Aviation Administration (FAA) in visioning and planning the spaceport of the future, including the transitioning of state and federal roles
- Supporting space transportation and advanced aerospace activities throughout Florida in range and operations safety, as well as emergency response when needed
- Developing approaches to support and facilitate commercial range safety and flight monitoring instrumentation, together with development of commercially operated support services
- Proactive participation in Florida land use planning, including planning on federal properties, to help ensure capacity for future space transportation needs

The plan defines the Florida Spaceport System vision, and an approach to implementation that includes:

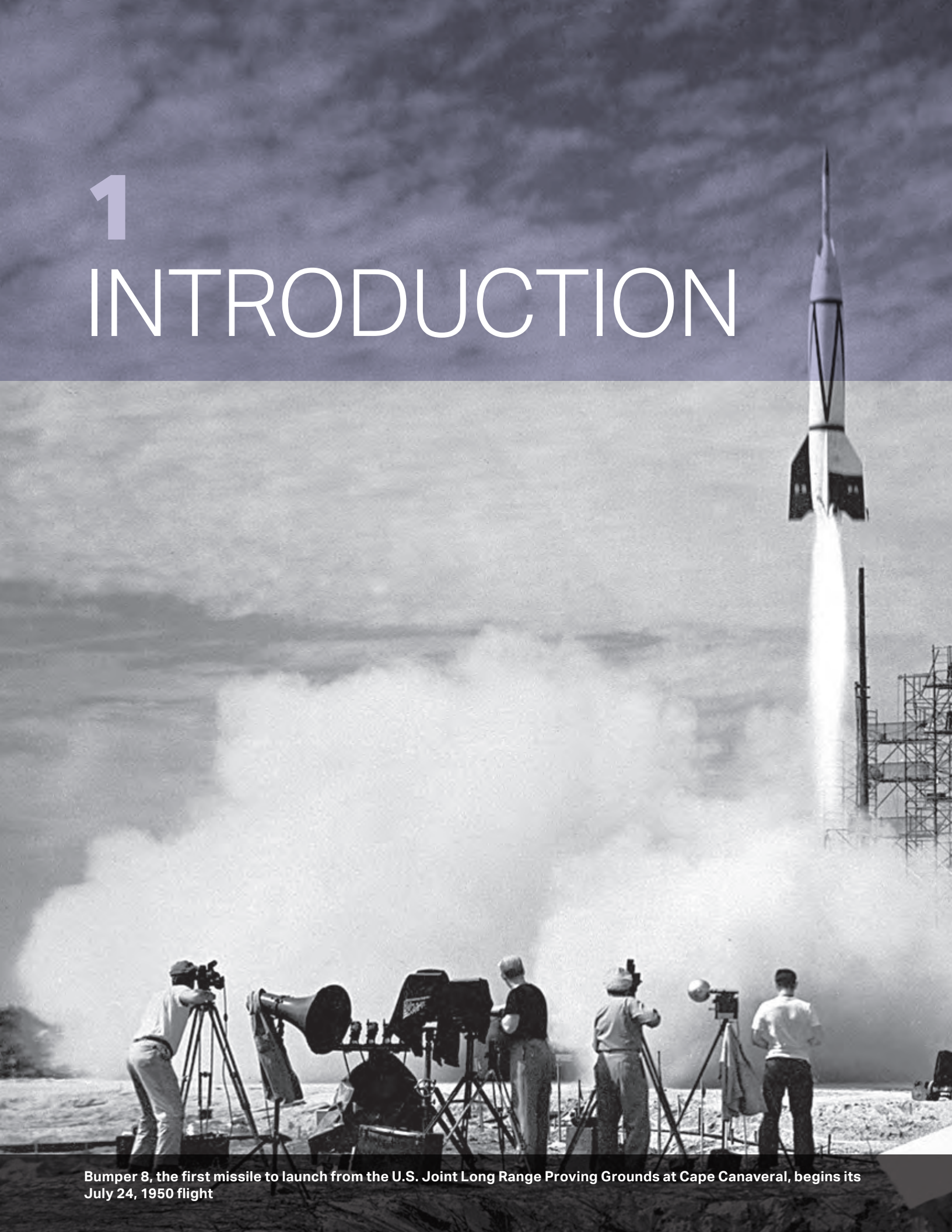
- A collaboration and decision-making structure
- System-wide program funding and prioritization criteria
- Modernization and sustainment of essential infrastructure
- Enhanced marketing and customer service focus
- Communicating to stakeholders the importance of the Florida Spaceport System

Florida's transportation trends reflect how technology is changing how we live, how we get ourselves from place to place, and how we deliver the goods and services essential to the well-being of our global community. In no mode of transportation is the influence of advancing technology and innovation more evident than it is in space transportation.

In visioning, planning, and implementing the spaceport system of the future, Florida is ensuring its citizens, its visitors, and its trading partners a future of boundless opportunities.

SpaceX rocket launch and landing at Cape Canaveral Spaceport

1 INTRODUCTION



Bumper 8, the first missile to launch from the U.S. Joint Long Range Proving Grounds at Cape Canaveral, begins its July 24, 1950 flight

1.1 SPACEPORT HISTORY

HISTORIC DEVELOPMENT OF FLORIDA SPACEPORTS AND SPACE TRANSPORTATION INDUSTRY

Space transportation has made enormous strides over the past 65 years. Florida has played a vital role in this industry, serving as the proving grounds for the nation's missile development programs of the 1950s, to the launch pad for sending Americans into space and the Moon's surface in the 1960s.

Florida's spaceport landscape has grown from the makeshift seaside launch site for its first missile launch, Bumper 8, to the extensive built infrastructure that today exists at NASA's Kennedy Space Center (KSC) and the Cape Canaveral Air Force Station (CCAFS) – together known as the Cape Canaveral Spaceport (CCS).

Spaceports worldwide support ever advancing technologies for transporting cargo and people into space. As they continue to evolve, spaceports will be networked for rapid transit providing point-to-point connections across our planet. The business model for space transportation is rapidly maturing with global space commerce.

Spaceport development was once funded solely by the federal government, driven by national security and exploration goals. Today's space industry increasingly relies on commercially operated launch systems and spaceport infrastructure to meet worldwide demand for space-based products and services.

While Florida's spaceports and spaceport system has its origins in the 1949 establishment of the Joint Long Range Proving Grounds at Cape Canaveral, the transformative era of commercial spaceport development began with the FAA's granting of a launch site license to Florida Spaceport Authority in 1997.

In 1969, a Saturn V rolls toward KSC's Pad 39A. To date, the tallest and most powerful rocket to operate from any spaceport in the world, with a lift capacity of 140 metric tons to low earth orbit

Florida was the second state, after California, to obtain a commercial site license for the redevelopment of Space Launch Complex (SLC) 46 on CCAFS to support multiple launch vehicles.

On January 7, 1998 a Lockheed Athena II launched the Lunar Prospector mission in the nation's first launch from a commercially operated site at SLC-46. A year later, Taiwan's first experimental satellite was launched from SLC-46.

Since that time, Space Florida and industry partners have enabled approximately $1 billion in non-federal public and private investment to modernize and grow Florida's spaceport infrastructure.

This has included modest but foundational investments in the spaceport territory operated by Jacksonville Aviation Authority (JAA) as Cecil Spaceport, granted an FAA commercial spaceport license in 2010 to become Florida's second and the nation's eighth commercial spaceport.

Gov. Rick Scott signed legislation passed in the 2011 Florida Legislature adding Cecil Spaceport to Florida's designated spaceport territories, and incorporating it into an evolving statewide spaceport system.

Titusville's Space Coast Regional Airport and adjacent commerce park property was added to Florida spaceport territory by the Legislature in 2013 and has initiated an application to the FAA for a launch site operator license.

1.2 A STATEWIDE AUTHORITY FOR THE NATION'S FIRST SPACEPORT SYSTEM

Florida has a long and impressive history of leaning forward to face a dynamic worldwide space transportation industry. It established the nation's first state-chartered space transportation authority in 1989 – Spaceport Florida Authority. The Legislature empowered the new organization with broad statutory powers generally modeled to be similar to those employed by airports and seaports to facilitate and operate infrastructure.

Prior to the formal establishment of the Spaceport Florida Authority, a statewide evaluation of potential sites for commercial vertical launch capabilities for a Florida Spaceport was performed, and identified underutilized sites and facilities at Cape Canaveral as the most feasible, even with the challenges of negotiating and implementing the required operating environment on federally-controlled property and under the rules of a federal launch range.

In 2006, the Legislature created Space Florida to consolidate several previously separate space industry development initiatives, and provide focus for a statewide authority responsible for planning the modernization and growth of space transportation infrastructure in designated geographic territories.

Space Florida was directed to serve as a spaceport authority for the purposes of identifying and planning a spaceport system to accommodate current and future commercial, national, and state space transportation demand. Space Florida's role, as defined in its enabling statute, is to develop a spaceport master plan (formally designated by Space Florida as a statewide systems plan to avoid confusion with the individual master plans for the component spaceport territory areas) for expansion and modernization of space transportation facilities within:

- The CCS territory, which incorporates all of the federal property in Brevard and Volusia counties making up the KSC and CCAFS
- Patrick Air Force Base in Brevard County
- Eglin Air Force Base and its Cape San Blas facility in several counties of the Florida Panhandle
- Cecil Spaceport and associated commerce park property in Duval County
- Space Coast Regional Airport and associated commerce park property in Brevard County

These territories and Florida's existing spaceport system are described in more detail in Part 2.

Working with the Florida Department of Transportation (FDOT) Aviation and Spaceports Office, Space Florida developed the Florida Spaceport System Plan to satisfy its responsibility to develop and maintain a master plan for space transportation facilities within all designated territories, and to coordinate the development of spaceport infrastructure and related transportation facilities as an element of Florida's Strategic Intermodal Systems (SIS) Plan. Space Florida's statewide authority role also includes supporting the funding through various mechanisms of spaceport infrastructure projects which it evaluates for eligibility and prioritization consistent with the goals of the system plan and the goals and objectives for the component elements of the Florida Spaceport System. Space Florida's evolving statewide space authority role, as it seeks to apply operational capabilities to broad system needs, is described in Part 6.

Entrance to Space Coast Regional Airport

1.3 EMERGING SPACE TRANSPORTATION TRENDS AFFECTING THE STATEWIDE SYSTEM AND SPACEPORT TYPES

Services enabling access to and from high-value destinations in space are provided by a space transportation industry increasingly commercial in operation, and highly diversified in carrier systems to meet the tailored needs of its customers. More forms and variants of launch vehicles in all classes exist worldwide today than ever before. New systems are in development continually, pursuing design improvements to lower the costs of space access for targeted markets, and provide increasing reliability, safety, and operability. Innovations in vehicle propulsion, cargo and human carrier systems, reusability, and flight capacity are stimulating increased levels of competition both in the United States and internationally.

In general, these transportation systems and the markets they serve operate to reach suborbital altitudes of about 100 kilometers (62 miles) for brief periods, or must be able to reach orbital velocities to place people or cargo into earth orbits. The size, power, and support needs of the launch systems all depend on whether the destination is suborbital or orbital for the customer's need, how much payload mass is being lifted, and the type of launch system.

The vast majority of today's space transportation industry is in medium to heavy lift launch vehicles that can place government or commercial satellites into orbit. Smaller rockets and an emerging fleet of reusable suborbital launch vehicles support space transportation demand for research flights, and soon for adventure tourism by people wanting to briefly experience spaceflight. With the increasing advances in small satellite technology and their shrinking size, these smaller launch systems flying suborbital trajectories may also be able to place small payloads into low earth orbit.

All end-user markets for space-based products and services depend on availability of reliable and competitively affordable space transportation capabilities, which in turn require the availability of responsive, efficient spaceport facilities that enable those providers to compete for and meet customer needs. Spaceports are becoming more tailored to the needs of the customer markets the launch operators are trying to serve.

Just as space launch systems compete by size class and market niches, so do spaceports. Consider airports, for example, where various niches of air traffic are served by facilities ranging

from international airport hubs to small airfields of general aviation (GA), regional and local airports. Ports serving maritime traffic range from deep-water seaports serving ocean-going freighters to inland waterway barge ports and pleasure boat marinas. There is a spectrum of spaceport types that are generally defined by the size and characteristics of the transportation systems they have capacity and location to support.

A few major spaceports, like Florida's CCS, have the site capacity to support a full range of launch systems and markets, while most will be designed and operated to support a limited range of either suborbital or orbital missions.

SpaceX Rocket launch from Cape Canaveral Spaceport SLC-40

1.4 TODAY'S COMPETITION ON A NATIONAL AND WORLDWIDE LEVEL

There has been an expansive proliferation of spaceports worldwide and within the United States to respond to the global space transportation trends described above. These launch sites range from the major world spaceports, to the rapidly growing list of spaceports both nationally and internationally that are being established to serve the emerging markets for suborbital spaceflight.

Florida's CCS has the potential to secure its position as the world's busiest and most productive spaceport throughout the 21st Century. Cecil Spaceport has the potential to secure a share of the world market for suborbital spaceflight, including the long-anticipated market for human spaceflight and adventure tourism to the edge of space just beyond earth's atmosphere. Additionally, as a result of the airspace architecture, available area for expansion and existing and planned infrastructure, both the Cecil Spaceport and CCS are well positioned to accommodate the Small Satellite Deployment and Educational Markets, as well as the Point-To-Point Transportation Market, which will evolve as the horizontal launch industry continues to grow.

But these Florida spaceports will not realize these positions without competition. In the United States alone, the FAA's latest inventory of spaceports includes 19 active launch sites. These include the 10 FAA licensed sites that are operated by state-established entities and local airport authorities. There are 8 U.S. Government operated launch sites, some of which are available for commercial operations. Proposed new U.S. orbital launch sites are being developed on the southeast coasts of Texas and Georgia. Other sites co-located with existing airports are also seeking a FAA license as spaceports. This competitive landscape of domestic spaceports serving a broad range of launch service demand is depicted in **Figure 1.4a**.

Figure 1.4a: U.S. Spaceports Source: Space Florida

Figure 1.4b is a map of major spaceports worldwide. It includes only those with site capacities to support one or multiple launch systems that can achieve a combined annual lift of 50 metric tons or greater to low earth orbit.

Both Russia and China brought new orbital spaceports on line in 2016. Other spaceports are seeking to improve throughput or field more powerful launch vehicles to more effectively compete with technology advances and lower costs of U.S. providers like SpaceX.

While all these competing spaceports are supported by system elements similar in function to those of the Florida Spaceport System, they are not presently connected to constitute a domestic or international spaceport system or network. It can be anticipated that such regional or global spaceport networks will almost certainly arise as efforts to advance point-to-point hypersonic and suborbital flight mature, and space transportation systems evolve to multi-spaceport operations for both launch and re-entry.

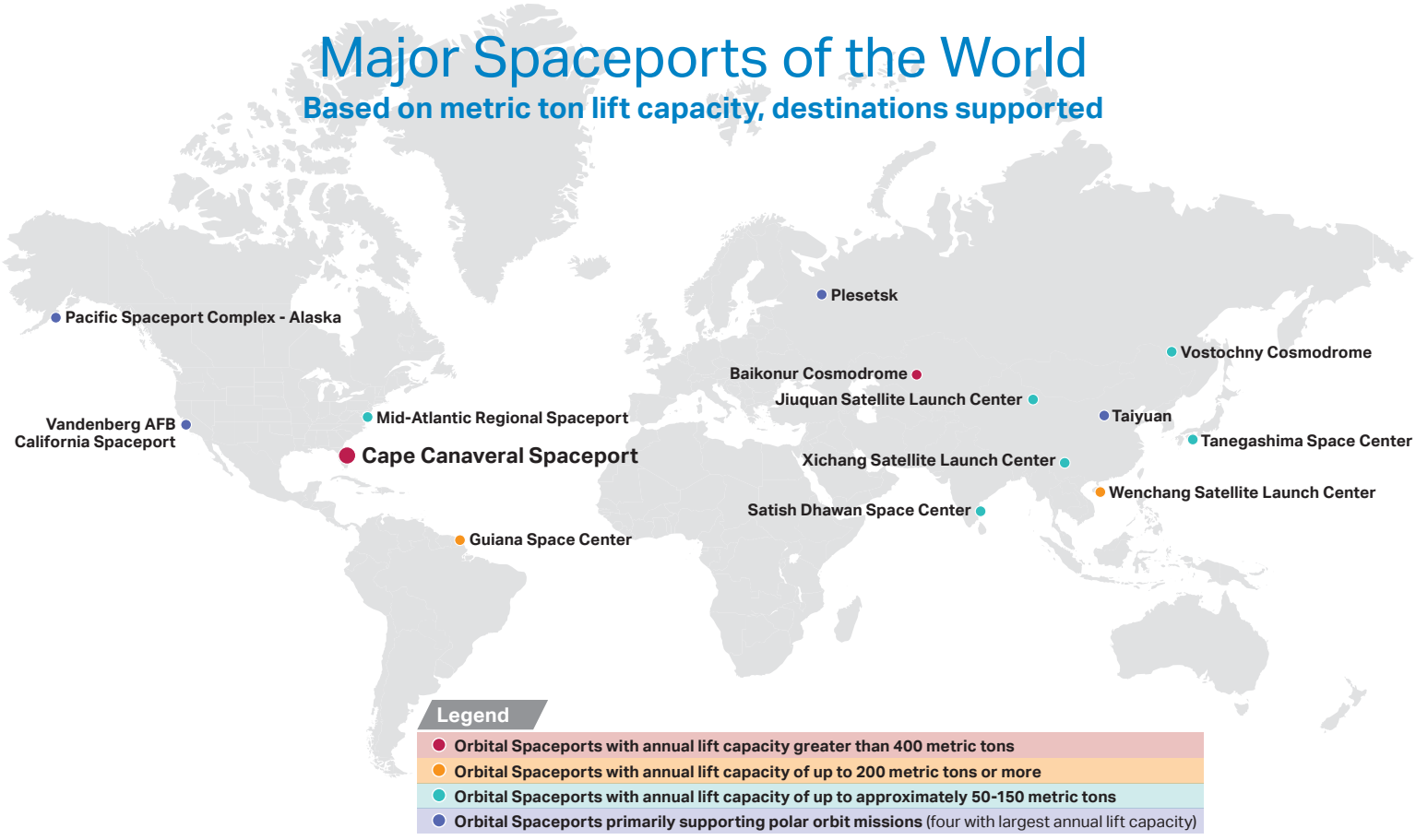


Figure 1.4b: Global Spaceports

1.5 COMPETING STATES SPACEPORTS AND SPACEPORT SYSTEMS

While not operationally connected with Florida's Spaceport System, the spaceports and spaceport systems in neighboring and nearby states share and influence some of the same critical infrastructure. Most notably the portions of the National Airspace System that are affected by space transportation activities, and the trajectory pathways utilized to achieve orbit, re-entry, or suborbital spaceflight in offshore areas (**Table 1.5a**).

Florida's Spaceport System is most directly impacted by the growth of orbital spaceport sites along the U.S. Eastern Seaboard and Gulf coast states. Georgia's proposed Spaceport Camden (**Figure 1.5a**) is located approximately 50 miles northeast of Cecil Spaceport and 30 miles northeast of Jacksonville International Airport. An environmental analysis was initiated in 2016 to support Camden County's application to the FAA for a launch site license, based on a medium class launch vehicle that would support a lift capacity of more than 150 metric tons annually, putting it in the class of a major world spaceport.

Launches occurring from Spaceport Camden would be capable of a wide range of trajectories similar to those departing from CCS. It would join the Mid-Atlantic Regional Spaceport in Virginia in sharing the need for scheduled use of the Eastern Range, adding new complexity to the growing challenge of managing the coordination and separation of air traffic and space traffic. The planned concept of Spaceport Camden includes provisions to accommodate vertical launch operations. While the potential exists for these to directly impact scheduled launches at Cecil Spaceport, airspace mitigation procedures and protocols are being developed to eliminate any possible operational interference induced by Spaceport Camden.

The privately operated SpaceX commercial launch site planned at Boca Chica Beach in south Texas has completed the FAA's environmental impact evaluation. FAA licensing is still in progress to enable the site to become a major orbital spaceport with capacity permitted to support more than 150 metric tons of space-bound cargo annually.

Ellington Spaceport in Texas was licensed in 2015 by the FAA and can support suborbital launch operations in an offshore area of the Gulf of Mexico. There have been frequent discussion of other potential suborbital spaceports along the Gulf Coast.

Gulf-area spaceports would have direct influence on the schedules and operations of each other. However, elements of the Florida Spaceport System, existing or future, that will support orbital reentries of spacecraft could be influenced by either orbital or suborbital operations over portions of the Gulf that may be in the re-entry flight path.

