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Keynote - Mark Bontrager - Necessary Conditions and Infrastructure for a Successful Multi-User Spaceport

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Presenter Information

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1st Annual Space Traffic Management Conference “Roadmap to the Stars”

Necessary Conditions and Infrastructure for a Successful Multi-User Spaceport

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Steve Szabo, P.E.⁶**

ABSTRACT

The future of successful spaceports will depend on a balance and co-location of commercial, civil, and defense activities in aviation and space flight operations. The current global orbital launch market is relatively flat with launches over the last decade migrating away from the US spaceports, but business is expected to return with growth in smallsat and microsat spacecraft launches and suborbital flights. To be successful in this emerging environment, spaceports will need to provide a number of necessary conditions to address a diverse multi-modal transportation portfolio, which includes multiple regulation regimes for airspace and land use that directly impact potential customers. The key elements discussed in the paper are necessary to enable a future market-facing commercial spaceport. The greater the degree to which these elements are provided for all users, the greater the probability the spaceport can contribute to a satisfied customer base and the eventual growth of the spaceport. To this end, Space Florida is pursuing multiple efforts to enable spaceport growth including 1) partnering with the Air Force and NASA to enable commercial space operations on the Cape Canaveral Spaceport; 2) working toward the development of the Shuttle Landing Facility for multiple users; and 3) development of the Shiloh Launch Complex on the Cape Canaveral Spaceport, which is highlighted in this paper. Space Florida was created to strengthen Florida’s position as the global leader in aerospace research, investment, exploration and commerce. As Florida’s spaceport authority and aerospace economic development organization, Space Florida is committed to attracting and expanding the next generation of space industry businesses.

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1. Introduction and About Space Florida

A successful and growing spaceport focuses clearly on the needs of its various users and customers. Its primary mission is to enable the success of its users in a safe, consistent and sustainable enterprise. The next generation of commercial users requires flexibility and tailoring to streamline processes and reduce costs. Successful spaceports will depend on a balance and co-location of commercial, civil, and defense activities in multiple domains including aviation and space flight operations. Operations may include: horizontal take-off and landing; traditional vertical launch and newly evolving launch vehicle return; general aviation; aviation systems with unique commodities for air launch payloads; unmanned aircraft systems; and localized vertical take-off and landings for technology development or suborbital flights. Spaceports will also be required to provide basic services and support for flight safety as required by the regulatory agencies.

This paper will address: the future spaceport market; the necessary spaceport conditions to enable a market-facing operating environment; and the Space Florida strategy on how to evolve today's spaceports with a focus on infrastructure.

Space Florida⁷ was created to strengthen Florida's position as the global leader in aerospace research, investment, exploration and commerce. As Florida's spaceport authority and aerospace economic development organization, Space Florida is committed to attracting and expanding the next generation of space industry businesses. With its highly trained workforce, proven infrastructure and recognized national leadership, Florida is the ideal location for aerospace businesses to thrive – and Space Florida is the perfect partner to help them succeed.

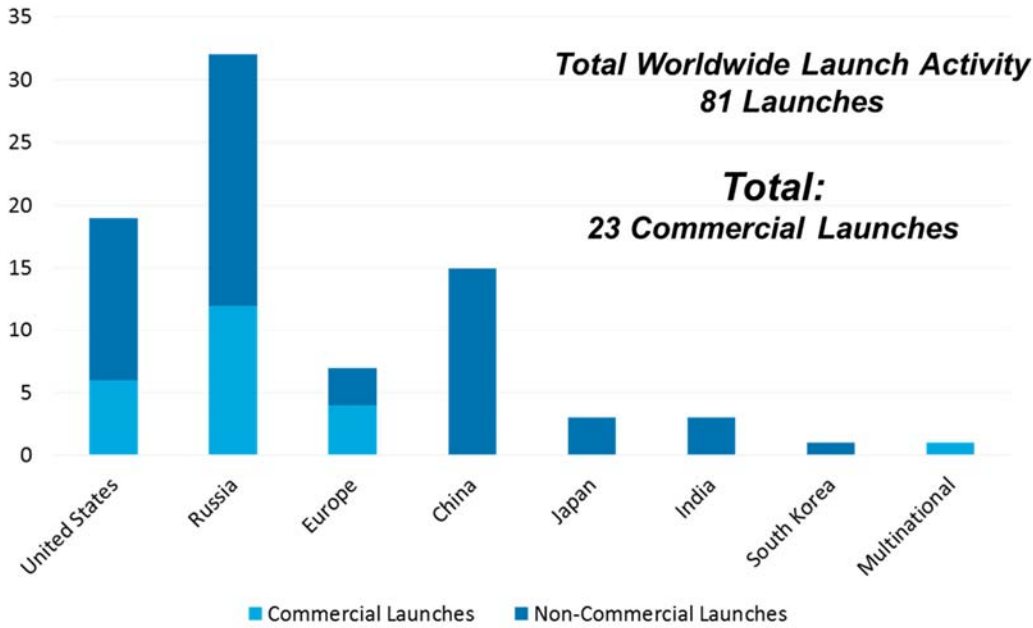
2. Future Spaceport Market

The global dependence on space and space technology require the ability to launch satellites. In the 1980s, the United States of America (US) dominated the global launch market from its spaceports in Florida and California. Over the last 30 years, competition from Russia, the Ukraine, French Guiana, and China has led to a migration of commercial launch business to those overseas spaceports (see Figure 1 for 2013 summary of launch activity around the world).

The overall space launch market is a relatively static market, with only modest annual increases or decreases in launch activity globally. With a few exceptions, such as an increased pace in Chinese government launches over the last several years, government demand for launches, by both US agencies and those in other countries, has been flat. The most prominent commercial launch market, the launch of communications satellites to geosynchronous orbit, remains stable.

Nonetheless, there has been considerable interest in the development of new spaceports, or upgraded facilities at existing spaceports. Part of this reflects an interest in foreign emerging launch markets, often as issues of national pride, but also domestically reflects the need to replace space shuttle cargo and crew transportation to the ISS, and to meet the increased demand for low-cost small satellites, suborbital space tourism, and research.

⁷ Space Florida website: <http://www.spaceflorida.gov>



Source: 2013 FAA Commercial Space Transportation: 2013 Year in Review

Figure 1: 2013 worldwide launch activity (FAA, 2013)

This raises the potential for a spaceport “glut” in the years to come, particularly in the suborbital market. There may be more facilities for these vehicles than operational vehicles themselves. While suborbital vehicles in particular have the flexibility to operate from a wide range of locations, vehicle operators are likely to concentrate their activities at just one or a few facilities until demand grows or additional operators emerge. The selected spaceports may have an advantage for gaining additional launch activity in the future from these and newer operators.

Growth in the launch markets for smallsat and microsat spacecraft (i.e., masses below 200 pounds) is expected to increase in coming years. For example, microsatellites constituted most of the 197 satellites launched in 2013 (Buchen, 2014; Snow, 2014). Advances in satellite technology are making possible more robust and capable microsat spacecraft and an increased demand for launch facilities capable of supporting these payloads.

The forecast of the orbital space launch market is shown as growing from over 10 launches per year to 25 per year (see Figure 2).