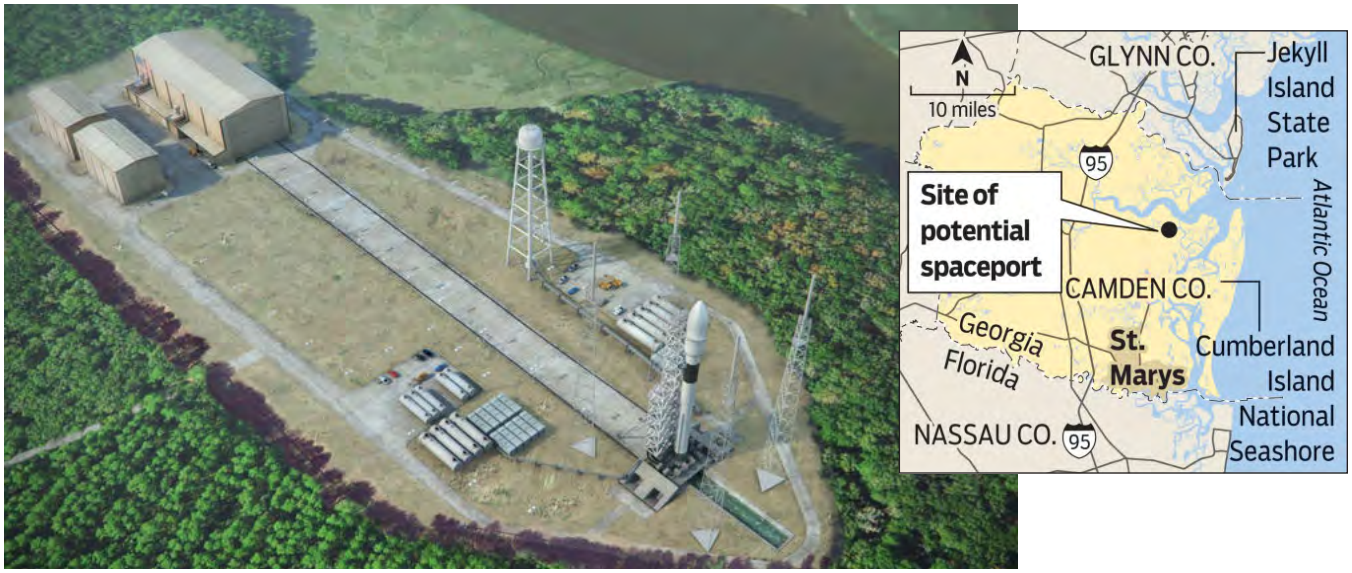


Figure 1.5a: Conceptual launch site facilities for Spaceport Camden and locational map of the proposed site

Table 1.5a: FAA-Licensed Commercial Spaceports in the United States

SPACEPORT NAME	LOCATION	OPERATOR	SERVICES	COMMERCIAL LICENSE ISSUED	ORBITAL	SUB-ORBITAL
Vandenberg Air Force Base	Lompoc, CA	Spaceport Systems International	Payload processing; commercial launches in future	1996	Y	N
Cape Canaveral Spaceport	Cape Canaveral, FL	Space Florida, NASA, United States Air Force (USAF)	Governmental, commercial, payload processing, scientific	1997	Y	Y
Mid-Atlantic Regional Spaceport (MARS)	Wallops Island, VA	Virginia Commercial Space Flight Authority	Commercial, governmental, scientific, academic	1997	Y	Y
Pacific Launch Complex*	Kodiak, AK	Alaska Aerospace Corporation	Commercial, governmental	1998	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	Sierra County, 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
Midland International Airport	Midland, TX	Midland International Airport	Commercial (horizontal launch), scientific	2014	N	Y
Ellington Airport	Houston, TX	Houston Airport System	Commercial, payload processing, scientific	2015	N	Y

* Formerly Kodiak Launch Complex

Source: Space Florida

1.6 SYSTEM COMPONENTS

Each component of the spaceport system has an important role. The major components of a spaceport system are 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, or rights-of way."[i]

In a sense, spaceports are 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 processing facilities, range assets, and ground control centers, which can be located away from launch/re-entry sites.

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 control. 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 SpaceX Launch Control Center at Cape Canaveral Air Force Station

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 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 vehicle (ELVs) or reusable launch vehicle (RLVs) launch vehicles. 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 1.6a** illustrates the main orbital launch vehicles and spacecrafts that currently operate or are expected to do so at CCS.

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.

Several SRVs are expected to operate at the former Shuttle Landing Facility (SLF) runway after Space Florida completes FAA licensing of the facility for commercial space operations. Those vehicles may include the human spaceflight and small satellite launch capable systems.

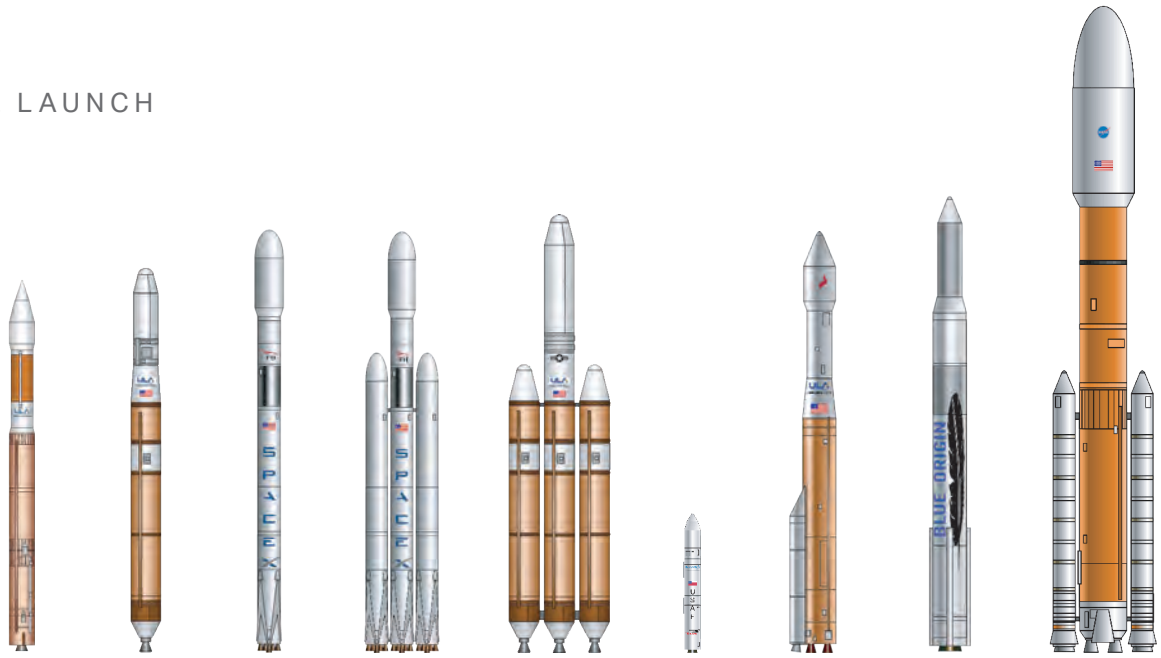
PAYLOAD PROCESSING FACILITIES

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 and center of commerce.

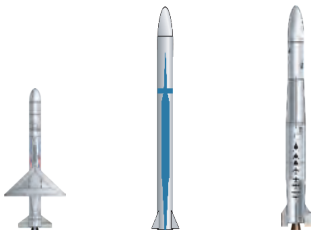
VERTICAL LAUNCH



Vehicle	Atlas V	Delta IV	Falcon 9	Falcon Heavy	Delta IV Heavy	Minotaur IV	Vulcan	New Glenn	SLS
Lift Class	Medium	Medium	Medium	Heavy	Heavy	Small	Medium	Medium-Heavy	Super Heavy
Operator	ULA	ULA	SpaceX	SpaceX	ULA	Orbital ATK	ULA	Blue Origin	NASA

Expected 2017-2020

HORIZONTAL LAUNCH



Vehicle	Pegasus XL	GOLauncher-2	LauncherOne
Lift Class	Small	Small	Small
Operator	Horizontal ATK	Generation Orbit	Virgin Galactic

Figure 1.6a: Current and Future Orbital Launch Vehicles

Source: FAA, Annual Compendium of Commercial Space Transportation, 2016

1.7 FLORIDA SPACEPORT SYSTEM GOALS AND FLORIDA TRANSPORTATION PLAN GOAL COMPARISON

All of Space Florida's Spaceport System Goals are in line with those set by the FDOT in their Florida Transportation Plan (FTP) of December 2015. A comparison is shown in **Figure 1.7a**.

VISION

The vision for Florida's Spaceport System is to have Florida Spaceports as the premier transportation hub for global space commerce. 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 such as autonomous flight safety and fly-back boosters. Moreover, new and innovative operations and business approaches will drive changing requirements for Spaceport infrastructure and capacity. Florida Spaceports shall be at the forefront of spaceports employ new techniques and support systems to lower their operational cost.

SpaceX's Falcon 9 carries the Eutelsat/ABS satellites on June 15, 2016

FLORIDA TRANSPORTATION PLAN GOALS

Transportation solutions that support Florida's global **Economic Competitiveness**

Agile, resilient, and quality **Infrastructure**

Transportation solutions that support **Quality Places** to live, learn, work, and play

More Transportation Choices for people and freight

Transportation solutions that enhance Florida's **Environment** and **Conserve Energy**

Safety and **Security** for residents, visitors, and businesses

Efficient and Reliable Mobility for people and freight

FLORIDA SPACEPORT SYSTEM PLAN GOALS

1 Create a **Stronger Economy** where Florida's spaceports and aerospace businesses can thrive

2 Guide public and private investment into **Emerging and Growing Aerospace Enterprises** and maximize the use of existing aerospace resources

3 Enrich our quality of life while providing responsible **Environmental Stewardship**

4 Advance a **Safer and Secure Spaceport** transportation system for residents, business, and others

Figure 1.7a: Florida Spaceport System Plan Goals

2 FLORIDA'S EXISTING SPACEPORT SYSTEM

NASA ASTER image of KSC and CCAFS taken from the Terra Spacecraft in 2006.

Space exploration missions have been launching from Cape Canaveral, Florida for more than six decades, including America's first launch of Bumper 8 on July 24, 1950 and the first manned mission in 1961. Florida is geographically well situated 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. In recognition of this fact, Florida has served the federal government, the Department of Defense and the commercial sector as one of their premier choices for space launch and operations destinations.

Entrance to Cecil Airport

2.1 INVENTORY OF SYSTEM CONDITION AND PERFORMANCE

FLORIDA SPACEPORTS AND SPACEPORT TERRITORIES

Florida is unique in that it has legislation specifying 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, the following spaceport territories exist in Florida:

i. 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".

ii. Certain real property located in Santa Rosa, Okaloosa, Gulf, and Walton Counties which is included within the 1997 boundaries of Eglin Air Force Base.

iii. Certain real property located in Duval County which is included within the boundaries of Cecil Airport and Cecil Commerce Center.

iv. 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."

v. Certain real property located in Brevard County which is included within the boundaries of Space Coast Regional Airport, Space Coast Regional Airport Industrial Park, and Spaceport Commerce Park.

Figure 2.1a illustrates the current licensed spaceports, designated spaceport territories, and other significant system components.

Two of these spaceport territories are spaceports with active licenses issued by the FAA: CCS and Cecil Spaceport. CCS includes facilities from both CCAFS and KSC. CCS currently has five active orbital launch sites in Space Launch Complex (SLC)-41, SLC-40, SLC-37, SLC-46 and Launch Complex (LC)-39A. There is one orbital LC in the process of being activated, LC-39B. There is one additional LC that is in a state of readiness but not currently active, LC-39C. SLC-36 is being rehabilitated for an orbital launch facility supporting Blue Origin heavy launch vehicle. A number of additional sites have been identified for orbital launch at the CCS. There is a horizontal launch and re-entry site, the former SLF, which is capable of supporting both spacecraft and aircraft. Space Florida is currently in the process of obtaining an FAA license for the SLF.

Cecil Spaceport completed the FAA licensing process in 2010 and was issued Launch Site Operators License 09-012 to accommodate suborbital horizontal launch operations capabilities. In 2015, Revision 1 to the license was issued to account for Cecil Spaceport's modified Explosive Site Plan which included solid propellants storage and an Oxidizer Loading Area (OLA).

Since receiving Revision 1, the JAA has completed the modifications necessary to add an additional flight corridor and operating range, which is located west of Cecil Spaceport and serves as one of the first overland flight corridors established in the State of Florida for the purpose of benefiting the Commercial Space Industry.

The Boeing Starliner spacecraft rendering that will take astronauts to the International Space Station

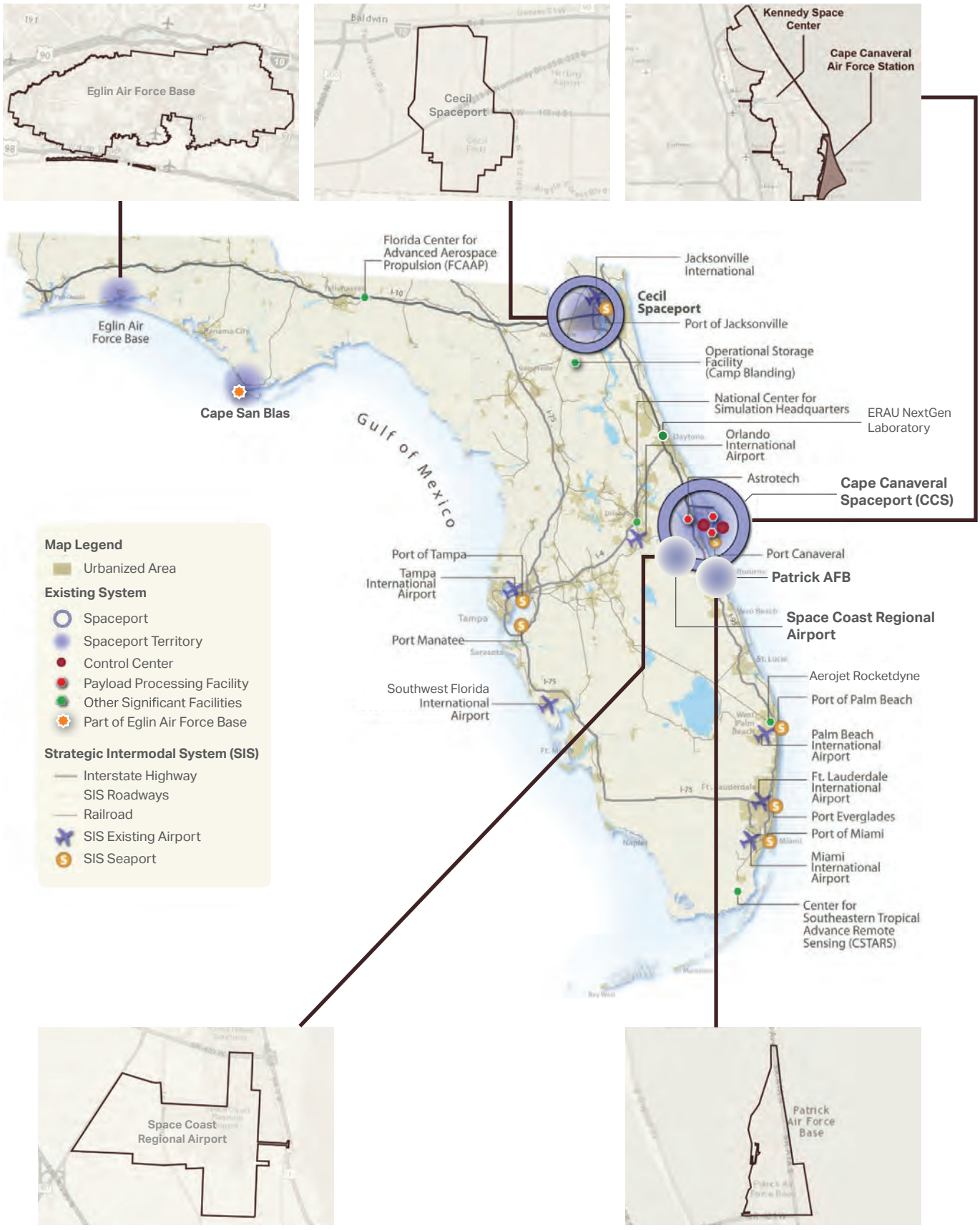


Figure 2.1a: Florida's Existing Spaceport System

SPACEPORT	ORBITAL VERTICAL LAUNCH	SUB-ORBITAL VERTICAL LAUNCH	ORBITAL HORIZONTAL LAUNCH	SUBORBITAL HORIZONTAL LAUNCH	VERTICAL TEST	HORIZONTAL TEST	UAS* TEST	RE-ENTRY
Cape Canaveral	X	X	X	X	X	X	X	X
Cecil			X	X		X	X	X

* Unmanned Aerial System

Source: Space Florida

NOTE: Florida's Strategic Intermodal System includes all facilities at Cape Canaveral Spaceport and Cecil Spaceport, but currently the only FAA/AST Active Launch Site Operator's Licenses are held by Space Florida for SLC 46 and JAA for Cecil Spaceport.

Figure 2.1b: Florida Spaceport Capabilities

Figure 2.1b shows the current and potential capabilities of Florida's spaceports:

CAPE CANAVERAL SPACEPORT

CCS consists of two properties, KSC and CCAFS (**Figure 2.1c**).

KSC makes up the largest portion of CCS and 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 2011, KSC is transitioning to a multi-use spaceport to serve government and commercial customers.

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 square miles to the Indian Ocean. CCAFS continues to conduct launch operations and provides range support for military, civil, and commercial launches. CCAFS has a variety of facilities including five active orbital SLCs and a 3,048-meter (10,000-foot) runway, that can support horizontal launch vehicles such as Pegasus. It also has special vehicle re-entry corridors, operations control center, and processing facilities.

KSC makes up the largest portion of CCS and is currently NASA's only launch site for human spaceflight.

CECIL SPACEPORT

Cecil Spaceport (**Figure 2.1d**), which is co-located with Cecil Airport in Jacksonville, is owned and operated by the Jacksonville Aviation Authority (JAA). 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 reusable launch vehicles (RLVs).

The existing aeronautical infrastructure includes four runways served by full parallel taxiways. Runway 18L/36R, which serves as the primary runway for horizontal launch operations, measures 12,500 feet in length and 200-feet in width and provides a Category I Instrument Landing System (ILS).

In addition to spaceport operations and general aviation activities, Cecil serves as a Maintenance, Repair and Overhaul (MRO) facility for Boeing, Flightstar, Pratt and Whitney and the U.S. Navy as well as the location of the QF-16 program, which includes the conversion of F-16 tactical aircraft to drones used by the U.S. Air Force for training activities.

Figure 2.1c: Cape Canaveral Spaceport

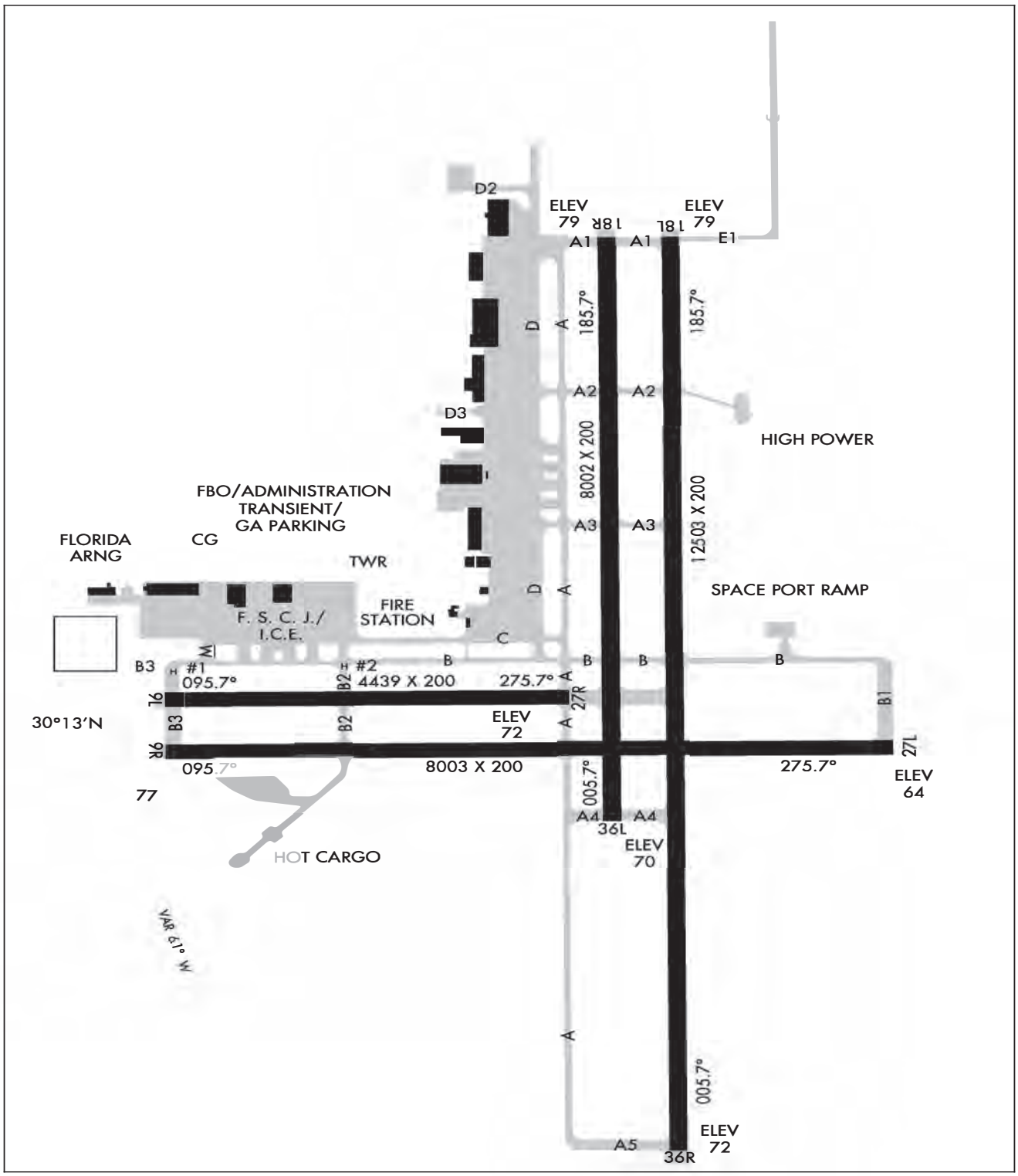


Figure 2.1d: Cecil Airport Diagram

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 initial stage of the plan implementation included the design and construction of the first phase of Taxiway 'E' and an access road, which opened the eastern portion of the airfield for the development of new spaceport facilities. In 2015, to accommodate reusable launch vehicles, JAA completed the design and construction of a 60,000 SF apron and associated connector taxiway (**Figure 2.1e**).