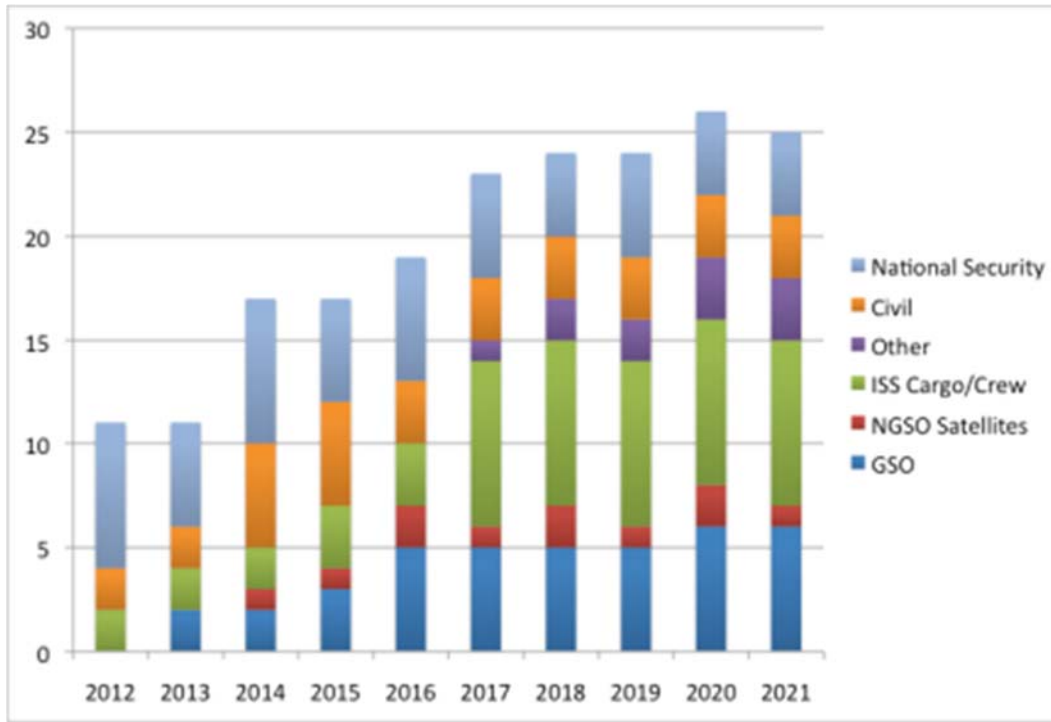


Figure 2: Growth scenario of number of orbital launches (Space Florida, 2013)

Suborbital spaceflight is projected to see a dramatic increase in the number of launches per year by 10 to 40. That forecast has already seen protracted delays, but once suborbital vehicles become operational, that jump in annual launches will occur (see Figure 3).

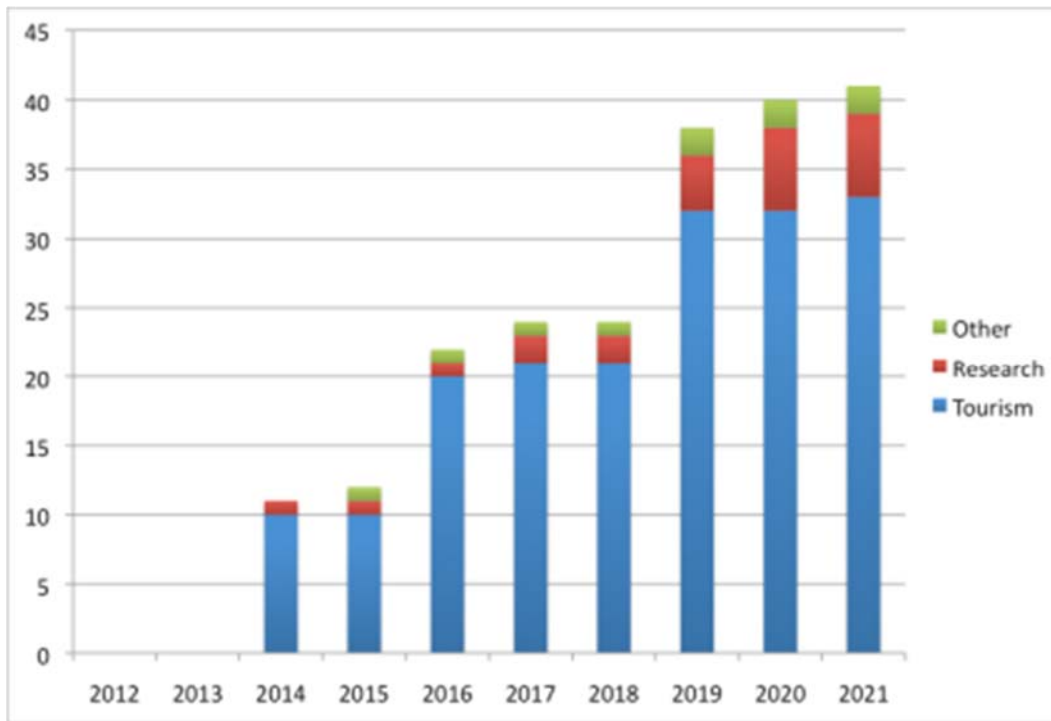


Figure 3: Growth scenario of number of suborbital launches (Space Florida, 2013)

US options for commercial operators are increasing and creating a more competitive environment. State investment incentives have been a primary attraction to new commercial investment. As national government space budgets continue to face challenges, there are several trends that will likely manifest themselves in this environment. The global space industry revenues from commercial sources will exceed that of governments. This has already been seen in the geosynchronous communication satellite subsector and, after initial government investment, may also occur in low earth orbit cargo and transportation services to several destinations. Future federal budgets for space activities will likely be constrained and flat.

3. Toward a Successful Multi-User Spaceport

As technology advancements in the areas of spaceflight continue, existing Spaceports must evolve to enable multiple user communities to accomplish their objectives in an efficient, market-responsive manner. These spaceports will require significant dialog early in the master planning process to address a diverse multi-modal transportation portfolio, multiple regulation regimes for airspace and land use, and unique funding profiles. All of these factors will directly impact the eventual end user and potential customer. A number of conditions are necessary to enable a future market-facing commercial spaceport and are addressed in this section.

Today's operational launch vehicles are expendable launch vehicles (ELV) in that they are not reused in any way. The commercial launch industry is moving toward fully and partially reusable launch vehicles (RLVs). Some may fly from mixed-use commercial spaceports that might also serve as airports with ongoing commercial operations. Suborbital RLVs of the future will encompass a wide range of operational profiles from vertical launch and landing to horizontal launch and landing and other variations. Orbital RLVs may fly with autonomous flight safety systems (AFSS) and will require both launch and re-entry/landing locations.

In planning for a commercial spaceport that accommodates both ELVs and RLVs, the spaceport operator must: demonstrate that the spaceport complies with environmental regulations; provides adequate services; has procedures in place for the cooperative use of the airspace; provides adequate emergency response services pursuant to an Federal Aviation Administration (FAA) approved plan; maintains an adequate weather prediction and lightning advisory capability; safely handles and stores propellants; and provides flight safety systems. The greater the degree to which these elements are provided for all users and are responsive to user needs, the greater it should contribute to a satisfied customer base and the eventual growth of the spaceport. This section is not intended to be "all-inclusive," but highlight some of the most significant conditions.

3.1. Regulatory Confidence: Maximum Commercial Flexibility with Minimum Regulatory Duplication

Spaceport users require clarity on which specific regulatory regimes apply to them. On today's federal ranges, commercial users can experience multiple agency requirements which can add confusion, cost, and burden to their operations. Many commercial users expect their operations to have minimal regulatory oversight and relative freedom similar to operations in common industrial settings. Thus, the spaceport that streamlines processes, is most responsive to market

conditions, and consistently lowers unproductive regulatory oversight will competitively win launch and operations portfolios.

In Florida, Space Florida works closely with the United States Air Force (USAF) 45th Space Wing, National Aeronautics and Space Administration (NASA) Kennedy Space Center and the FAA to refine applicable regulatory processes and minimize redundancies. Multiple users operate on the Cape Canaveral Spaceport today and have seen increased responsiveness and reduced regulatory oversight that allows them to compete more aggressively in the global market. In addition, Space Florida also mentors new commercial customers through the USAF Eastern Range process and sponsors their entry onto the Cape Canaveral Spaceport in an effort to reduce their regulatory burden.