Currently, JAA is moving forward with the design and construction of those infrastructure elements associated with all Commercial Space operators. JAA is completing the design phase of a new Air Traffic Control (ATC) facility, which will incorporate a level or floor within the structure to serve as a commercial space missions operations control facility to be used by commercial space operators to monitor and collect telemetry and optics data. Construction of the new air traffic and missions operations control facility is anticipated to be complete in FY18.

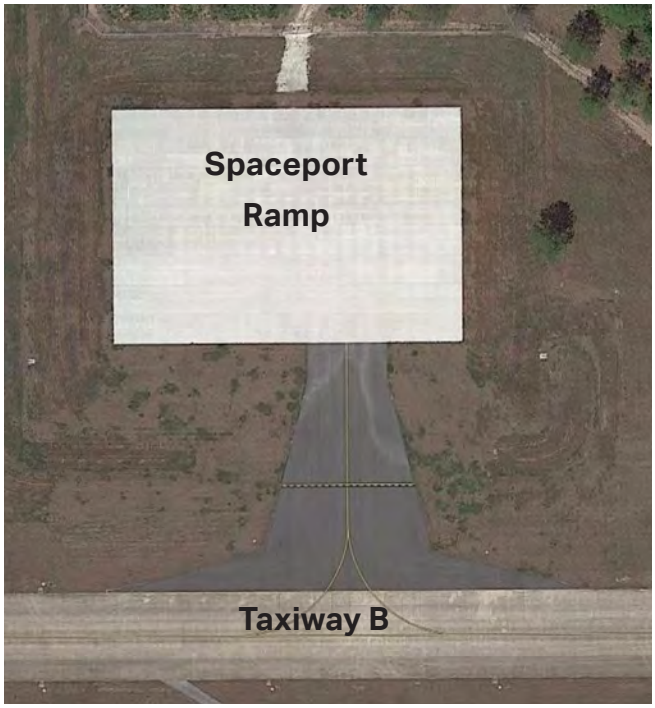


Figure 2.1e: Cecil Spaceport Apron and Taxiway

FLORIDA CONTROL CENTERS AND AIRSPACE

Currently, all existing Launch Control Centers (LCCs) in Florida are at CCS. Within KSC property, located southeast of the Vehicle Assembly Building is a four-story LCC which is considered the electronic "brain" for support activities of LC-39B.

The Morrell Operations Center (MOC) on CCAFS property is the hub of operations during launches of expendable vehicles, as well as ballistic missile tests. The Eastern Range is extremely large and 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 the 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 and LC-39A, just outside the security gate of CCAFS.

During launch operations, the control centers must interact constantly with the state's aviation system. Florida has over 125 airports, including 21 commercial service airports that handle over 1.5 million aircraft 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. Furthermore, operations from other east coast spaceports, such as Spaceport Camden and the Mid-Atlantic Regional Spaceport, can impact operations from spaceports within Florida given usage of the Atlantic Launch Operating Area (**Figure 2.1f**), which includes the Eastern Range.

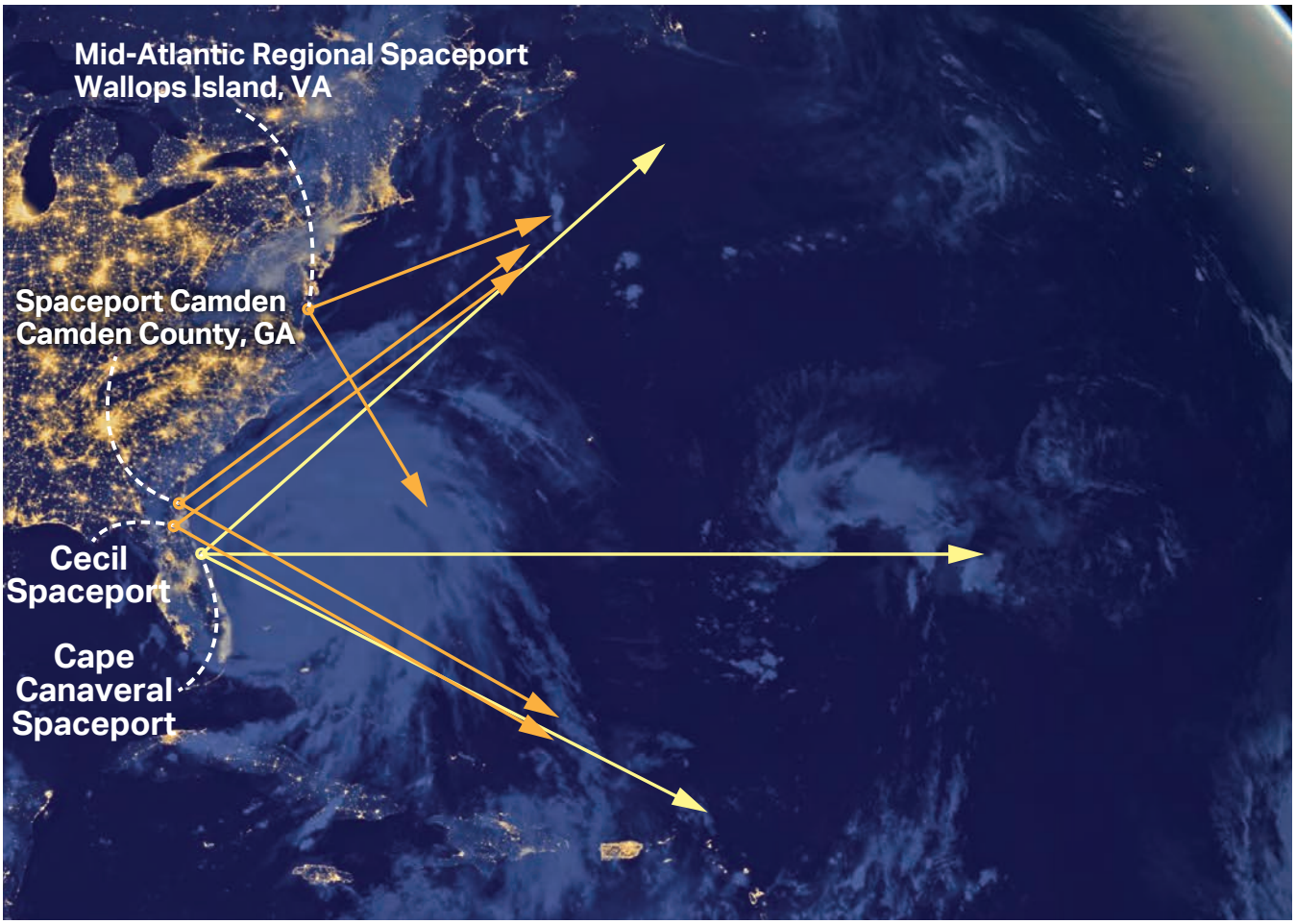


Figure 2.1f: Atlantic Launch Operating Areas (including the CCAFS Eastern Range)

During space flight operations from CCS, 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 2.1g**).

For horizontal launch operations from the SLF at CCS, aircraft will depart the SLF to the north and remain within the FAA approved operations area for the duration of the flight (**Figure 2.1h**).

For horizontal launch operations at Cecil Spaceport, air traffic management is provided by Cecil Tower, Jacksonville Air Route Traffic Control Center (JAX Center) and the U.S. Navy's Fleet Area Control and Surveillance Facility in Jacksonville, Florida (FACSFACJAX). Through a letter of agreement established between these parties, launch vehicles operate in a designated flight corridor to traverse the air space located between Cecil and the Atlantic Coast before entering airspace managed by the U.S. Navy. After a reusable launch vehicle has completed the launch operation, the vehicle will exit the range and return to Cecil Spaceport using the same corridor used for departure (**Figure 2.1i**).

Recognizing the need to provide additional operational diversity considering the array of launch characteristics associated with the different reusable launch vehicles, JAA and Cecil Spaceport recently completed the environmental review and license modifications necessary to establish an on-shore flight corridor and operating range. The new corridor and range will be located immediately west of Cecil Spaceport and extend to the north and south providing a more conducive operating environment for horizontal launch providers (**Figure 2.1j**).

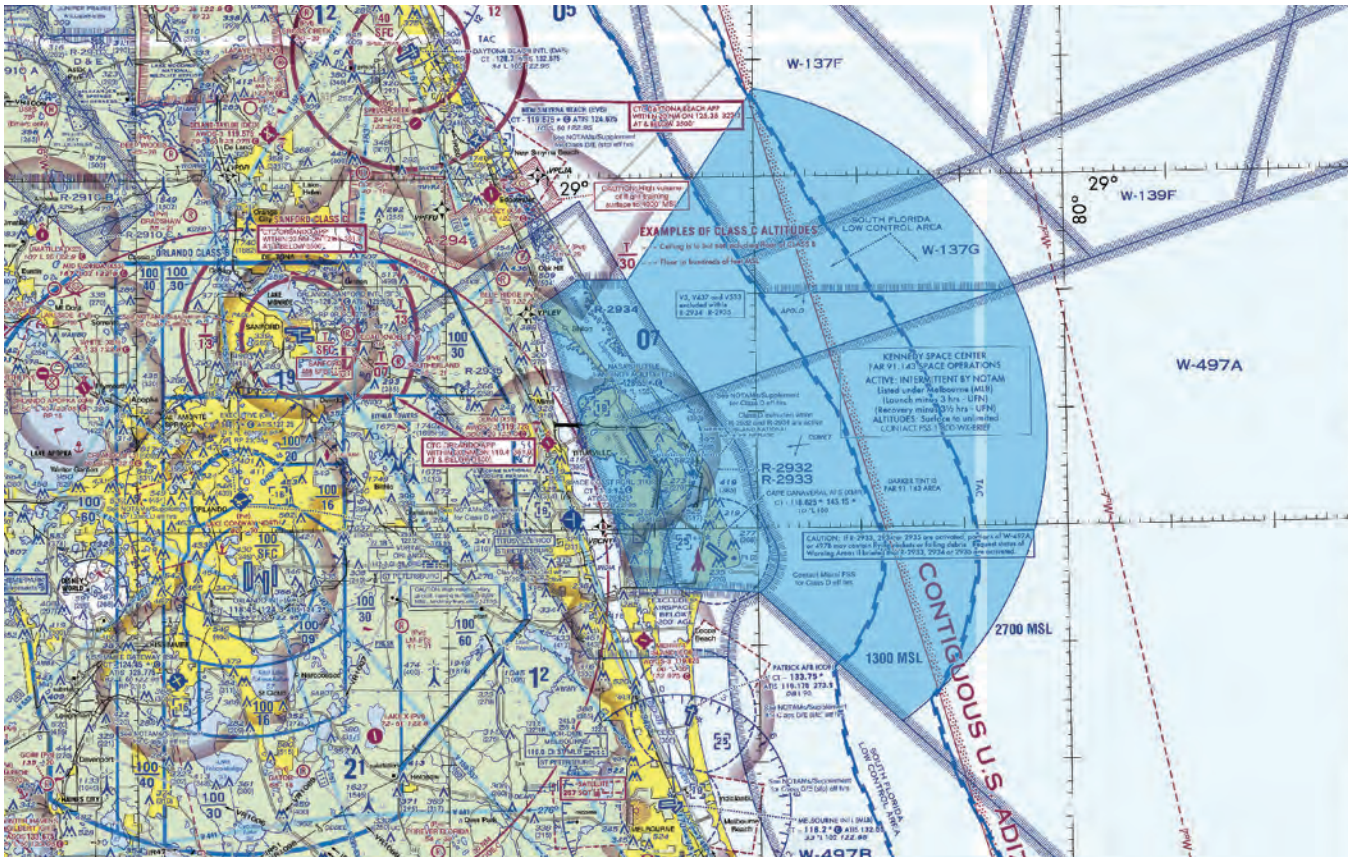


Figure 2.1g: Cape Canaveral Spaceport FAA Approved Operating Area

Source: Jacksonville Aviation Authority

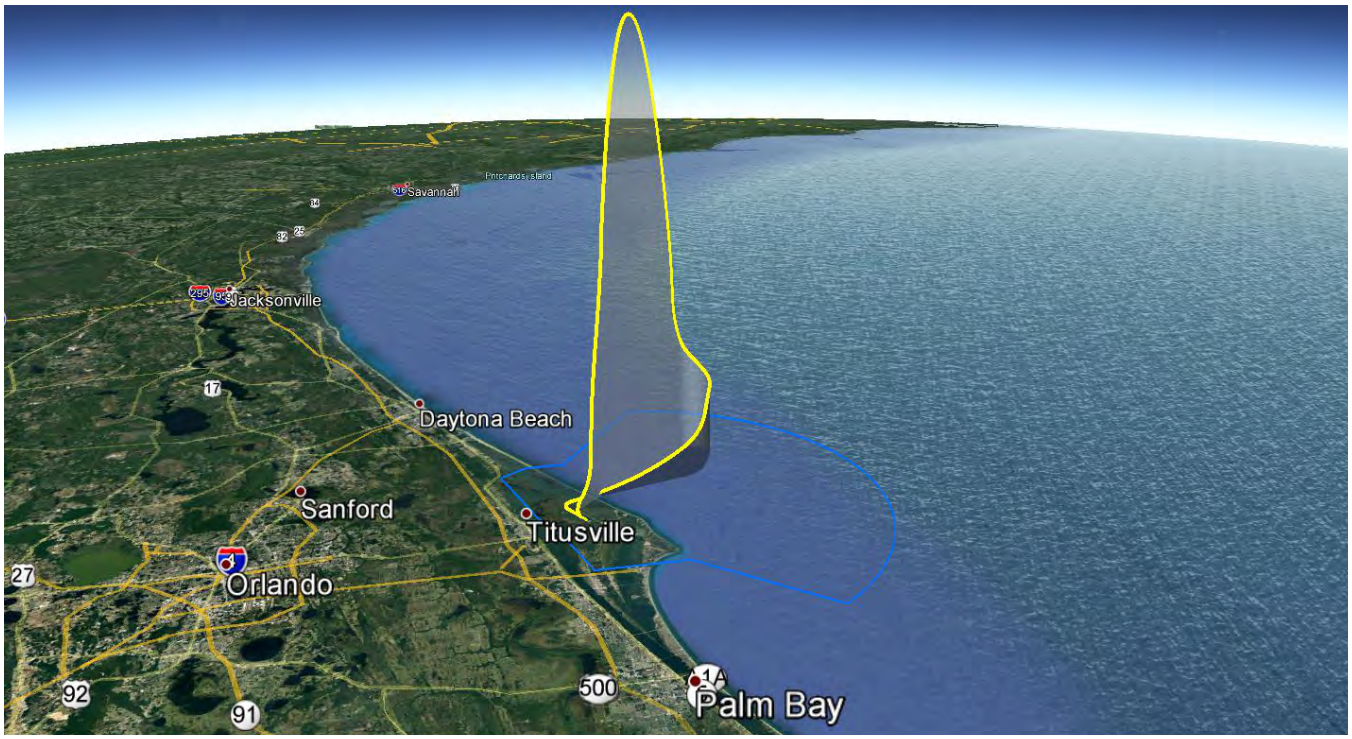


Figure 2.1h: Cape Canaveral Spaceport Conceptual Horizontal Launch Operations

Source: Google Earth; Space Florida

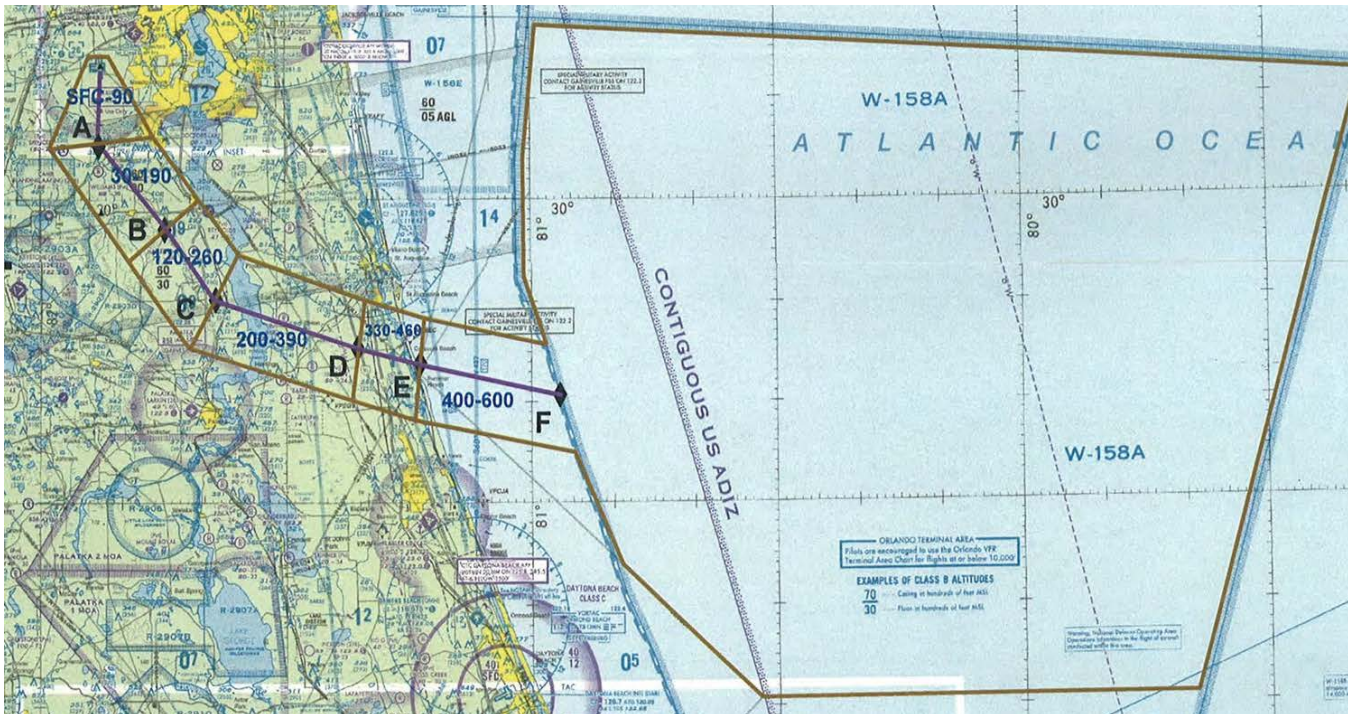


Figure 2.1i: Cecil Spaceport FAA Approved Operating Area

Source: Jacksonville Aviation Authority

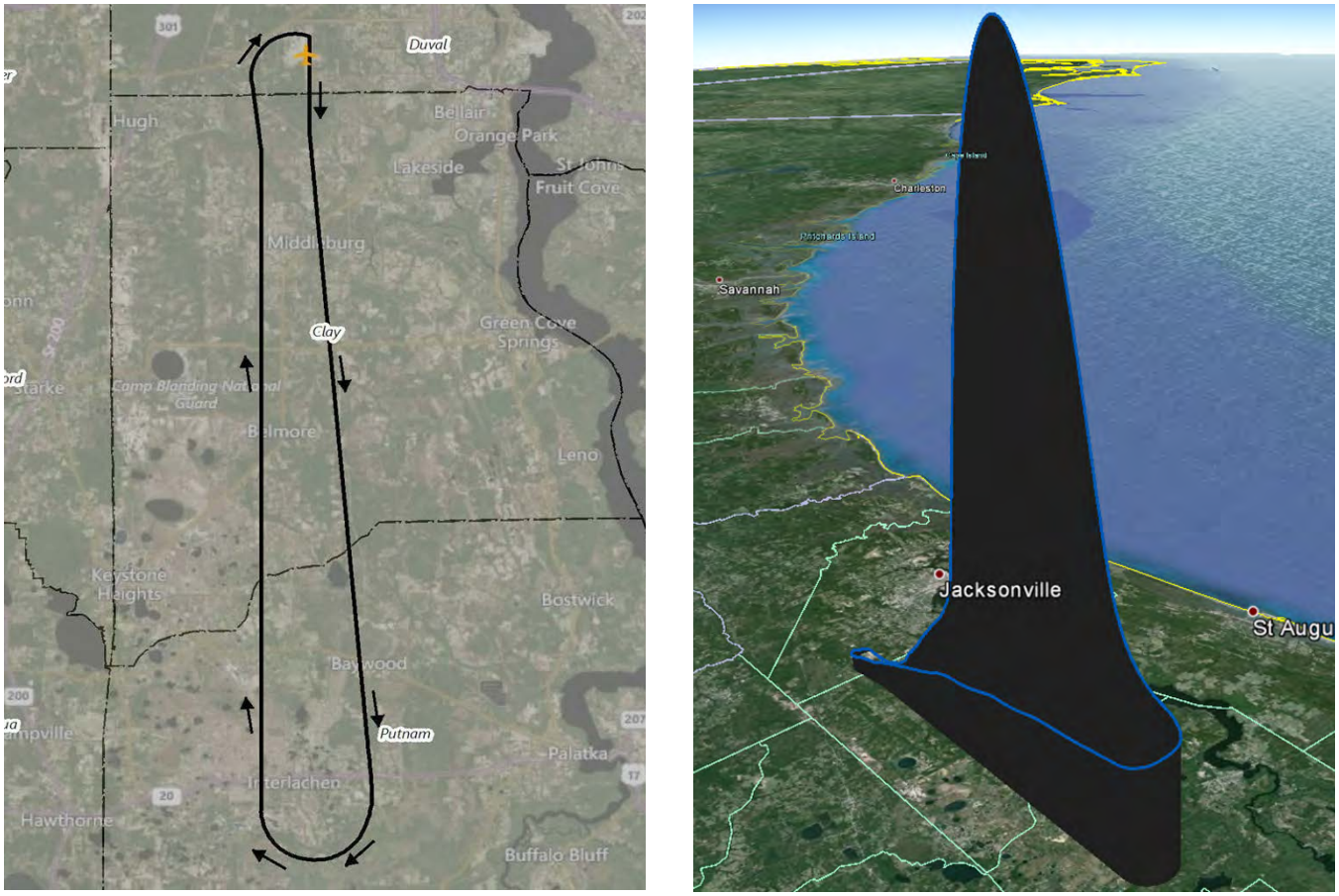


Figure 2.1j: Cecil Spaceport Proposed Westerly Corridor for Suborbital Flights

Source: Jacksonville Aviation Authority

KSC's Launch Control Center (NASA)

FLORIDA LAUNCH VEHICLES AND SPACECRAFT

Several launch vehicles are currently launched from sites in Florida. Following the retirement of the Space Shuttle Program in 2011, no crewed orbital launches are expected from CCS until at least 2018. NASA's new Space Launch System (SLS) is also expected to begin in late 2019. 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).