The ideal scenario for the commercial launch providers would be to operate under only an FAA commercial launch license. As the federal agencies work to streamline oversight, Space Florida continues to pursue the development of the Shiloh Launch Complex as an independent launch site operating under only an FAA license. Additionally, Shiloh offers commercial operators the ability to operate under more commonly understood state and local regulations rather than sometimes unique federal regulatory requirements. This flexibility could allow commercial operators to self-perform or subcontract elements of the range services.

3.2. Operational Efficiency: Toward culture of Government “Coordination” vs. “Approval”

All Spaceport users have a common driving purpose – to serve their customers in the most operationally efficient way. The globally competitive nature of this industry forces US companies to drive great efficiency into every process. Diverse customers require different protocols and procedures due to differences in size and scope of operations.

Multiple Autonomous Flight Safety Systems are working through the certification processes to become approved solutions to provide for public safety during launch activity. As these solutions become more ubiquitous, the limitations of the current ranges, driven by the limited number of tracking and command destruct assets will become less pronounced. Today, ranges focus the required range assets on a specific launch at a specific time. This also includes some measure of pre-launch checks and range reconfigurations that take time, add costs, and limit throughput. However, the current ranges can reconfigure very quickly to accommodate user demands within 24-48 hours and the ranges are rarely causes of launch delays.

With FAA-licensed launches, the responsibility for public safety sits with the launch provider rather than the spaceport. Also, other spaceport functions such as approval for launch dates and times can transition to more of a coordinating authority function able to accommodate multiple customer needs. Operational efficiency will drive streamlined real estate processes to enable users to secure land and operational autonomy as appropriate. This streamlined access to commercial facilities for both operators and customers will enable operational efficiency and allow US providers to compete more effectively in a global launch marketplace.

3.3. Schedule Assurance: Customer Oriented Scheduling

Every launch activity requires significant orchestration of hundreds of activities from site preparations to commodity delivery to payload readiness to range and customer interfaces. The importance of schedule assurance cannot be underestimated. For the end user of a payload, an operational satellite on orbit delivers a critical mission need or profit-driven revenue stream. Any delays negatively impact the ultimate user and add costs and mission impacts. Commercial launch companies require schedule assurance to routinely meet their customer requirements. Just as airports seek to give airline customers schedule assurance for departures and arrivals, tomorrow's Spaceports will be required to do the same. Moreover, as new spaceport facilities come online and flight safety systems mature, users will be able to operate more autonomously and independently of the federal range scheduling and operational systems. Finally, customer oriented scheduling will require increased customer access to launch viewing and payload processing. The current national security and/or exploration missions of the federal ranges dictate security priorities that can conflict with the access demanded by commercial customers. As the federal agencies work to streamline that oversight, Space Florida continues to pursue the development of the Shiloh Launch Complex to provide an independent launch site with all of the benefits, especially unencumbered access, that comes from being separate from the federal ranges

3.4. Investment Confidence: Maximum Return on Investment

Many spaceport users will be investing significant private capital into their infrastructure at the Spaceport. Users will demand real estate agreements that have long terms that are 35 years or greater, provide for exclusive use, and are more comparable to the commercial marketplace. Real estate agreements that have minimal termination liabilities and more commercially friendly indemnification and liability clauses will become more common. Such agreements will facilitate increased commercial investment in space launch infrastructure. Finally, commercial users will demand increased cost transparency to ensure they are doing everything they can to control costs and deliver increased value to their customers.

4. Adapting Today's Spaceports

4.1. Space Florida's Role

4.1.1. Goals and Mission

As an independent special district of the State of Florida, Space Florida has unique financing capabilities that can significantly reduce the upfront 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 on publicly held lands. Space Florida is working with the State of Florida, NASA, the USAF, the FAA, and other important stakeholders and agencies to streamline the process of bringing space related businesses to Florida. In supporting this development, Space Florida is providing financial assistance, legislative advocacy, customer assistance and mentoring, and pre-negotiated access to launch complexes. Space Florida accomplishes this by:

- Arranging financial incentives and providing start up and relocation support
- Providing financial and business consulting on business formation, relocation and venture development

- Providing access to experienced professional workforce and retraining resources
- Developing targeted infrastructure and facility improvements
- Researching and developing opportunities that enable target industry growth

4.1.2 Capabilities

The powers of Space Florida are described in Sec. 331.305, of the Florida Statutes (Florida Legislature, 2014). These powers provide Space Florida with considerable abilities. Space Florida serves as both a spaceport authority and an economic development organization. As a Spaceport Authority, Space Florida may provide the following new infrastructure, or maintain existing facilities:

- Space Florida may own, acquire, construct, develop, create, reconstruct, equip, operate, maintain, extend, and improve launch and support facilities, including launch pads, landing areas, ranges, payload assembly buildings, payload processing facilities, laboratories, aerospace business incubators, facilities and equipment for the construction of payloads, space flight hardware, rockets, and other launch vehicles, and other spaceport facilities and aerospace-related systems. It may also provide educational, cultural, or parking facilities for aerospace related initiatives. (Sec. 331.305(11) of Florida Legislature, 2014)
- Space Florida may 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. (Sec. 331.305(12) of Florida Legislature, 2014)

As an economic development organization, Space Florida may provide the following:

- Finance and issue bonds for development:
 - Space Florida may lend money, invest, and reinvest its funds. (Sec. 331.305(6) of Florida Legislature, 2014)
 - Space Florida may issue revenue bonds, assessment bonds, or any other bonds or obligations and pay all or part of the cost of the acquisition, construction, reconstruction, extension, repair, improvement, or maintenance of any project or combination of projects. It may provide financial assistance for payloads and space flight hardware; and equipment for research, development, and educational activities, provide for any facility, service, or other activity of Space Florida. (Sec. 331.305(20) of Florida Legislature, 2014)
- Utility services:
 - Space Florida may own, acquire, construct, reconstruct, equip, and operate utility services, including electrical power, natural gas, water, wastewater, and solid waste collection and disposal. (Sec. 331.305(13) of Florida Legislature, 2014)

4.2. Partnering and Creating

Space Florida is chartered to work closely with existing federal agencies as noted in its enabling statute: “Consulting, as necessary, with the appropriate federal, state, and local authorities, including the National Aeronautics and Space Administration, the Federal Aviation Administration, the Department of Defense, the Department of Transportation, the Florida National Guard, and industry on all aspects of establishing and operating spaceport infrastructure and related facilities within the state” (Sec. 331.3051 (7)(e) of Florida Legislature, 2014).

Space Florida has also become an aggressive advocate in Washington, Tallahassee and in the marketplace for the welfare of those organizations and stakeholders in Florida. Increasingly Space Florida is championing the interests, in private or publicly, of those who seek to win market through their business and operations in Florida.

Space Florida has an active role in national and commercial space programs, specifically under the Commercial Space Launch Act (CSLA) of 1984 (US GPO, 1984), codified as amended in Chapter 509 of Title 51 of the United States Code (US GPO, 2010). It codifies the finding of the United States Congress that the participation of State governments in encouraging and facilitating private sector involvement in space-related activity, particularly through the establishment of a space transportation-related infrastructure, including launch sites, reentry sites, complementary facilities; and launch site and reentry site support facilities, is in the national interest and is of significant public benefit. For “Commercial Space Launch Activities,” the US Secretary of Transportation is authorized and directed to take actions to promote public-private partnerships involving the United States Government, State governments, and the private sector to build, expand, modernize, or operate a space launch and reentry infrastructure. The US Secretary of Transportation is further authorized and directed to facilitate and encourage the acquisition by State governments of launch or reentry property of the United States Government that is excess or otherwise not needed for public use. Heads of executive agencies, including NASA and the Department of Interior, are directed to assist the Secretary in carrying out the provisions of Title 51, Chapter 509.