There are currently five orbital Space Launch Complexes (both active and inactive) located on CCAFS property:

- *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. Recently Blue Origin has selected SLC-36 as their preferred site to launch their missions from CCS.
- *SLC-37* is currently used to support ULA Delta IV launches.
- *SLC-40* is currently used to support SpaceX Falcon 9 launches.
- *SLC-41* is currently used to support ULA Atlas V launches.
- *SLC-46* was designed to support the U.S. Navy's Trident II ballistic missile efforts. Space Florida supported the launches of the Athena I and II from SLC-46 in 1998/99. Currently, the complex is available to support solid-fueled launch vehicles such as Orbital Sciences' Minotaur vehicle and Lockheed Martin's Athena vehicle. The Navy maintains the capability of resuming Trident missile testing as required. Space Florida is refurbishing SLC-46 for near-term Minotaur launch missions.

The major components at KSC include the Vehicle Assembly Building (VAB) for launch processing, the Launch Control Center (LCC) for command and control, and launch complexes LC-39A, LC-39B, and LC-39C. LC-39A has been re-purposed to serve SpaceX medium and heavy launch missions. LC-39B is undergoing major modifications to support the SLS program. Lastly, LC-39C, which became available in July 2015, will serve as a multi-purpose facility for commercial companies and start-ups to

test vehicles and capabilities in the smaller class of rockets.

Currently, three operators of orbital launch vehicle systems are performing launches at CCS with a 2018 manifest of planned flights that could achieve a launch tempo approaching 30 missions. ULA continues to operate two versions of the Delta IV – a Heavy and a Medium – from SLC 37. ULA also operates the Atlas V medium from SLC 41 and is modifying the pad facility to support NASA's commercial crew program. The company's planned Vulcan launch vehicle, a next generation expendable launch vehicle, is also expected to use SLC-41 and eventually replace the Atlas V. SpaceX operates the Falcon 9 from SLC 40 and the Falcon Heavy from LC-39A. Orbital ATK air-launched its Pegasus vehicle from the CCAFS skid strip in December 2016, and the Minotaur IV vehicle from SLC 46 in August 2017. Launch pad facilities at LC-39B are being prepared for debut of NASA's SLS super heavy vehicle in late 2019, and Blue Origin has begun work on a manufacturing facility in Exploration Park and the preparation of SLC 36 to support initial operation of the New Glenn orbital vehicle by 2020.

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

FLORIDA PAYLOAD PROCESSING FACILITIES

CCS is serviced by the following major payload and processing facilities, mapped in Figure 2.1c.

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

ULA's Delta IV Heavy Launch Vehicle (USAF)

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

Astrotech Space Operations (ASO) is the only major payload processing company in Florida that is not located on CCS. However, it is located very close to Spaceport and serves multiple Department of Defense (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).

Currently, payload processing at Cecil Spaceport is completed using existing facilities, which were modified per the needs required for specific payloads of individual launch providers. Because of the expanding roles and markets associated with the horizontal launch industry, the JAA and Cecil Spaceport will move forward with the development of a payload preparation and integration facility, which will be designed to satisfy the clean space and processing criteria required for most payloads and launch providers. Prior to design and construction of the payload processing facility, an evaluation will be completed to determine the facility's developmental requirements.

OTHER SIGNIFICANT FLORIDA FACILITIES

Other major facilities in Florida's spaceport system include 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. Significant aerospace facilities in Florida, such as modeling and simulation laboratories, satellite data centers, wind tunnels, and propulsion test facilities have also been identified for the purposes of this plan.

Representative samples of these types of facilities, previously identified in **Figure 2.1a,** include:

- *Center for Southeastern Tropical Advance Remote Sensing (CSTARS).* Located in southern Dade County and managed by the University of Miami, this 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. These include three wind tunnels, sensor and actuator labs, combustion facilities, a propulsion and aerodynamics computational laboratory, and a short takeoff and vertical jet facility.
- *Aerojet Rocketdyne.* Operations center located in West Palm Beach and formed in 2013 following the merger of Aerojet and Pratt & Whitney Rocketdyne, Aerojet Rocketdyne is a global leader in the development of space propulsion

Astrotech Space Operations facility in Titusville

Conceptual Processing Facility at Cecil Spaceport

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.

- *Florida NextGen Test Bed (FTB).* Located at Embry-Riddle Aeronautical University (ERAU) in Daytona Beach, this facility is part of the FAA's NextGen initiative, which aims to modernize the nation's air traffic control systems for safer and more cost-effective travel. NextGen will leverage new and existing airspace capabilities to facilitate aviation and aerospace operations. ERAU is contracted by the FAA to operate the FTB.

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, highways, and spaceports. 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 CCS provides easy access to all four modes of transportation from highway to rail to sea to air. The Cecil Spaceport also provides connections to the State's SIS with easy access to roads, rail, and air.

Figure 2.1k illustrates Florida's SIS. The facilities represent a full integration of individual facilities, services, and forms of transportation that create a complete network.

The Crew Access Arm transported over Haulover Canal Bridge from Oak Hill, Volusia County to ULA SLC 41

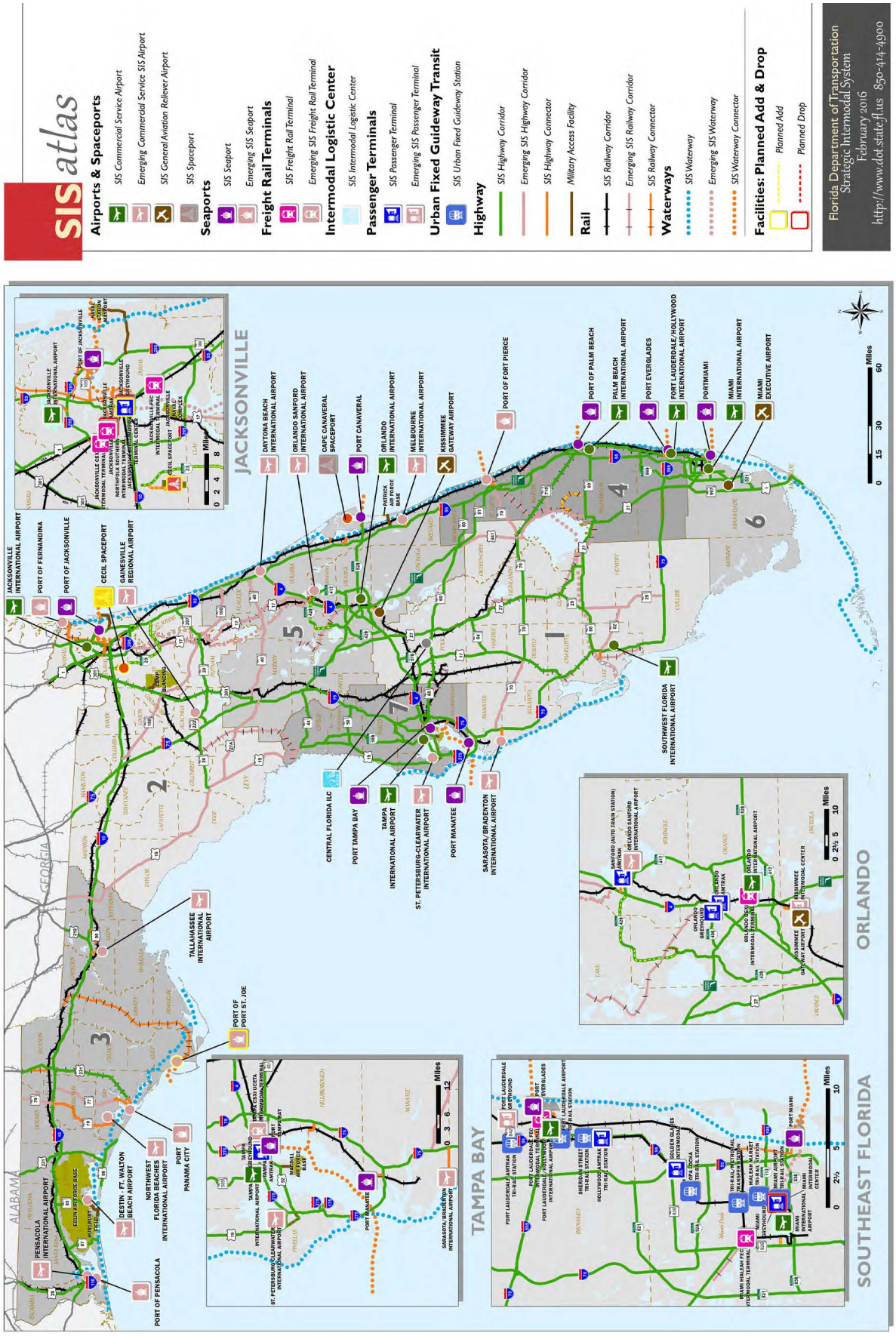


Figure 2.1k: Florida's SIS
Source: FDOT

2.2 CLASSIFICATION OF SPACEPORTS

Spaceports serve distinct types of markets and therefore have characteristics and required infrastructure that can define their respective roles and contributions to Florida's statewide system.

There is currently no established classification method for international or domestic spaceports that would be analogous to FAA airport classifications. However, a definition of how Florida spaceports fit into an emerging statewide, national, and global spaceport system is important to understanding how their capabilities support overall system strategy and prioritization of investments to optimize the economic value to Florida based on market needs and opportunities.

The best current discriminator that can be used to classify a spaceport is by the lift-class of the vehicles licensed to operate at a specific location together with the destinations in space that can be supported by those vehicles. Such factors, coupled with the licensed frequency of spaceflight activity, dictates which space transportation markets a spaceport can compete.

Market volumes and values can be expected to vary over the coming years as space market segments emerge and mature, or wane due to changes in technology or market demand. But the inherent capabilities of a spaceport are largely defined by its geography, neighboring land uses, areas that will be overflown during missions, and other limiting factors. **Table 2.2a** provides the initial classifications used in the System Plan for categorizing the existing and potential spaceports in Florida.

CCS currently has capacity for annual lift of more than 400 metric tons and therefore has a leading competitive position among the world's major orbital spaceports.

Cecil Spaceport would be best classified at present capability as a regional spaceport with launch areas generally designed for support of reusable suborbital launch vehicle systems departing from and returning to Cecil. These systems will support commercial human spaceflight for adventure tourism and may also include systems designed to deploy small and lower-mass satellites into Low Earth Orbit (LEO).

The proposed spaceport at Space Coast Regional Airport in Titusville is currently undergoing the licensing process to determine what its capabilities will be for supporting horizontal space launch systems.

FAA licensing of a launch site places limits on the frequency of flights. FAA stipulates an annual ceiling on licensed launch operations that results from environmental analyses and negotiation of agreements with affected air traffic managers. These license limitations can result in a more constrained level of spaceflight activity than would otherwise be possible based on a site's physical capacity.

For example, the proposed Spaceport Camden is seeking an initial FAA license based on up to 12 annual launches of a medium-class orbital vehicle such as a Falcon 9. This would limit its annual lift capacity for payloads needing to reach orbit to no greater than about 156 metric tons. While many space transportation systems and markets are in early phases of development, the evaluation of how much cargo can be transported to high-value destinations in or through space is an important gauge of the market potential and economic activity a spaceport site can attract.

ANNUAL CAPACITY (METRIC TONS)	FLIGHT TRAJECTORIES/DESTINATIONS	CLASS
> 50	Orbital to LEO/GEO/Lunar-Planetary May also support suborbital	Global
10 - 50	Suborbital/Orbital to LEO	Regional
< 10	Suborbital only	Limited

Capacity to support international point-to-point is not considered predictable at this time given current technical definition and immaturity of conceptual transport systems. Spaceports with higher lift capacities and a range of allowable flight trajectories are positioned to capture a share of internationally-competed launches for the larger orbital satellites and space missions that comprise the majority of today's global space transportation industry.

Table 2.2a: Florida Spaceport Classifications (Proposed)

2.3 GOVERNANCE AND FUNDING

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

NASA. As the owner of KSC, NASA manages LC-39. It also runs 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 CCAFS, the 45th Space Wing operates the Eastern Range in support of all launches from CCS. It operates the Morrell Operations Control Center (MOC), SLCs, 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 the SLF, SLC-36, SLC-46, Exploration Park including the Space Life Sciences Lab (SLSL) and Area 57. 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). The FDOT uniquely supports spaceports as part of its transportation network, and provides funding for spaceport development projects. FDOT and Space Florida work together to provide space transportation services and infrastructure in the state.

Blue Origin Orbital Launch Site Manufacturing Facility Rendering - Construction Completion Anticipated 2019

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 Florida Department of Transportation, the Space Coast Metropolitan Planning Organization, Florida Department of Economic Opportunity, Enterprise Florida, Inc, Career Source Florida, Metropolitan Planning Organization (MPO) Advisory Council, and other modal transportation partners.

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 USAF 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 spaceport 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. It works with the State of Florida, NASA, DOD, FAA and other important stakeholders and agencies to streamline

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.

FACILITY	FUNDING/FINANCING	PROGRAM/PROJECT
CCS Roadway Improvements	$2,500,000 funded	Blue Origin Transportation Improvements
CCAFS Electrical Capacity Improvements	$10,000,000 funded	Common Use Electrical Infrastructure
SLC-17/SLC-18	$1,850,000 funded	Moon Express Facility Improvements
SLC-39A	$10,000,000 financed	SpaceX Orbital Launch Site
SLC-41	$294,000,000 financed	EELV/Atlas V
	$6,150,000 funded	ULA Commercial
SLC-40/Hangar AO	$12,500,000 funded	COTS/SpaceX Falcon9
SLC-37 HIF	$24,000,000 financed	EELV/Delta IV
SLC-36	$1,200,000 funded	CCS Med-Large Commercialization
SLC-36 & 11	$43,000,000 funded	Blue Origin Orbital Launch Site
SLC-46	$6,800,000 funded	Space Florida Small-Med LV Tenants
KSC O&C High Bay	$35,000,000 funded	NASA MPCV (Orion)
Space Life Sciences Lab	$30,000,000 funded	ISS Payload / Cargo Processing
Space Commerce Way	$5,000,000 funded	KSC Commercialization
RLV Hangar SLF	$5,500,000 funded	Horizontal Launch & Landing Facility
C3PF Re-Purposing	$20,000,000 funded	Boeing Starliner Processing Facility
Exploration Park Phase 1	$7,500,000 funded	Site Improvements
Exploration Park Phase 1	$17,500,000 funded	Airbus/OneWeb Satellite Manufacturing Facility
Exploration Park Phase 2	$10,000,000 funded	Blue Origin LV Manufacturing Facility
Apollo/Saturn V Center Shuttle Atlantis Exhibit	$25,000,000 financed $62,500,000 financed	KSC Public Visitor Program
OPF 1 & 2	$9,000,000 funded	Boeing X-37B
TOTAL CCS	**$639,000,000**	**Commercial, USAF, NASA**

Table 2.3a: Principal state-facilitated funding investments to date
Source: Space Florida

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.[ii] Through State appropriations from various funding lines and its independent special district powers, Space Florida has been able to supply nearly $600 million in financial resources (**Table 2.3a**), leveraging the investments of industry and the U.S. Government to provide essential program and mission capabilities for both NASA and the DOD.

Funding is also 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. The 2045 SIS Multi-Modal Unfunded Needs Plan (MMNP) for the identification of unfunded needs is discussed in more detail in **Appendix B** of this report.

A 2013 amendment to U.S. Code Title 10 added Section 2276, Commercial Space Launch Cooperation, authorizing the USAF to accept non-federal contributions in support of DOD space transportation infrastructure.

This change in law enables potential partnerships for expanded, modernized federal range infrastructure and support. However, use of such non-federal funds for DOD space transportation infrastructure requires a Congressional appropriation from a designated account established for deposit of such contributions.

Direct contributions for NASA-owned infrastructure remain constrained by Government prohibitions against augmentation of Congressional appropriations, except in specific Congressionally enacted circumstances.

In addition, State use of public funds for spaceport improvements generally requires a matching contribution from the partner. Federal and state transportation agencies are exploring policies to allow federal partners to utilize their federal funds to provide a match for a shared investment improvement. Most other modes of transportation allow federal, state, and even private funds to be used jointly on modal transportation projects.

The Spaceport System Plan guides state infrastructure funding across the Spaceport System. Individual facility-specific Master Plans will inform the statewide System Plan. **Figure 2.3a** illustrates the relationship between the System Plan and the various Master Plans.

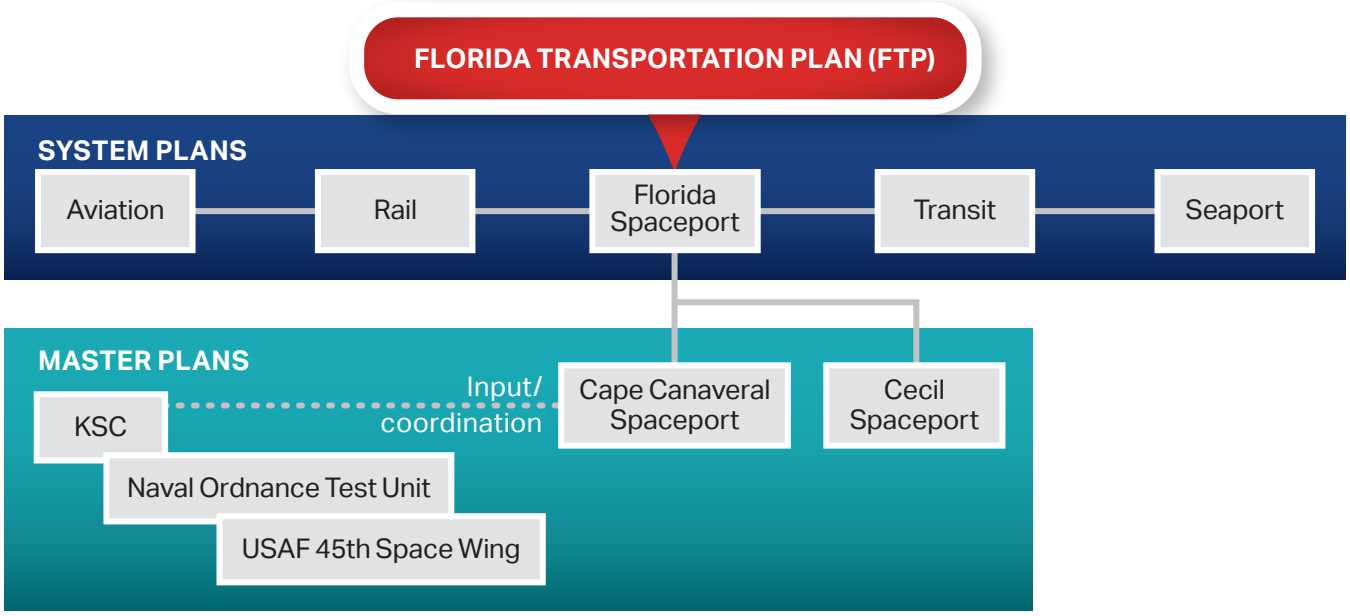


Figure 2.3a: Florida Spaceport System and Master Planning

2.4 FLORIDA'S COMPETITIVE ADVANTAGES

Florida and the space industry share a seven-decade history together, one that has continuously demonstrated the state's long-term commitment to space transportation and exploration. From the first rocket launch at Cape Canaveral in July 1950, Florida has grown to become a national and global base of aerospace expertise and know-how.