Title 51 authorizes the US Department of Transportation (DOT) to issue licenses for non-governmental space activities. Such licenses include licenses to operate a launch site (spaceport), to launch vehicles into space, and for space vehicles to reenter the Earth’s atmosphere from space (US GPO, 1984; codified as amended at 51 USC sections 50901-50923 (2006)). The Secretary of Transportation delegated commercial space licensing authority to the FAA through its Office of Commercial Space Transportation, which licenses commercial launches, reentries, and the operation of spaceports (launch and reentry sites). FAA regulations implementing the CSLA are codified at 14 CFR (Code of Federal Regulations) sections 415,420,431, and 435.⁸

Since 1988, the FAA Office of Commercial Space Transportation has taken steps to simplify the licensing process for spaceport operators, with the largest effort being the completion of 14 CFR Part 420 in October 2000. Since that time, there has not been a significant modification to the regulations, despite a rapidly evolving commercial landscape for launch vehicle operators and spaceport operators. The FAA licenses the operation of non-federal launch sites or commercial spaceports in the United States, and these licenses may be renewed every five years.

The Office of Commercial Space Transportation (AST) has five divisions - the Space Transportation Division, the Licensing and Evaluation Division, the Regulations and Analysis Division, the Safety Inspection Division, and the Operations Integration Division. Through these divisions, the AST issues FAA licenses and permits for commercial launches of orbital rockets and suborbital rockets. Since 1989, AST has licensed over 200 launches.

⁸ The CSLA and its implementing regulations impose training, medical and informed consent requirements for space flight passengers and crew for this “inherently complex and dangerous activity of space travel.” Of the more than 536 individuals who have travelled into space, 18, or 3.4 percent, have died during a mission” (Silver, 2014).

NASA and DoD launches from John F. Kennedy Space Center (KSC or NASA-KSC) and the Cape Canaveral Air Force Station (CCAFS) are examples of launch facilities that do not require an FAA license because they are operated by the federal government. Some federal launch facilities, including CCAFS, are available to commercial launch providers using FAA-licensed vehicles. Zero Gravity Corporation has used NASA-KSC's Space Shuttle Landing Facility for commercial microgravity flights, and NASA-KSC may be used for commercial reusable launch vehicles (RLVs). CCAFS Launch Complex 40 has been used by SpaceX for commercial Falcon 9 launches as well as other pads at the Cape including Launch Complex 41 used by United Launch Alliance for commercial Atlas V launches.

New commercial launch sites are being developed in both coastal and inland areas and are capable of supporting a wide range of potential launch vehicles, including horizontally launched suborbital RLVs, vertical launch and vertical landing (VTVL) suborbital vehicles, and other launch vehicle systems, both expendable and reusable. Some of the new launch vehicle systems are being developed to require only aviation type facilities utilizing airport infrastructure, such as runways and hangars, and standard aviation departure and arrival procedures.

The regulations, as currently written, do not always closely align with the new types of commercial launch systems. Commercial stakeholders have expressed a desire to adjust the regulatory regime of launch site licensing to more closely align with current conditions and enable a more flexible licensing approach.

For those Florida commercial operators that require increased access and independence from the federal partners, a new and independent launch site must be created. The proposed Shiloh Launch Complex offers the only other place in Florida for vertical launch operations to meet FAA launch safety requirements and offers the independence to enable new commercial growth potential.