Over the years, the state facilitated close to one billion dollars in infrastructure improvements, a combination of both public and private funds, to build one of the nation's most sophisticated spaceport facilities. It also established the first state space entities in the country, consisting of the Florida Space Authority, the Florida Space Research Institute, and the Florida Aerospace Finance Corporation. In May 2006, the Florida Legislature consolidated these three entities to create one single organization, Space Florida, to guide space development within its state boundaries.

Today, the existing spaceport system in Florida is capable of accommodating any current or new launch vehicle in the market. It also holds adequate launch capacity with the ability to add additional proficiencies at designated territories as needed. Moreover, each system site and designated territory stands perfectly integrated with Florida's intermodal transportation system, whether through seaport, railroad, highway, or airport access.

Finally, the coastal locations of current and potential spaceports and spaceport territories have a distinctive safety advantage, turning Florida into an ideal setting for space startups, testing, and demonstration.

Kennedy Space Center Launch Complex 39

Space Florida Shuttle Landing Facility

3
CURRENT DEMAND AND NEED

The ULA Delta IV Heavy rocket with NASA's Orion spacecraft mounted atop, lifts off from CCS SLC-37 on December 5, 2014.

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 implications or opportunities related to how Florida can more effectively position itself to address markets reliant on space transportation.

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 11 market segments outlined below, Florida can position itself to accommodate the demands of the industry for:

- 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
- Cis-lunar space

3.1 DEMAND

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. Fourteen (14) countries currently have the capability to conduct orbital launches: U.S., China, Russia, France, Japan, India, Israel, Iran, North Korea, South Korea, Canada, Singapore, Indonesia and Philippines.

In the U.S., orbital launches are conducted from five federal launch sites and four commercial launch sites (Part I). 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.

Blue Origin: New Glenn, Reusable, Vertical-Landing Booster

	TOTAL NUMBER OF NON-COMMERCIAL ORBITAL LAUNCHES CONDUCTED FROM 2006-2015	TOTAL NUMBER OF COMMERCIAL ORBITAL LAUNCHES CONDUCTED FROM 2006-2015
Russia	225	93
USA	208	151
China	198	14
Europe	55	64
Japan	39	2
India	41	4
Iran	8	0
Israel	4	0
South Korea	4	0
North Korea	4	0
Multinational	0	23
Argentina	0	3
Canada	2	2
Singapore	5	1
Indonesia	2	0
Philippines	1	0
TOTAL	**800**	**357**

Source: FAA, Commercial Space Transportation Year in Review (2006 to 2017); AECOM compilation

Figure 3.1a: Total Number of Orbital Launches Conducted by Country (2006-2017)

GLOBAL ACTIVITIES

Since 2006, the annual number of orbital launches has increased from a low of 66 to a high of 90 in 2017. **Figure 3.1a** compares the total non-commercial and commercial orbital launches conducted by country. The U.S. has led the world in orbital launches conducted since 2006, with a total of 359 (151 of which were commercial). Russia launched 318 missions during the same time period, but only 93 of these were commercial.

In 2017, the U.S., Russia, Europe, China, Japan, India, and New Zealand conducted a total of 90 orbital launches. **Figure 3.1b** compares the total non-commercial vs, commercial orbital launches, and the 33 commercial launches by Countries. U.S. led the world in terms of the number of orbital launches conducted in 2017. For comparison, in 2016 there were 85 orbital launches of which 22 were commercial launches[1] .

1 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.

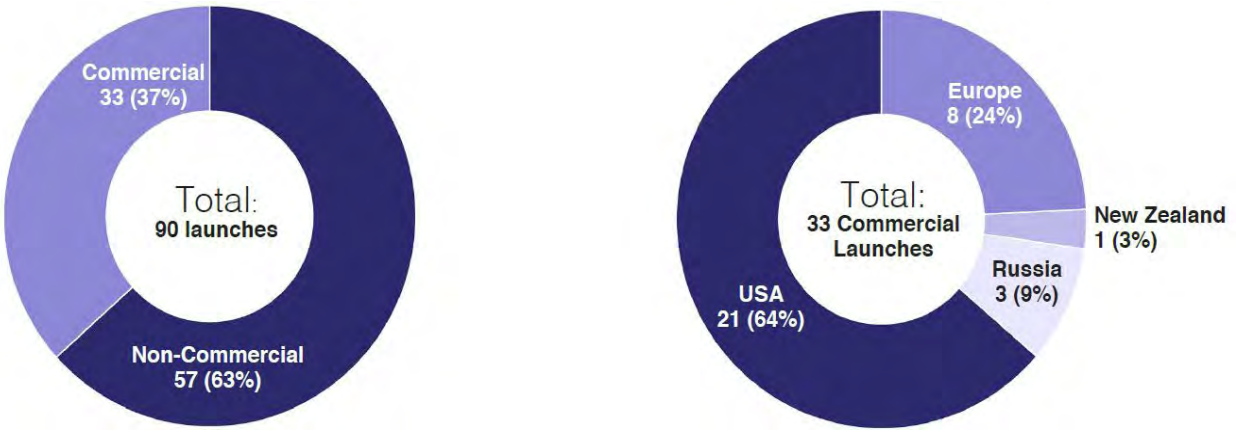


Figure 3.1b: 2017 Total Worlwide and Commercial Launch Activity

Data Source: FAA, Annual Compendium of Commercial Space Transportation:, 2018

COMMERCIAL LAUNCHES FORECAST.

Historically, the U.S. has conducted approximately 20 percent of global commercial launches each year, with Russia and Europe holding approximately 60 percent, and the other capable countries retaining the remaining 20 percent of the market share. However, U.S. accounted for over 60% of the commercial orbital launches in 2017. Figure 3.1c provides an overview of globally projected commercial launches by industry segments for the next decade. Overall, 423 launches are expected to occur in the next decade, the forecast projects an average of 42.3 commercial launches per year between 2018 and 2027.

This growth will be spurred by new commercial cargo services to the ISS and commercial crewed flights to ISS which are expected to begin 2020/2021. Boeing and SpaceX were selected by NASA 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. Blue Origin and Orbital ATK are already marketing their new vehicles to international customers.

The initial market for the Orbital ATK Antares and SpaceX Falcon 9 will be NASA's commercial crew and cargo program, but both companies hope to capture the commercial communications satellite market.

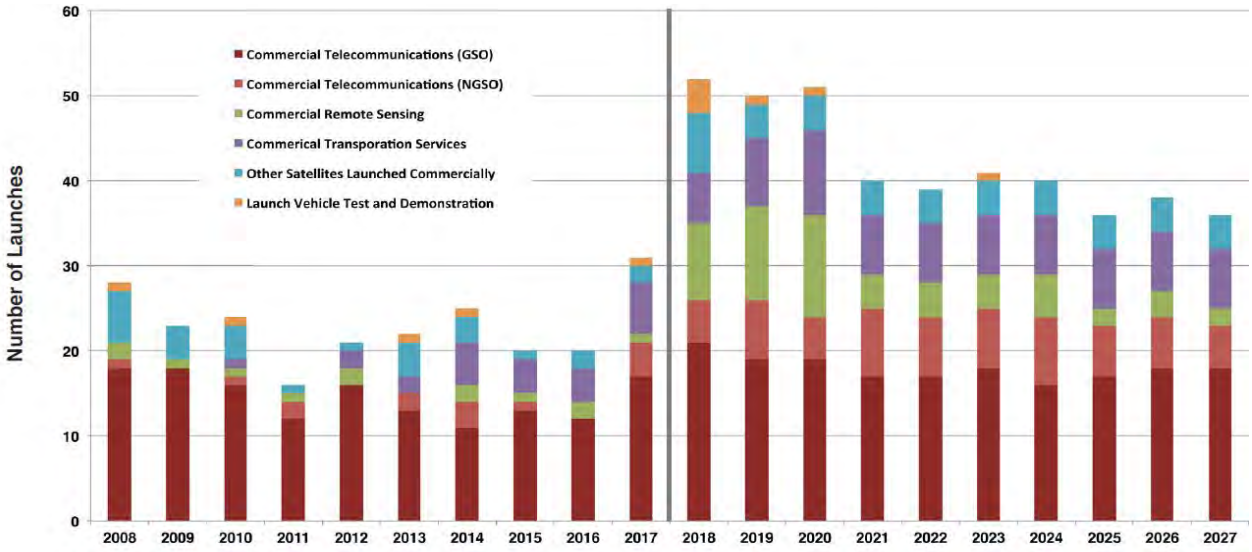


Figure 3.1c: Historical and projected commercial orbital launches by industry segment

Data Source: FAA, Annual Compendium of Commercial Space Transportation: 2018

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 CCS. In the recent past, 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 ATK, the former having been launched a few times from Florida.

Recently, the vehicle mix has been significantly different due to the retirement of the Space Shuttle and Delta II, and the introduction of the SpaceX Falcon 9 and Falcon Heavy. In the future, newer models of these launch vehicles will continue to dominate the domestic market.

FLORIDA ACTIVITIES AND OPPORTUNITIES

A total of 152 orbital launches were conducted from Florida between 2006 and 2017, an average of about 13 per year. Thirty-six of these were commercial, an average of about three per year (although the number of launches were five and seven in 2016 and 2017, respectively). During the next 10 years, the average number of orbital launches conducted from the CCS is expected to increase over 30 as compared with the preceding years 2016 and 2017 with 18 and 19 launches respectively.

The increase is due mainly to the introduction of commercial cargo and crew services to the ISS that began in 2012. Note, the number of small- and medium-class vehicles used to support government missions dropped off after 2011. This is due in part to retirement of the Delta II.

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

Florida has the capacity to launch any class of Launch Vehicle using its existing infrastructure.

The next 10 years could see a variety of changes in the orbital launch industry. These changes are due to new launch vehicles such as the Antares, Athena, Falcon 9, Falcon Heavy, Stratolaunch, and potentially others, entering the launch market, making NASA rely more on commercial vehicles to resupply the ISS. Of the 41 launches listed in the SpaceX manifest, 29 are planned for launch from CCS (with the remaining launches planned from VAFB). CCS SLC- 46, which previously supported Athena launches, hosted the Orbital ATK Minotaur 4 in 2017. Moreover, SpaceX has began using LC-39A at the CCS to support the Falcon Heavy and Falcon Medium 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.

Several assets located at CCS 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. LC-39C (completed in 2015) supports a fleet of small class launch vehicles. SLC-18 is scheduled to be re-purposed in 2018-2019 to support Moon Express's mission of mining the Moon for natural resources.SLC-36/SLC-11 are being reconstructed to accommodate Blue Origin's New Glenn and New Shepard Launch Vehicles (anticipated construction to be completed in 2020).

IMPLICATIONS

Forecast 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 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 the planning timeframe

expires, assumptions must be made based on vehicle capacity and historical data.

In addition, NASA's SLS launches are considered probable (as opposed to existing) because the system will not be introduced until late 2019 and is subject to change.

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

- 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 (GSO) 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 can be launched from CCS, either on an Antares vehicle (requiring a new or modification of existing pad) or on a Falcon 9 from SLC-40.
- SpaceX has developed heavy lift launch vehicle capability for the Falcon Heavy at LC-39A.
- The non-polar U.S. Government launches using small vehicles like Athena, Minotaur, Pegasus, and Taurus are currently launched from Kwajalein, VAFB, and Wallops Flight Facility; however, these could be launched from Florida. These decisions would be primarily driven by mission considerations and other factors. **Figure 3.1d** shows the breakdown by year of existing, probable, possible and non-addressable launches based on worldwide orbital launch forecasts. Non-addressable launches refer to bundled government-to- government deals, launches captive to particular launch service

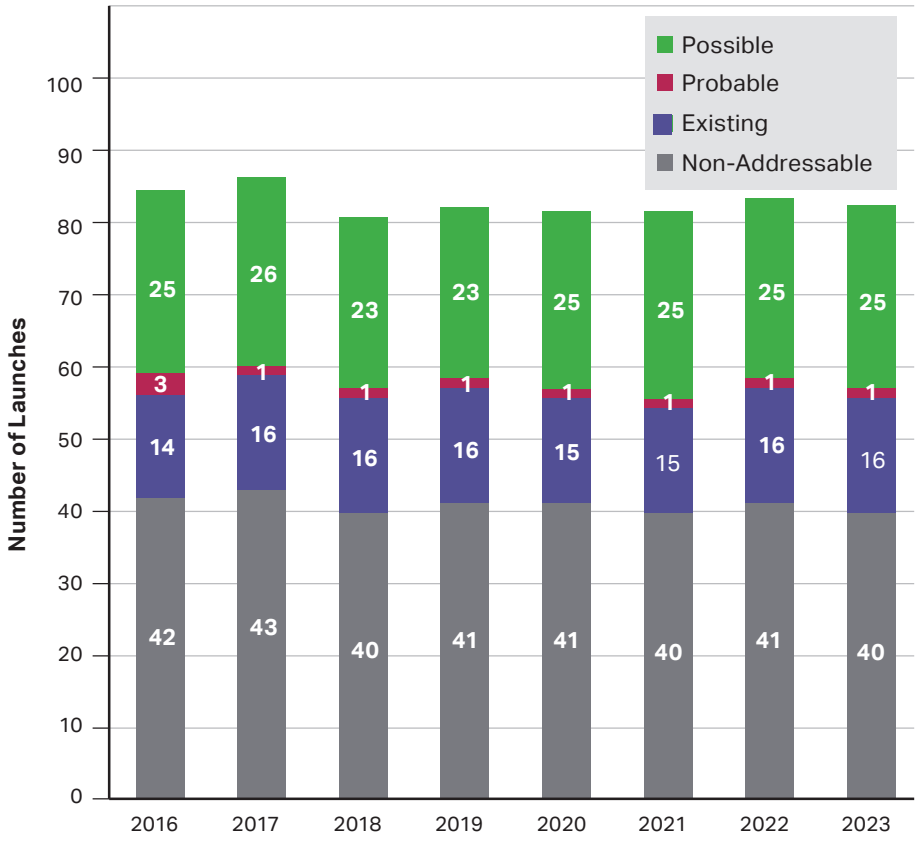


Figure 3.1d: Possible, probable, existing, and non-addressable orbital missions projected for the state of Florida based on worldwide orbital launch forecast (2016-2023)

Data Source: The Tauri Group

providers, and others, that are not internationally competed. Overall, Florida can expect continued robust numbers of government launches during the 2016-2023 period.

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, from a high of 730 per year in 1991 to fewer than 100 per year. Since 2002, an average of 32 sounding rocket launches have been conducted annually worldwide, with most taking place from Anodya Rocket Range in Norway, and White Sands Missile Range, New Mexico.[2]

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, therefore emphasis will be on RLVs in this section.

GLOBAL ACTIVITIES

There are nine RLVs 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

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

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 crew members.

In **Figure 3.1e**, 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 U.S. (based on global wealth distribution).

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 approximately 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,

2 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.

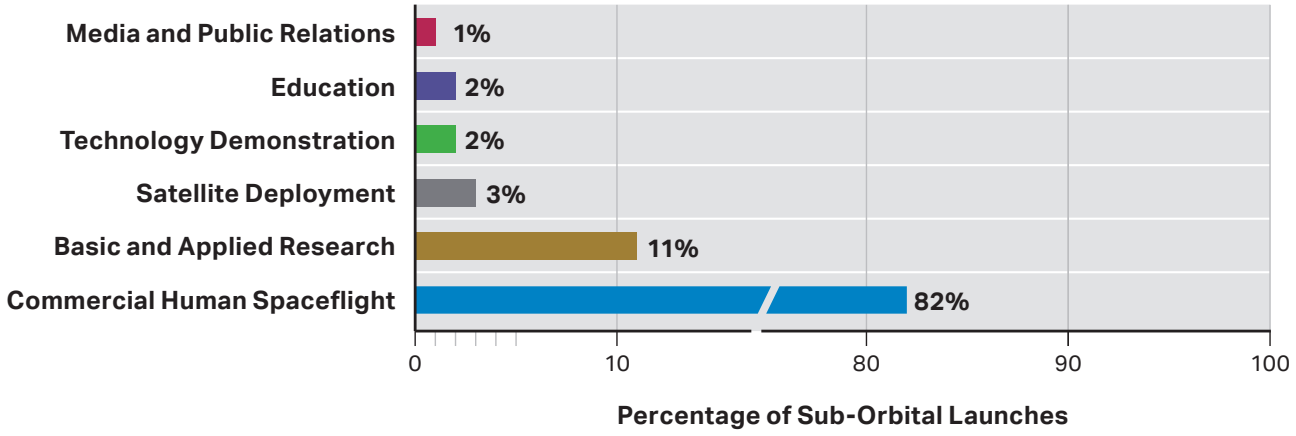


Figure 3.1e: 10-year RLV demand forecast

Data Source: The Tauri Group

Note: Total exceeds 100 percent due to rounding

longitudinal human research, and microgravity. The remaining 8 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.

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.

FLORIDA ACTIVITIES AND OPPORTUNITIES

In Florida, RLV operations are expected to occur using leased assets located at CCS and Cecil Spaceport. Other launch and re-entry sites throughout the state are being considered for RLVs, including Space Coast Regional Airport in Titusville.

However, given the market size, and the types of vehicles in development, the market may only require part-time operations at a select few spaceports worldwide. Without greater demand, as more vehicles and spaceports are developed, the market will be further split.

IMPLICATIONS

Typically, RLVs will require little infrastructure, and in most cases this infrastructure is mobile. For example, propellant 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 currently has the minimum required equipment and infrastructure in place to accommodate a launch and satisfy the needs of a launch provider. Current demand stipulates liquid propellant and oxidizer for the initial launches will be provided via truck as previously mentioned. However, Cecil Spaceport, which features a 3,811-meter (12,504-foot) runway, will require installation of small liquid propellant and pressurant (nitrogen and helium) plants as demand and traffic volume increase. Recognizing the need for propellant and oxidizer storage, JAA has included the project in FY19 of the Cecil Spaceport Capital Improvement Program.

Aircraft Rescue & Firefighting (ARFF) services at Cecil Spaceport are provided through Jacksonville Fire and Rescue Department (JFRD) Station 56. The facility was built in 1953 and has had few updates since initial construction. In order to address the building age and condition while simultaneously increasing capabilities to handle solid as well as liquid rocket propellants and minimizing offsite response times, JFRD is in the design process of completing the development and construction of a new fire station. It is anticipated the facility will be completed in the September 2018 timeframe.

In addition, NASA transferred control of the SLF to Space Florida in July 2015 which intends to transform it into a testing ground for commercial enterprises involved in the suborbital market. This facility has access to an RLV hangar, a 4,572-meter (15,000-foot) runway, a parking ramp, and direct access to LC-39 and the Industrial Area. Florida-based Starfighters Inc., which operates F-104 jets as suborbital flight trainers and nanosatellite launch platforms, already conducts flights from the SLF.

Florida's existing space transportation infrastructure is fully capable of handling a large number of flight operations. SLC-41 and SLC-37, has been modified and operate to support the Evolved Expendable Launch Vehicle (EELV) Program that 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 following the retirement of the Space Shuttle Program in 2011.

COORDINATING COMMERCIAL AIRSPACE WITH SPACE LAUNCH ACTIVITY

The FAA continues to address multiple challenges associated with the growth and expansion of commercial space transportation. These challenges primarily deal with the integration of commercial space transportation into the National Airspace System (NAS). As commercial space launch and reentry operations continue to increase in the future, the FAA has devoted increasing attention to accommodate these operations safely within the NAS.

Currently, the FAA has no formal policy that balances the priority of mutually exclusive operations in the NAS. Consequently, the agency has developed a case-by-case assessment.

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

3.2 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 been announced over the past three to five years. 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 process for space launch and reentry operations.

Figures 3.2a and 3.2b illustrate the infrastructure elements typically required to support an orbital launch.

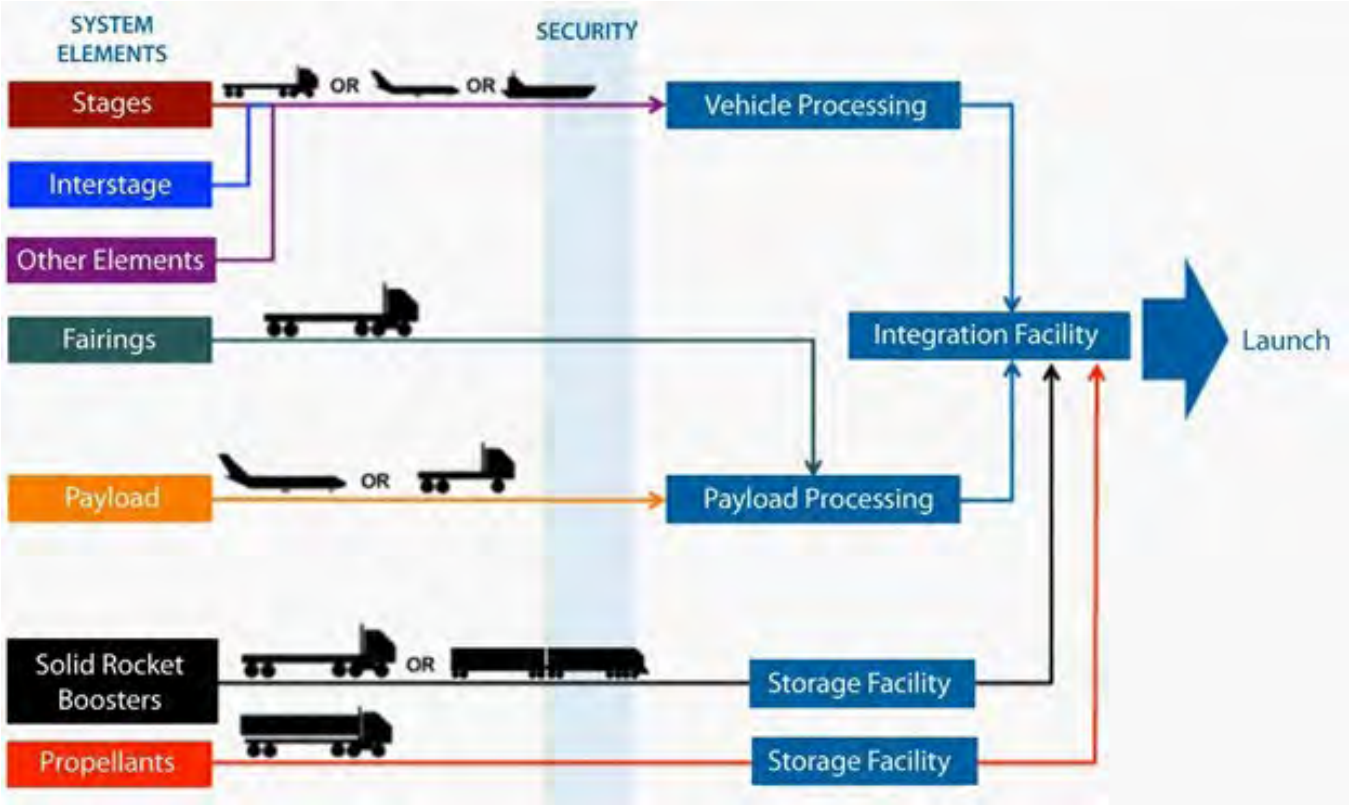


Figure 3.2a: Generic launch vehicle and payload processing overview
Source: The Tauri Group

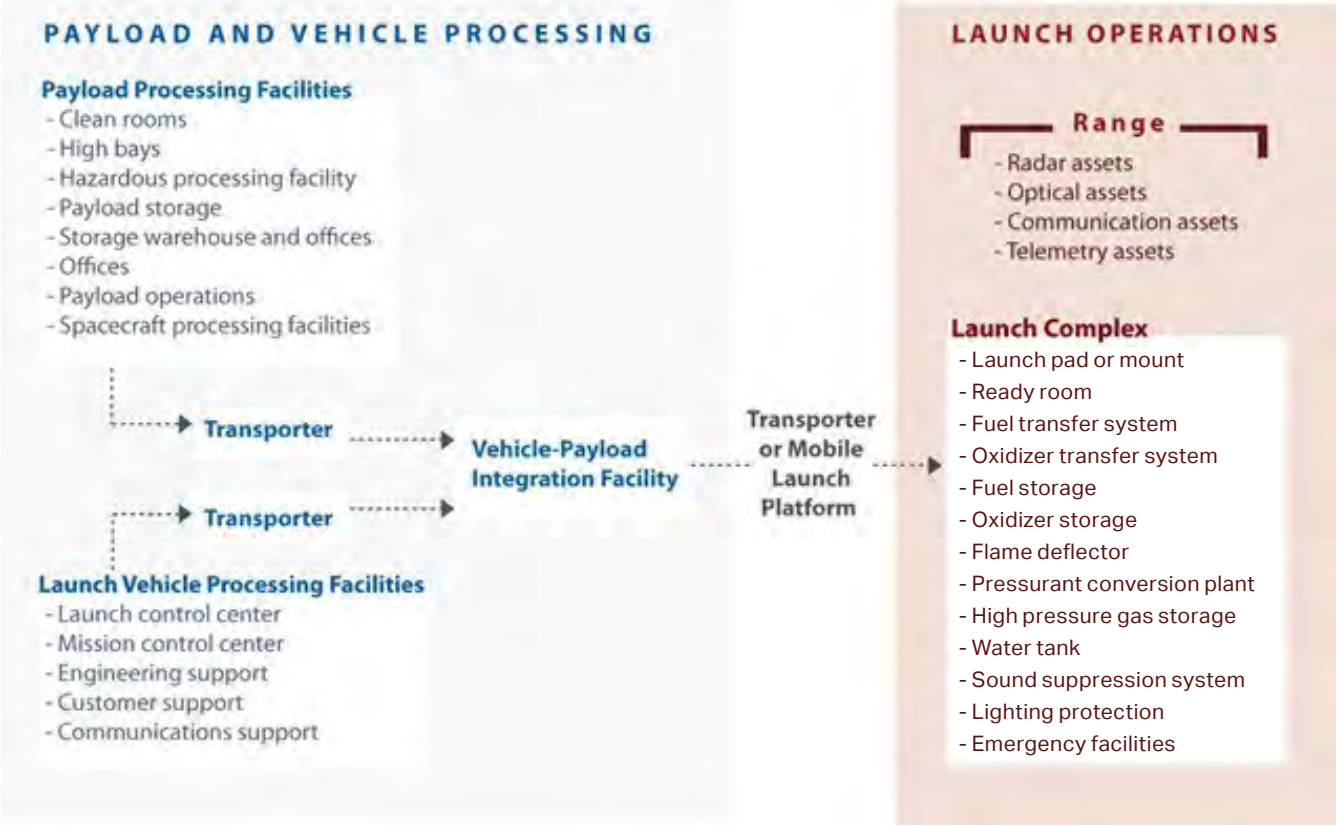


Figure 3.2b: Generic launch vehicle and payload processing detail for orbital flights

Source: The Tauri Group

A Florida East Coast Railway locomotive rolling past the Vehicle Assembly Building at KSC

A small team comprised of representatives from the Office of Commercial Space Transportation works collaboratively with space vehicle operators on a mission-by-mission basis. Through a series of meetings and discussions, the team works to understand operators' needs, identify their constraints and those of the airspace system and its other users, and develop airspace management strategies for a safe mission. Of course, not every strategy can be applied to every mission. For instance, launches to the ISS must be undertaken at specific times on specific days in order to rendezvous with the ISS.

Over time, the FAA is seeking to transition from an approach that protects from failure using extensive airspace restrictions to one that operates for success through airspace integration, increased mission monitoring capabilities, and the ability to effectively respond to contingencies. One major goal is to implement the National Airspace Redesign (NAR) which is a multi-year initiative to review, redesign, and restructure the nation's airspace. It will require working with users and service providers to identify available airspace, facilities and equipment; followed by calculating future use of these resources to improve efficiency and reduce delays. When fully implemented, the NAR is bound to positively impact launch activity in Florida. The next full update of the Florida Spaceport System Plan will have a more detailed section on NAS/NAR and Spaceport activity integration including direct collaboration with the FAA and their airspace redesign initiatives.

Completed vehicle components or sub-assemblies, like the vehicle stages, inter-stages, and fairings, arrive at the launch site from the manufacturing facilities, usually by boat, rail, or plane. These sub-assemblies 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.

SUBORBITAL

Infrastructure requirements for suborbital launch vehicles 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 CCS and Cecil Spaceport for suborbital RLV maintenance, storage, and processing, some operators may require construction of manufacturing facilities.

Airbus OneWeb Satellite Integration Facility – Construction Completion Anticipated 2018

3.3 CHALLENGES

As the demand and needs analysis demonstrates, Florida has the inventory of infrastructure necessary to embrace the future market needs for space transportation serving all user sectors – commercial, civil, and national security.

But to secure its position as the leader in enabling global space commerce throughout the 21st century and beyond, Florida's statewide spaceport system must successfully confront and address a set of seven major challenges.

These are not unique to Florida. They are challenges associated with an evolving mode of transportation that is required to access and operate in the environment beyond our atmosphere to support a space-based economy of growing worldwide importance.

But Florida is uniquely positioned to convert these challenges into opportunities for leadership of this industry and the markets it serves. To do so, Florida must:

i. Adapt to a dynamic global market

ii. Modernize and sustain Florida's existing space infrastructure

iii. Maintain strong governance, management, and partnerships

iv. Meet industry needs for schedule reliability and expectations for service

v. Balance space transportation needs with environmental considerations

vi. Streamline the rules and regulations governing commercial space

vii. Communicate the value of Florida's Spaceport System to stakeholders

Proposed RLV Storage/Processing Hangar at Cecil Spaceport

ADAPT TO A DYNAMIC GLOBAL MARKET

Florida has been at the forefront of U.S. Government civil and military space transportation since the beginning of the Space Age. CCAFS has been involved with advanced missile testing since 1950, 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 U.S. Federal Government. Beginning with the world's first international telecommunications satellite that rocketed into orbit from the Cape in 1965, Florida has launched and enabled the growth of a worldwide industry of space-based services and products which today has an annual value of $330 billion.

Today, that global market has expanded beyond traditional applications – like satellite television and navigation services – to include new emerging space services such as adventure tourism and commercial exploration ventures that will be carried out beyond earth orbit. This dynamic and evolving marketplace has a great diversity of customers with different needs. The value of global space commerce is expected to grow dramatically in the years ahead.

Florida is uniquely positioned to convert challenges into opportunities for leadership of this industry and the markets it serves.

Over the past few decades, spaceports have developed impressive capabilities in other countries and across the U.S., creating a competitive environment for Florida. Although Florida remains a global leader in its capabilities for orbital launches, there are now multiple other facilities in the U.S. and abroad that compete for both orbital and suborbital space transportation users.

SpaceX Falcon 9 CRS-8 launch from SLC-40

Moreover, the technologies and business models for space transportation are also rapidly evolving to both enable and respond to this new and expanding marketplace. While commercial missions once depended on Government launch systems, Government missions now depend on commercial launch systems. These new industry trends place an increasing priority on the availability of reliable launch schedules, and a predictable regulatory environment.

Florida's Spaceport System will need to strategically develop a plan to face the evolving marketplace and adapt to the innovative trends. Florida should draw on its historical strengths and positional advantages while adapting and/or modernizing its space infrastructure and operating environment to stay competitive and ensure a position of leadership in the space transportation industry of the future.

MODERNIZE AND SUSTAIN FLORIDA'S EXISTING SPACE INFRASTRUCTURE

Florida's existing Spaceport System has more than adequate physical capacity to accommodate the anticipated increase in the future missions and tempo of orbital and suborbital launches. One of the system's greatest challenges is to maintain the infrastructure, and/or retool it to meet the specific needs of modern civil, military, and commercial markets.

Nearly all of the Government's buildings and facilities within the system were purpose-designed for specific programs. Some are at least 50 years old, and maintenance of many facilities has been deferred for lack of available federal 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 betterment of the commercial market. As operations and maintenance funding decreases for NASA and the DOD, it is critical to differentiate between "essential" and "nonessential" spaceport facilities and infrastructure to remain competitive, and sustainable.

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

- NASA's Center Master Plan (CMP) for the Kennedy Space Center 2012-2032
- Cape Canaveral Air Force Station General Plan and a new Installation Development Plan (in progress at the time of this update)
- Cape Canaveral Spaceport Master Plan and supporting strategic studies (2017)
- Cecil Spaceport Master Plan (2012)

There is an emphasis within NASA, as directed by Congress, to reduce its institutional footprint, retaining only those facilities and assets that are required to meet its agency missions. The new CMP for KSC identifies several initiatives to divest infrastructure not needed for future NASA programs, and consolidate facilities within a reduced footprint.

Similar infrastructure divesting initiatives are also present at the CCAFS for the USAF. Both federal installations are under policy mandates to reduce their operations and maintenance burdens while also enabling access and use of capabilities by commercial launch operators and service providers.

While a transformational opportunity exists to modernize and re-tool critical elements of the Florida Spaceport System as a result of these trends, the challenge is to identify new funding sources to re-capitalize and sustain common spaceport infrastructure in partnership with an industry that must maintain its competitiveness in an increasingly contested marketplace.

MAINTAIN STRONG GOVERNANCE, MANAGEMENT AND PARTNERSHIPS

In Space Florida's authorizing 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.

Space Florida is established as a statewide authority for planning the effective development and growth of the Florida's space infrastructure within defined spaceport territories and as a part of the State's SIS. It is directed to work with various federal, state, and local stakeholders as well as the industry it serves and seeks to attract to Florida.

Blended ownership of space transportation assets and multi-sector mission requirements make this a challenging task. The State of Florida has been and continues to be a highly invested stakeholder in the federally-developed elements and the recent privately-financed, commercially-operated spaceport system assets.

All of the various partners must work together to enable the accomplishment of their missions along with the responsibility of maintaining the State's space transportation infrastructure. See Section 5 for a discussion of governance models that would enable a more robust and responsive spaceport system.

MEET INDUSTRY NEEDS FOR SCHEDULE RELIABILITY AND EXPECTATIONS FOR SERVICE

The Florida Spaceport System has a competitive advantage in the world due to its geographic location, extensive track record, and multi-modal connections. It offers a strong network of regional and statewide assets ready to support a growing commercial space industry. However, the system risks falling behind in the industry if it is unable to meet industry needs for schedule reliability and expectations for service.

For example, while most launch vehicle providers consider NASA and DOD valued customers, there remains concern regarding the commercial market requirements. These include schedule reliability coupled with a need for significant increase in launch tempo. One question is, how priorities will be assigned and schedules managed as the launch rate increases? It is important to know that the commercial providers have commitments to their customers.

There are collaborative efforts underway for a reliable spaceport system. These include "streamlining of" processes, minimizing of environment impacts, and coordinating of the Eastern Range Airspace to accommodate the growing number of launches. These efforts include using advances in technology together with re-aligning policies and the respective roles of government and the private sector.

A ULA Atlas V rocket lifts off from SLC-41 at CCAFS

Adapting the CCS to new management structures and operating paradigms will be critically important to providing customer service expected by the global marketplace.

Recent commitments to expand Florida operations by SpaceX, the selection of a Florida site by Blue Origin, and other developments indicate the market is embracing the efforts by the Florida Spaceport System stakeholders to meet this challenge at CCS and on the Eastern Range.

In addition, 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

To provide improved service reliability and assist with the management of industry expectations, the JAA and Cecil Spaceport completed a Strategic Business Plan in 2015. The business plan serves as an instrument to analyze the basic elements of the space forecast, facility requirements, business opportunities, the commercial space industry environment, the inherent strengths and weaknesses of the Spaceport, the horizontal space markets, and specific business models to meet the needs of the Spaceport.

STREAMLINE THE RULES AND REGULATIONS GOVERNING COMMERCIAL SPACE

This challenge is largely in the hands of the U.S. Secretary of Transportation, working through the Federal Aviation Administration's Office of Commercial Space Transportation and the key federal partners in the Florida Spaceport System – NASA and the USAF.

Florida, however, has a vital role to play in advocating for the commercial launch industry, and in its capacity to operate and support space infrastructure and enabling capabilities.

Regulatory predictability and a stable operations environment are critical to the business model for growing global space commerce and U.S. competitiveness in those markets. At present, commercial launch operators must deal with duplicative, inconsistent, and sometimes conflicting rules and policies, all depending on where their operating sites are located within the system.

Space Florida is actively engaged in assisting the federal efforts to identify streamlining needs and opportunities to facilitate a robust U.S. commercial launch industry. Recent rule changes to the federal regulations have attempted to correct some of these issues, but more effort is required.

BALANCE SPACE TRANSPORTATION NEEDS WITH ENVIRONMENTAL CONSIDERATIONS

Environmental considerations pose a significant challenge to the development of new spaceports or the construction of new launch or reentry sites at existing spaceports. Identification of adverse environmental impacts can result in major constraints on permitting and development.

The FAA safety regulations mandate protection of the public and property during launch and reentry events. All sites must demonstrate that launch and landing points are safely separated from populated areas, and that the trajectories of space launch vehicles do not pose an unacceptable level of risk to the public during their flights.

This generally requires location of spaceports at or near the coastline, and at a site several miles from urbanized areas and even sparsely populated land. Operators must ensure they can control public access and clear areas near the launch site and the vehicle trajectory path. Those factors are why most existing spaceport sites and any that have been proposed are co-located or adjacent to areas which are environmentally- protected coastal lands serving to support wildlife habitat and offering recreational venues.

Areas that may otherwise be suitable for location of launch facilities must be evaluated for impacts to environmental resources during the FAA's deliberation on a proposed launch site application, and with particular attention to potential adverse impacts to protected species habitat, or impacts to known or previously unidentified cultural resources. A licensing of a launch site is a Federal action and requires compliance with National Environmental Policy Act (NEPA).

In addition, Section 4(f) of the U.S. Department of Transportation (DOT) Act, provides that the Secretary of Transportation will not approve any program or project that requires the use of any publicly-owned land from a public park, recreation area, or wildlife and waterfowl refuge of national,

State, or local significance or land from an historic site of national, State, or local significance, as determined by the officials having jurisdiction thereof, unless there is no feasible and prudent alternative to the use of such land and such program, and the project includes all possible planning to minimize harm resulting from the use. The applicability of this provision on areas acquired to support space transportation has not yet been determined.

At the same time, over five decades of co-location of space launch operations amidst a vast acreage of conservation-managed land at CCS has demonstrated that these land uses are compatible. This is especially evident when proper environmental reviews have been performed, less environmentally-damaging sites are selected, and development is performed in an environmentally responsible fashion to minimize and mitigate impacts.

Beyond the issues associated with land uses and potential impacts to wildlife and cultural resources, environmental analysis of noise to nearby populations and potential impacts to air and water resources are also among many other environmental considerations that are weighed.

COMMUNICATE THE IMPORTANCE OF FLORIDA'S SPACEPORT SYSTEM

Aerospace is one of Florida's leading industries, along with the other modes of transportation, tourism, agriculture and construction. Florida State University (FSU) 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.

Florida's Spaceport System has had an immense impact on Americans' daily lives, for example:

- Every currently operational Global Positioning System (GPS) satellite has launched from Florida.
- Every Geosynchronous U.S. weather satellite has launched from Florida.
- Every Geosynchronous U.S. early warning satellite has launched from Florida.
- The Hubble Space Telescope was launched from Florida and remains a vital research tool and a public relations boon for astronomy.

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.

Updated analysis of the recent industry job gains and statewide economic impacts of this industry will be performed for the future update of the Systems Plan. The value of Florida leadership in the future growth of global space commerce must continue to be quantified and communicated clearly to Florida's leadership and the system stakeholders.

The 45th Space Wing supported Orbital ATK's successful rocket launch December 15, 2016 from the L-1011 carrier aircraft which took off from the Skid Strip at Cape Canaveral Air Force Station, Florida.

The Hubble Space Telescope

Launch Pad 39 B and 39C

4
FLORIDA SPACEPORT SYSTEM VISION

4.1 INTRODUCTION

There are not many regions or places in the world that have the aerospace infrastructure capacity and capabilities, related target industries (commercial, private or government), and preferred location of launch complexes - 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 U.S. Air Force, the DOD and other Federal agencies. Florida's Spaceport System generates economic, social and environmental benefits that strengthen every Florida county, the state, the nation, and the world.

Florida's Spaceport System is undergoing an unprecedented cultural shift since its inception over 65 years ago.

Florida's Spaceport System is currently 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,

SLC46 ORS5 Mission August 2017

construction, maintenance and/or operations of the future system include:

- Changes in motivations from traditional drivers such as national pride, interest and defense to motives of economic development, job creation and profitability
- Shift from a willingness to retain and 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 through sharing arrangements or via "excess property" transfers
- Increased focus on diverse funding sources and return-on-investment
- Emphasis on expanding capabilities while reducing maintenance needs and operating a smaller physical "footprint"
- Increases in mobile launch platforms versus traditional stationary launch sites
- Shift from single-use 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 leverage of available resources to generate the greatest benefits for Florida residents.

VISION

The vision for Florida's Spaceport System is to have Florida Spaceports as the premier transportation hub for global space commerce. 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 such as autonomous flight safety and fly-back boosters. Moreover, new and innovative operations and business approaches will drive changing requirements for Spaceport infrastructure and capacity. Florida Spaceports shall be at the forefront of spaceports employ new techniques and support systems to lower their operational costs.

Figure 4.1a illustrates Space Florida's "Vision 2025". In less than two decades and throughout the 21st Century, Florida will become the planet's premiere transportation center for global space commerce, enabling all the elements in the blue and purple boxes. Space commerce will be an underlying foundation for worldwide space-based services and products already valued at $330 billion annually, with a potential to nearly double over the next 10 years. The elements that involve placement of both hardware and humans into space will also drive and facilitate activities in the frontiers beyond Earth's atmosphere.

With a growing reliance on space-based investments, Florida will continue to deliver essential support to the Federal Government and DOD, serving as guardian of the nation's commercial and national interests in space. Florida will facilitate the logistics and transport of commodities, materials, and the systems necessary to place and operate at high value destinations in orbit and far beyond.

Figure 4.1a: Space Florida's Vision 2025

Florida will strive to be the center for management of space traffic and have spaceports that can deploy and provide disruptive technologies that reduce costs and expand access to space. It will be a classroom for best practices, Research and Development hot spot for innovating space products, and a meeting place for free market entrepreneurs from around the globe.

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 continuing to provide responsible environmental stewardship**
- **Advance a safer and secure spaceport transportation system for residents, businesses, and others**

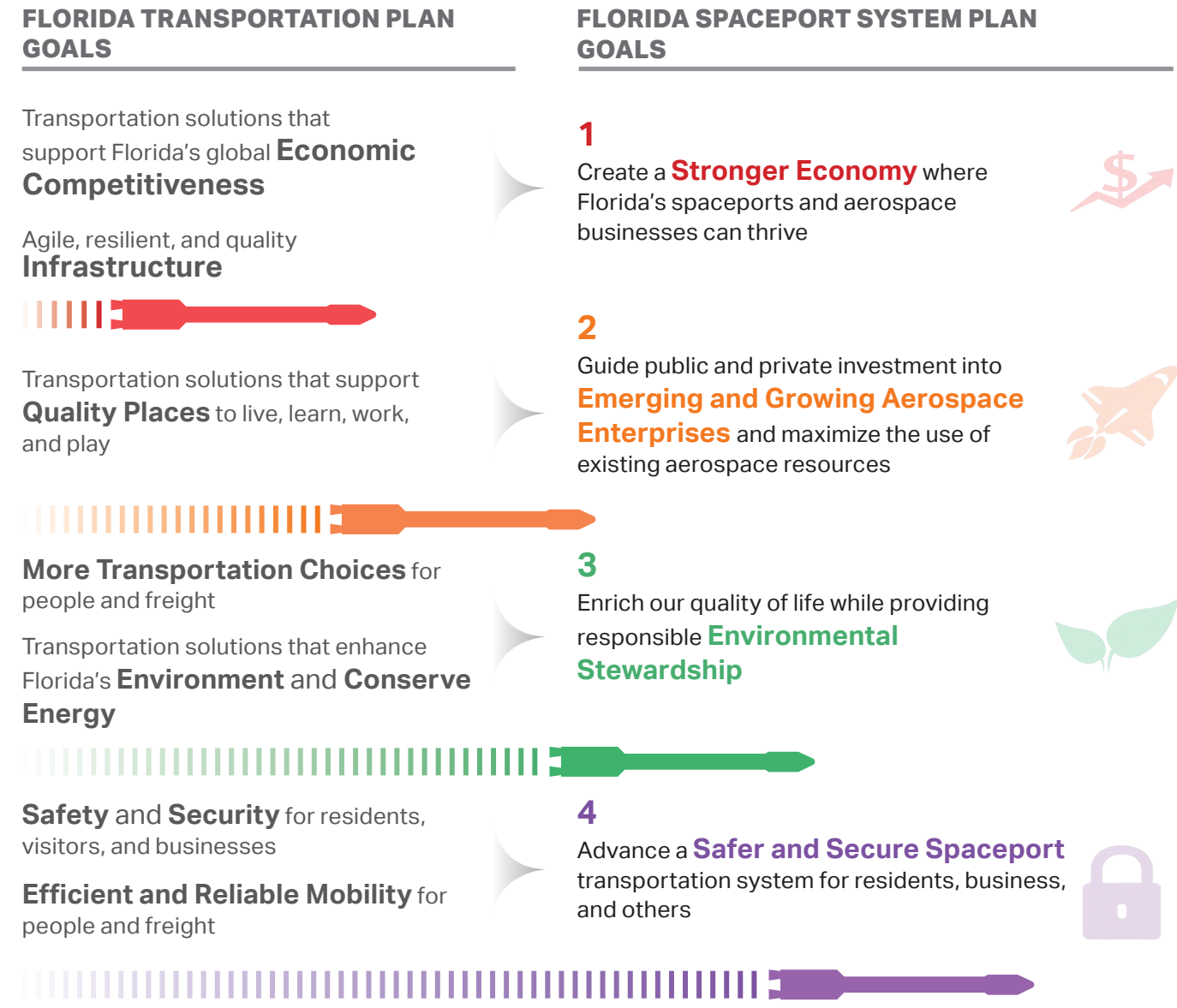


Figure 4.1b: Florida Spaceport System Plan Goals

4.2 SPACEPORT AND SPACEPORT TERRITORIES

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

For the orbital market, the CCS 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 CCS at the north end of KSC, known as Shiloh. 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 connections will be operational within the next 10 years due to technical, logistical, legal/regulatory and economic barriers (see Part 2). However, as the RLV technology matures and the market expands, there may be opportunities for additional spaceports in Florida. It is imperative that those proposing a new spaceport in Florida develop a robust market-based business case with a full understanding of costs of licensing, management, operations, and compliance with existing grant assurances. Moreover, proposers should take into account the impacts of FAA safety criteria, NEPA compliance, the needs and infrastructure associated with the proposed commercial spacecraft, population densities, and other critical siting factors. Space Florida has produced a Spaceport Licensing Lessons Learned document to assist potential future spaceports in Florida in their decision-making.

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

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, the vision for the spaceport sub-system includes enhancements to existing spaceports, including:

- "Right-sizing" existing infrastructure, based on market demand, to decrease operations and maintenance (O&M) costs.
- 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, shared or multi-users, such as space and space

Heavy-lift Transport Truck Carrying the Crew Access Arm to SLC-41

vehicle testing facilities and engine testing and development.

- Identifying of additional revenue sources such as land leases and ground rents to help offset O&M costs.

Figure 4.2a 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

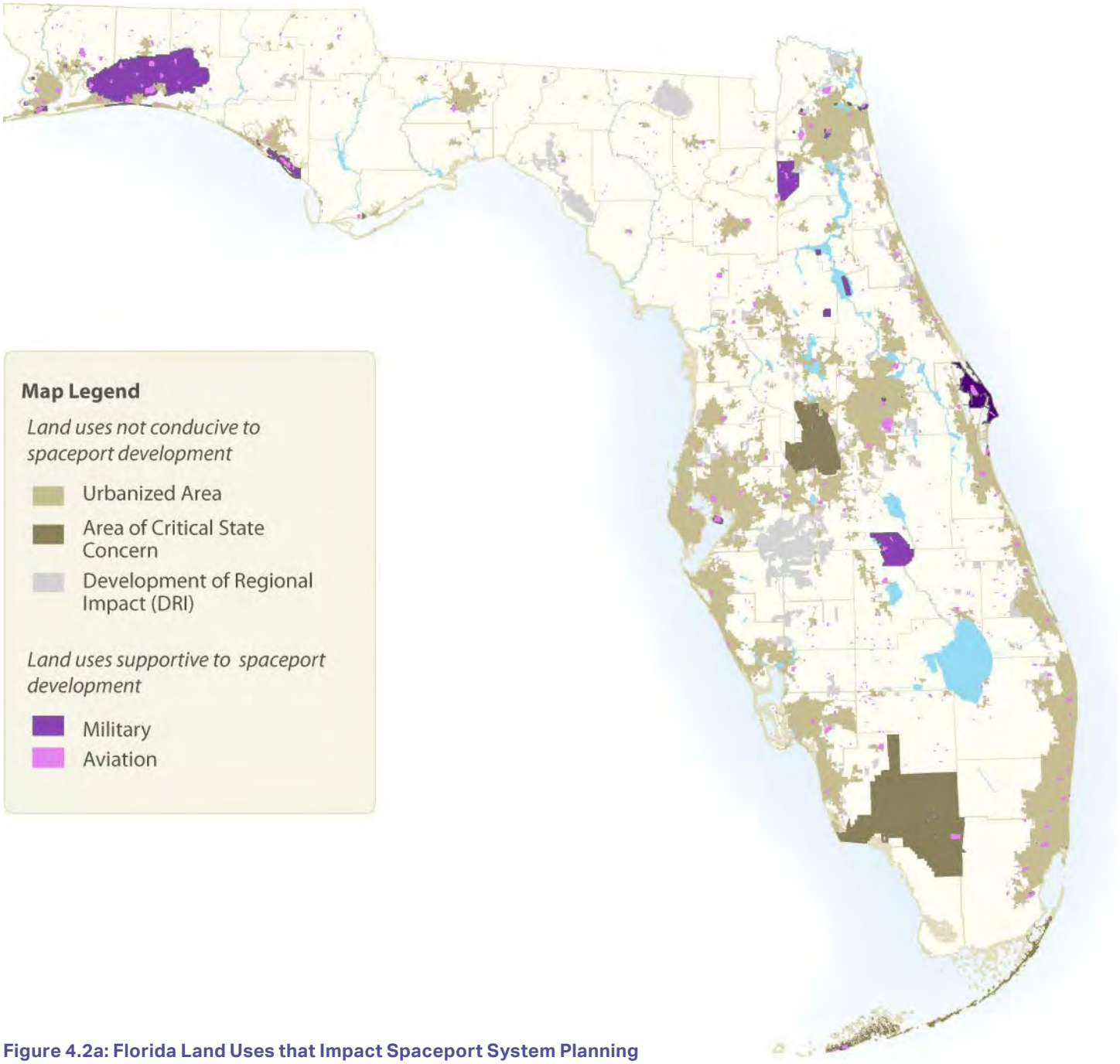


Figure 4.2a: Florida Land Uses that Impact Spaceport System Planning

regulated and closely monitored. The Areas of Critical State Concern Program has defined areas "containing, or having significant impact upon, environmental or natural resources of regional or statewide importance".[vi] These can also extend to protect historic and archaeological 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.

With these limitations considered, **Figure 4.2b** shows the vision for Florida's future spaceport subsystem including major urban airports and conceptual locations for potential re-entry sites.

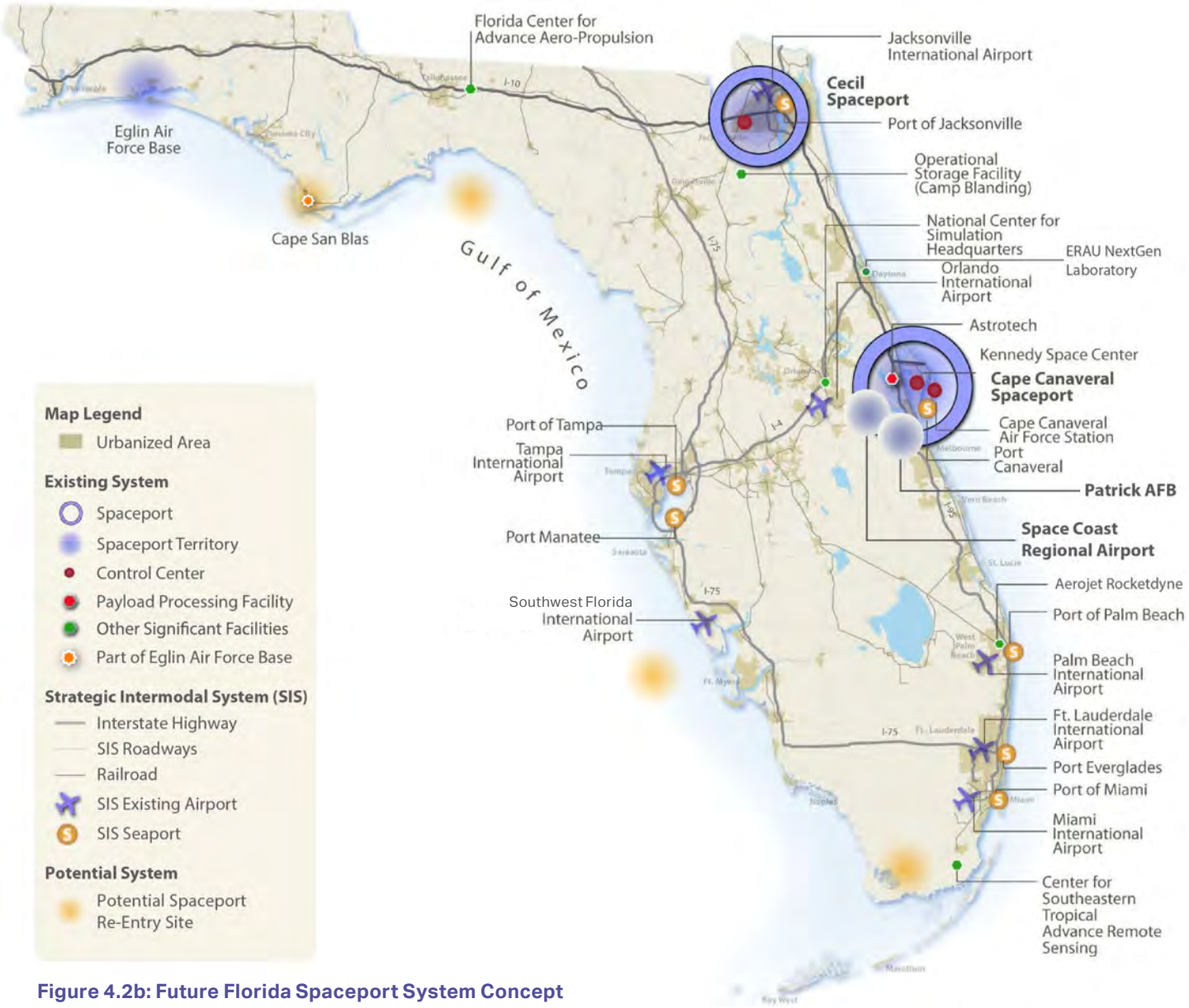


Figure 4.2b: Future Florida Spaceport System Concept

SUMMARY OF NEEDED INFRASTRUCTURE IMPROVEMENTS: SPACEPORTS

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

4.3 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 and opportunities to the system.

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."[vii] 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 CCS 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 may require the re-routing of aircraft around designated restricted areas (based on the launch characteristics).

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.

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 including Unmanned Aerial Systems (UAS) flights
- Accommodating increased demand
- Designation (size, location, time frame) of restricted areas
- Assessment of "re-routing" impacts (costs and schedule)
- 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*

4.4 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 4.4a illustrates historic, current, and future launch vehicles relevant to Florida's Spaceport System.

The most significant changes in the types of orbital launch vehicles and spacecraft over the next 10 years will likely be in the small launch vehicle class. Existing ELVs such as ULA's Atlas V and Delta IV and SpaceX's Falcon 9 and Falcon Heavy are dependable and meet current and anticipated needs for the foreseeable future. Additionally, Falcon 9 boosters are being recovered for re-use, potentially increasing SpaceX's tempo of flight operations.

ULA plans to introduce the Vulcan ELV as a replacement for the Atlas and Delta in 2019. Blue Origin's New Glenn and NASA's Space Launch System will be additions to CCS launch vehicle capabilities as well.

Other orbital vehicles that can be launched from Florida include the Orbital ATK Pegasus XL, Virgin Galactic's LauncherOne, and the Minotaur. Multiple new small launch vehicles are in development and will be using CCS's launch complexes. This vehicle mix is likely to remain available for customers for at least 10 years.

NASA expects the SLS, capable of sending 70 tons to low Earth orbit, to be operational following test flights around the 2019-2021 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.

FLORIDA'S SUBORBITAL FUTURE

One company is positioned to have an impact on suborbital launch in Florida's near future: 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. 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 climbing to an altitude of about 15,240 meters (50,000 feet), SpaceShipTwo will release from the carrier aircraft and ignite a rocket engine to climb straight up to an altitude of about 110 kilometers (68 miles). At the apogee, the vehicle will experience about three to 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.

SUMMARY OF NEEDED INFRASTRUCTURE IMPROVEMENTS: SPACECRAFT AND LAUNCH VEHICLES

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

4.5 PAYLOAD PROCESSING FACILITIES

Florida's Spaceport System includes a wide range of payload processing services and facilities at or near 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.

Over the next 10 to 15 years, these existing payload processing facilities at CCS 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 Module). Beginning in 2005, the building was renovated for $55M in order to receive and assemble the Orion 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 processing, and thus will be in service at least through the mid-2030s. No other future use is projected beyond Orion.
- *Orbiter Processing Facilities (OPFs)*: There are three OPFs at KSC. OPF-3, the largest facility, has been renamed the Commercial Crew and Processing Facility is the home to Boeing's Starliner (formally CST-100) program. OPFs 1 and 2 have been transitioned to Boeing to support processing of the USAF's X-37B program.
- *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):* This facility offers payload processing space for future users. It will remain in service until at least the end of the decade; future plans for the SSPF will depend on the ISS. The plans for the ISS beyond 2020 remain uncertain.

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.

- *Large Processing Facility (LPF)*: This facility was built in 1964 for the USAF to assemble the solid motor sections of military rockets for the 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 licensed to SpaceX and is used for large payload processing.
- *Eastern Processing Facility (EPF)*: A recently-complete National Reconnaissance Office (NRO) space vehicle processing facility at CCAFS. The facility provides the necessary support for final preparations, testing and status monitoring just prior to launch.
- *Space Life Sciences Laboratory (SLSL)*: The SLSL serves as the primary gateway for life sciences payloads bound for the 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 CCS 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.

Recognizing the payload processing needs of commercial operators and research institutions, the JAA and Cecil Spaceport are initiating a Payload Preparation Facility Requirements Evaluation project in FY17-18 to determine the specific infrastructure criteria necessary to meet operator needs. Once the evaluation is completed, the design and construction of a formal payload processing facility is budgeted and included in the Capital Improvement Program (CIP) for FY18/19.

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.

Technicians at Astrotech processing a payload.

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*

4.6 INTERMODAL CONNECTIONS

Highway, waterway, and railway 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; however, scheduled maintenance, rehabilitation or reconstruction of infrastructure associated with the existing modes should be a top priority for either the State of Florida or the applicable responsible regulatory agencies.

With the addition of new spaceports in the future, specific intermodal connections should be examined during the planning phase. Moreover, as the intermodal freight and logistics volume increases to the Spaceports, increased opportunities will drive studies and implementation plans for public-to-public (federal to state, or state to authority) infrastructure transfers to enable increased commercial commerce.

The Delta Mariner delivers Delta IV components at Port Canaveral

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*

4.7 SUMMARY

The Florida's Spaceport System in the year 2027 may look very similar to the 2018 system; however, the governance and ownership of the spaceport infrastructure may see shifts from federal ownership to either commercial, private or a Statewide Spaceport Authority ownership. Florida's existing spaceports will adapt to the evolving space industry and will:

- Continue to meet demand for launches and payload processing;
- Support the classes/types of launch vehicles and spacecraft;
- Ensure airspace be managed and coordinated by the Air Force, NASA, FAA and commercial operators; and ,
- Improve the intermodal support system to accommodate aerospace needs.

An as-yet-unknown effect will be the introduction of RLVs such as SpaceX's and Blue Origin's orbital boosters, their anticipated reduction in launch costs and a corresponding increase in launch rates as customers take advantage of the lower launch costs to open new market opportunities.

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; multi-use infrastructure will be deployed to service customers of all sizes; 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.

SpaceX CRS -12, Falcon 9 Commercial Supply Liftoff, August 14, 2017

5 IMPLEMENTING THE VISION

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

- Develop 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

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

5.1 COLLABORATION AND DECISION-MAKING STRUCTURE

The key partner agencies of Florida's Spaceport System are Space Florida, NASA, the USAF 45th Space Wing, FDOT, JAA and the FAA Office of Commercial Space Transportation. These partners 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 (TPO), such as the Space Coast TPO in Brevard County.

Space Florida has developed a structured process for soliciting project and infrastructure needs from the space/aerospace industry and key partner entities with responsibilities for managing and operating elements of the system. This process seeks to integrate the planning carried out for each of the individual planning areas described in Section 5.2. A decision-making process to prioritize projects and identify unfunded needs, together with funding recommendations by the Space Florida Board, is described in Section 5.3.

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.

While it is anticipated that the agencies will continue to actively collaborate to implement the vision, there is currently 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 establishment of implementation planning councils made up of key partners in the system will influence the deployment of resources to enable Florida spaceports to compete effectively in the global marketplace. A future governance model, graphically depicted in **Figure 5.1a**, 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

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

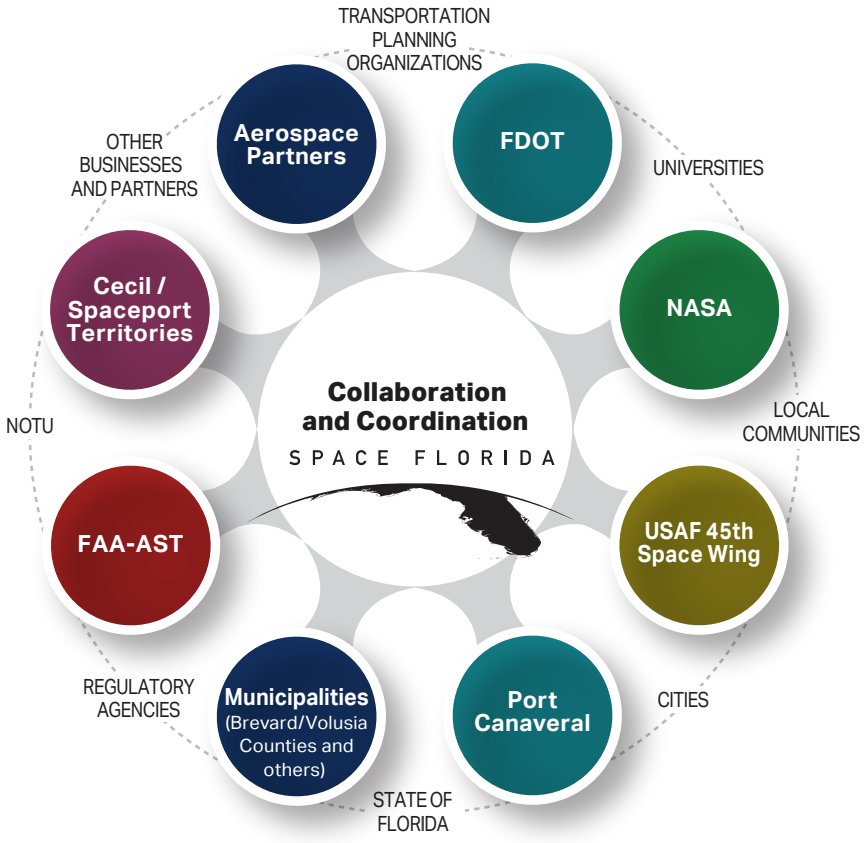


Figure 5.1a: Governance Model of Florida Spaceport System

- 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 continue 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:

i. Convene a Florida Spaceport System Planning Council to recommend a governance model for the coordinating entity; if so, determine if any changes are needed to Space Florida's organizational structure to serve in this role

ii. Formalize the new collaborative and decision-making structure in some manner, such as a memo of understanding between agencies

iii. Schedule and initiate regular Florida Spaceport System Planning Council meetings

iv. Study and propose recommendations on changes to federal, state, and local laws and regulatory guidance to enable joint participation in projects on Spaceport Territory.

5.2 ORGANIZE SPACEPORT TERRITORY PLANNING BY AREA

For purposes of performing an integrated master plan and capital improvement program for the entire system, Space Florida has organized the designated spaceport territory land described in statute into Territory Planning Areas.

Doing this allows for a focused consideration of how each area fits into the overall system. This aids in identifying its existing conditions and emerging requirements, and offers maximum opportunity for territory areas that are operated and developed by local authority entities other than Space Florida to identify future needs for funding consideration.

The Territory Planning Areas and responsible entities are:

i. Cape Canaveral Spaceport, managed and developed by Space Florida in collaboration with federal land owners and system element operators (NASA and USAF)

ii. Cecil Spaceport, managed and developed by the Jacksonville Aviation Authority

iii. Space Coast Regional Airport, a proposed commercial spaceport managed and operated by the Titusville-Cocoa Airport Authority

iv. Patrick Air Force Base, planned for system capabilities support by Space Florida

v. Eglin Air Force Base and its Cape San Blas facility, planned for system capabilities support and potential future utilization by Space Florida

5.3 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 Improvement Program. 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)
- Will the proposed project be sustainable? (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 (**Figure 5.3a**).

COLLECT PROJECTS
(February – March)

- Call for projects
- Hold public/applicant workshop
- Receive applications

QUANTIFY
(April)

- Review project applications
- Categorize
- Determine benefits to the state
- Return on investment

PRIORITIZE
(May)

- Perform initial prioritization
- Assess alignment with Space Florida goals/ objectives
- Classify projects based on capital investment and job growth

ALLOCATE
(May – June)

- Identify projects and allocations for approved projects
- Compare to available funding sources
- Strategically invest in Florida
- Approval by Board

Note: Dates are typical but may vary.

Figure 5.3a: Call for Projects and Prioritization

ACTIONS TO ESTABLISH SYSTEM-WIDE PROGRAM FUNDING AND PRIORITIZATION CRITERIA

i. *Distribute proposed criteria to partner agencies as part of the Spaceport System Planning Council*

ii. *Meet to review, discuss and revise the criteria*

iii. *Request that partner agencies "test" the criteria for funding priorities over a one-year trial period, e.g. the FDOT spaceport infrastructure grant program*

iv. *Meet to review and discuss findings from the trial period, and revise the criteria as needed*

v. *Adopt the revised criteria as a basis for system-wide recommendations*

5.4 UPGRADE AND MAINTAIN ESSENTIAL INFRASTRUCTURE

Florida's existing Spaceport System has adequate capacity to accommodate the anticipated increase in orbital and suborbital launches; however, it must be at the forefront of the evolving space industry. 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 due to lack of funding. Other facilities need to be right-sized to serve launch demand.

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

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.

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 system-wide basis, such a process could easily be established with the guidance provided by the FSSP. 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 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

i. *Update individual agency master plans, including the identification of needed infrastructure improvements*

ii. *Differentiate between essential and non-essential system-wide infrastructure based on agency and system goals, available funding, existing and anticipated markets, and prioritization criteria*

iii. *Develop system-wide one, five and 10-year capital improvement plans (CIPs) for essential infrastructure*

iv. *Incorporate system-wide CIPs into the Florida Spaceport System Plan to comply with project review and submittal requirements in s. 331.360, F.S.*

v. *Re-purpose existing launch complexes and supporting facilities as necessary to accommodate civil and commercial flight*

vi. *Define partner (public and private) roles in developing and maintaining infrastructure*

5.5 CREATE A SYSTEM-WIDE BRANDING IDENTITY AND MARKETING STRATEGY

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.

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.** Establish the perception that Florida is customer friendly. This will naturally occur as the paradigm shifts to a 21st century commercial launch provider platform.

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

- **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 and NASA's intent of using commercial companies to resupply the ISS. NASA is funding the development of three new launch vehicles that will help the United States re-enter the commercial launch market. There is also hope that the emergence of two new potential markets, RLV's and UAV's will keep the Florida Spaceport System busy. 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, Blue Origin, OneWeb/Airbus and Moon Express have all signed agreements with projects at CCS. 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.

- **Continue collaborating on a new initiative with industry and academia.** 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 freight and logistics as more and more cargo going to Space will be going through Florida Spaceports. The economic value of this cargo is critical for global commerce. It is critical for public agencies to identify the benefits and returns generated by taxpayer investments in order to continue to receive public funding.

ACTIONS TO CREATE A SYSTEM-WIDE BRANDING IDENTITY AND MARKETING STRATEGY

i. Evaluate current launch costs; make recommendations for cost reductions

ii. Identify alternatives for Launch Schedule Assurance

iii. Continue to identify and pursue new markets for the system

iv. Develop a new brand for the Florida Spaceport System

v. Continue collaborating with Workforce Florida, Florida universities and the business community to educate, attract and retain engineers and technical professionals

vi. Develop and monitor metrics that measure the Florida Spaceport System's success in meeting its goals; publish an annual report of the metrics

5.6 COMMUNICATE THE IMPORTANCE OF FLORIDA'S SPACEPORT SYSTEM

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 CCS. 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 Floridians. Space and space-derived technology is more central to our lives than ever before as demonstrated by: GPS tools; weather monitoring techniques; modes and means of communicating globally; satellite imagery (Google Earth); and, other life science spinoffs. The importance of space remains but it may not be communicated efficiently or the perception of the public might be different. This communication effort/support is critical if Florida's Spaceport System is to be successful.

Moreover, commercial space capabilities have become more visible to the public via social media. The relevance of space adventurism in our everyday lives include: SpaceX orbital launches and landings; Blue Origin suborbital launches and landings; startup companies ability to build an operational CubeSat with little experience and infrastructure; and, space tourism – which can give one the astronaut experience. This natural perception of relevance creates an opportunity for Florida to market and brand itself as the world leader in Space commerce.

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

In addition to marketing Florida and providing good customer service to the aerospace industry, Florida should develop a public awareness campaign to promote the benefits of the aerospace industry to residents, visitors, business leaders, elected officials and policymakers 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

i. *Develop succinct, compelling messages regarding Florida as a center for Space Commerce*

ii. *Develop a public awareness campaign to promote the benefits of Florida's aerospace industry, building on the system's new brand*

iii. *Include both traditional media (television, radio, print) as well as new social media technologies*

iv. *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*

v. *Monitor and evaluate the effects of the campaign; adjust as necessary based on results*

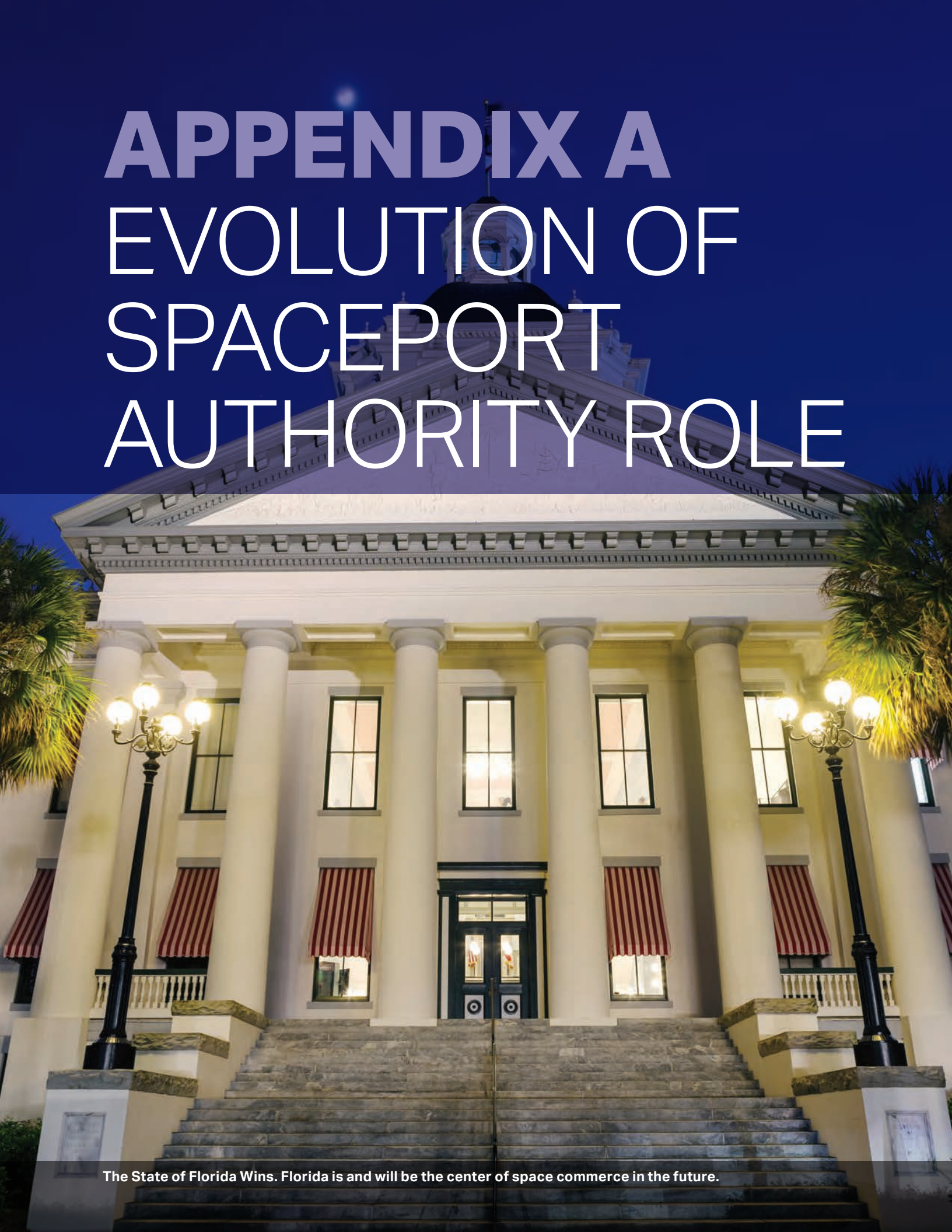
5.7 SUMMARY

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 65-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 the State of Florida, 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.***

Falcon 9 First Stage Booster Landing

APPENDIX A
EVOLUTION OF SPACEPORT AUTHORITY ROLE



The State of Florida Wins. Florida is and will be the center of space commerce in the future.

A.1 INTRODUCTION

Space Florida's role and statutory responsibilities as a statewide spaceport authority are defined in its establishing legislation, Chapter 331 Part II, Florida Statutes. In framing its intent, the Florida Legislature determined that under Space Florida's direction, this state has the opportunity to strengthen its existing leadership in civil, commercial, and military aerospace activity and emerge as a leader in the nation's new vision for space exploration and commercial aerospace opportunities, including the integration of space, aeronautics, and aviation technologies. Further, the Legislature declared its intent that Space Florida seek to preserve the unique national role served by the CCAFS and KSC by reducing costs and improving the regulatory flexibility for commercial sector launches while pursuing the development of complementary sites for commercial horizontal launches.

In creating Space Florida, the Legislature defined its relationship with FDOT to jointly participate in the planning, development, and improvement of statewide aerospace transportation facilities, including the improvement of space transportation capacity and efficiency. To that purpose, Space Florida is directed to develop a spaceport master plan for expansion and modernization of space transportation facilities within defined spaceport territories.

In addition, its authorizing statute provides Space Florida with broad powers to develop and operate infrastructure, facilities, and enabling capabilities to support Florida's Spaceport System wherever it may be needed.

Space Florida's role as a statewide spaceport authority is founded in its statutory responsibility to identify and recommend projects to meet current and future commercial, national, and state space transportation requirements, along with appropriate funding levels, throughout the statewide system.

Anticipating the emergence of spaceport operations at FAA-licensed Cecil Spaceport, the potential licensing of a spaceport at Space Coast Regional Airport in Titusville, the potential licensing for the SLF, the prospect for possible vertical launch capabilities in the Florida Panhandle, and multiple orbital or point-to-point spacecraft reentry sites, Space Florida envisions an evolution of its spaceport authority role and functions.

A.2 SPACE TRANSPORTATION AND SPACEPORT POLICY ENGAGEMENT

Space Florida has already assumed a leadership role in the development and evolution of national and international space transportation policy, working closely with federal agencies, other states, and the international space transportation industry to address the many policy and regulatory issues associated with a growing domestic and global spaceport network.

A.3 TRANSITIONING STATE AND FEDERAL JURISDICTIONAL ROLES

Space Florida's engagement with NASA and the U.S. Air Force in visioning and planning the spaceport of the future within its CCS territory is focused on a transitioning of state and federal jurisdictional roles to enable a transformed regulatory and operating environment. Promoting an accelerated transition to an independent CCS Authority by 2025, Space Florida expects to apply its spaceport authority powers to develop appropriate sources of revenue that can support and sustain spaceport infrastructure and operations for a multi-sector space transportation complex.

These sources of revenue should allow space transportation to begin making a contribution to the State Transportation Trust Fund as is identified as a statutory goal.

Space Florida anticipates that application of concurrent legislative jurisdiction in the federally-owned areas of CCS, and perhaps to other federal spaceport territory areas in the Florida Panhandle, can facilitate defined areas referred to as "space commerce zones" where operations can be carried out under applicable state and local codes, in accordance with commercial operating standards, and in a streamlined regulatory environment governed solely by the FAA-adopted rules for commercial space transportation.

A.4 RANGE AND OPERATIONAL SAFETY EMERGENCY RESPONSE

Space Florida has established a near-term goal to define and implement safety programs and policies required to facilitate, coordinate, and manage ground, air, and space operations.

An operational priority is to support space transportation and advanced aerospace activities throughout Florida by developing a state-wide emergency response program. The objective of such a program will be to enable effective and timely response to commercial spaceflight or advanced aerospace accidents and incidents wherever they may occur within the state during launches, reentries, or test operations. Space Florida is already participating in the statewide Emergency Management Council and establishing necessary relationships with the Florida National Guard and other entities to initiate planning for this program.

A.5 COMMERCIAL RANGE INSTRUMENTATION AND CAPABILITIES

Space Florida is developing approaches to support and facilitate the emergence of commercial range safety and flight monitoring instrumentation that can lessen or perhaps even eliminate the reliance on traditional federal ground-based tracking and control systems. Additionally, Space Florida is seeking to develop independent, commercially operated services for safety analysis and operational support of launch, reentry, and test operations. These may include capabilities such as tailored weather forecasting and real-time information; flight safety hazards analysis and real-time monitoring; and required public clear zone verification monitoring.

Space Florida's objective in advancing the development and commercial availability of such capabilities with an efficient delivery system is to furnish a tool kit of operations support capabilities wherever needed throughout the Florida Spaceport System.

This will address the Systems Plan goal for a safer and secure spaceport transportation system throughout Florida. It will support industry efforts to meet FAA safe flight requirements by transitioning to a space-based range, enabling private and government investment in systems which allow an increased launch tempo to meet market demand .

New technologies for launch vehicle tracking and flight control will meet a standard of safety for the public and property that is equivalent to or higher than that afforded in the current operating environment, which has remained reliant on aging, limited capacity ground based stations.

A.6 LAND USE PLANNING TO SUPPORT FUTURE CAPACITY NEEDS

Space Florida is employing its spaceport authority role to proactively participate in Florida land use planning, including the planning for future land uses on federal properties, to help ensure and support capacity for future space transportation needs. This is a critical function to address and balance the goals of a Florida Spaceport System that achieves a growing, safe, and secure space transportation network while ensuring environmental stewardship.

This function will address the federal transportation requirements related to how federal transportation projects, including FAA-licensed spaceports, may impact conservation lands and public access/ recreational uses. It will address how to balance these requirements with the needs for safe and secure space transportation launch areas and reentry sites that meet industry safety standards and federal regulations adopted to protect the uninvolved public.

Falcon Heavy Test Flight Boster Landing, February 6, 2018.

APPENDIX B
UNFUNDED NEEDS

SLC-41 ULA at Cape Canaveral Spaceport

The Unfunded Spaceport Infrastructure needs list provides details regarding Space Florida, FDOT and State of Florida projects related to enhancing the transportation mode of "Space". The projects shall be for improvements/modifications to address statewide spaceport needs and may include other transportation assets (i.e., roadways, bridges, railways, waterways or other spaceport territories assets). The projects horizon span 30 years to 50 years. The projects are not specific, have insufficient basis/justification and responsibilities are not yet identified.

FDOT updates their SIS Multi-Modal Unfunded Needs Plan (MMNP) every five years. The 2018 Plan programs out to 2045 compared to the 2011 plan that programmed out to 2040. The unfunded spaceport needs identified in this section are not currently funded in local, regional or state plans. Projects identified for the SIS 2045 MMNP account of $1.1 billion in unfunded spaceport needs. The SIS MMNP does not imply a commitment to fund or build, but rather identifies and recognizes transportation needs. Should any of the unfunded needs Spaceport projects be selected for inclusion in the future updates of the SIS Long Range Cost Feasibility Plan, they will be prioritized for funding, and move forward as recommended solutions for increasing mobility and meeting the FTP goals and SIS objectives. The FDOT SIS MMNP can be found at:

http://www.dot.state.fl.us/planning/systems/MMNP.shtm

NASA Orion Ascent Abort-2 Rendering - Scheduled to fly from Space Florida operated/maintained SLC-46 in 2019

Falcon Heavy Test Flight, February 6, 2018.

ACRONYMS

ASO	Astrotech Space Operations
ASOC	Atlas V Spaceflight Operations Center
ATK	Alliant Techsystems
C3PF	Commercial Crew and Cargo Processing Facility
CCAFS	Cape Canaveral Air Force Station
CCS	Cape Canaveral Spaceport
CIP	Capital Improvements Program
CMP	Center Master Plan
CSTARS	Center for Southeastern Tropical Advanced Remote Sensing
DOD	Department of Defense
DOT	Department of Transportation
DRI	Development of Regional Impact
EELV	Evolved Expendable Launch Vehicle
ELV	Expendable Launch Vehicle
EPF	Eastern Processing Facility
F.S.	Florida Statutes
FAA	Federal Aviation Administration
FCAAP	Florida Center for Advanced Aerospace Propulsion
FDOT	Florida Department of Transportation
FSSP	Florida Spaceport System Plan
FSU	Florida State University
FTB	Florida NextGen Test Bed
FTP	Florida Transportation Plan
GIS	Geographic Information System
GPS	Global Positioning System
GSO	Geostationary Orbit, Geostationary Earth Orbit or Geosynchronous Equatorial Orbit
HTHL	Horizontal Takeoff, Horizontal Landing
ISS	International Space Station
JAA	Jacksonville Aviation Authority
KSC	Kennedy Space Center
LC	Launch Complex
LCC	Launch Control Center
LEO	Low Earth Orbit
LPF	Large Processing Facility
LSP	Launch Services Program
MARS	Mid-Atlantic Regional Spaceport
MMNP	Multi-Modal Unfunded Needs Plan
MOC	Morrell Operations Center
MPCV	Multi-Purpose Crew Vehicle

MPO	Metropolitan Planning Organization
MPPF	Multi-Payload Processing Facility
MRO	Maintenance, Repair, and Overhaul
NAS	National Airspace System
NASA	National Aeronautics Space Administration
NEPA	National Environmental Policy Act
NRO	National Reconnaissance Office
O&C	Operations and Checkout
O&M	Operations and Maintenance
OPF	Orbiter Processing Facility
PHSF	Payload Hazardous Servicing Facility
RLV	Reusable Launch Vehicle
SAB	Satellite Assembly Building
SF	Space Florida
SFA	Spaceport Florida Authority
SIS	Strategic Intermodal System
SLC	Space Launch Complex
SLF	Shuttle Landing Facility
SLS	Space Launch System
SLSL	Space Life Sciences Laboratory
SPFL	Space Florida
SPIF	Satellite Processing Integration Facility
SRV	Suborbital Reusable Vehicle
SSPF	Space Station Processing Facility
TPO	Transportation Planning Organization
UAS	Unmanned Aerial Systems
ULA	United Launch Alliance
USAF	United States Air Force
VAFB	Vandenberg Air Force Base

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SLF Midfield Development Rendering .

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