4.3. [Toward a new Spaceport: Creating Shiloh](#)

Space Florida intends to support the construction and operation of the Shiloh Launch Complex which would include up to two vertical launch facilities and associated space vehicle processing, launch, and recovery operations on up to 200 acres of presently undeveloped, but previously disturbed land in the general vicinity of a former citrus community known as Shiloh (see Figure 4). The proposed property is under the control of NASA within the boundaries of KSC. The Shiloh Launch Complex falls within the approximately 140,000 acres of the Merritt Island National Wildlife Refuge (MINWR). Space Florida is proposing the Shiloh Launch Complex be separate and apart from the existing government launch facilities at NASA-KSC, CCAFS, and the USAF Eastern Range. The development of the Shiloh Launch Complex is consistent with Space Florida's statutory roles and responsibilities as outlined in Chapter 331 Part II Florida Statutes (Florida Legislature, 2014).

The proposed Shiloh Launch Complex would:

- serve the commercial market for space transportation services to promote commercial space and enable private sector science and exploration missions;
- reduce the likelihood of more commercial launch activity leaving Florida; and

- improve Florida’s attractiveness to the existing and evolving commercial space transportation industry, resulting in new economic development opportunities, high-tech job creation, and mitigation of the negative economic impacts on Florida from the reduction of Federal space program activities.

Space Florida solicited the commercial launch industry for the following Shiloh Launch Complex recommendations:

- not co-located within a Federal range and allows unhindered access to the property for primary use by commercial operators;
- allows scheduling flexibility to offer high probability of meeting commercial customer launch requirements and avoids scheduling conflicts with government launches;
- offers continuity of processing operations which is not impacted by the operations of any neighboring launch facilities;
- located in an area of low population density in order to comply with 14 CFR §420;
- at least 40 acres within a secure fence line;
- allows the capability of landing stages of vehicles back at the launch site from which it was launched;
- accommodate up to 12 launches/landings per year and associated pre-launch operations, such as static fire engine tests and wet dress rehearsals; and
- easily accessible for delivery of hardware and commodities (e.g., vehicle stages, fuel tanks, and payloads).



Figure 4: Proposed Shiloh Launch Complex

4.4. Florida’s Space Transportation Infrastructure and Vision

4.4.1. Florida Spaceport System Plan

Florida is unique in that it has legislation that specifies areas where spaceport activity can occur. Designated as “spaceport territories,” section 331.305, Florida Statutes (Florida Legislature, 2014), enables Space Florida to “own, acquire, construct, reconstruct, equip, operate, maintain, extend, or improve transportation facilities appropriate to meet the transportation requirements of Space Florida and activities conducted within spaceport territory.” Currently, there are four spaceport territories in Florida⁹:

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

Two of these spaceport territories are active spaceports that have been licensed by the FAA: the Cape Canaveral Spaceport and Cecil Spaceport. Cape Canaveral Spaceport includes facilities from both CCAFS and NASA-KSC and currently has three active orbital launch complexes, two inactive orbital launch complexes and two active runways for horizontal takeoffs and landings.¹⁰ Cecil Spaceport was licensed in 2010 and has suborbital horizontal launch capabilities (see Florida Spaceport System Vision 2013-2023 in Figure 5 and capabilities in Table 1).

Table 1: Florida Spaceport Capabilities

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

⁹ Title XXV, Chapter 331, Part I, 331.304, Florida Statutes (Legislature, 2014)

¹⁰ It should be noted that Florida’s Strategic Intermodal System includes all facilities at Cape Canaveral Spaceport, but currently only Space Florida’s SLC 46 there has an active FAA/AST Launch Site Operator’s License.

4.4.2. The Cape Canaveral Spaceport Complex Master Plan

Section 331.360(3) of the Florida Statutes requires Space Florida to “develop a spaceport master plan for the expansion and modernization of space transportation facilities within spaceport territories... The plan shall contain recommended projects to meet current and future commercial, national, and state space transportation requirements” (Florida Legislature, 2014). This Master Plan provides information and analysis to guide Space Florida in its efforts to face the market, grow the space industry, and attract commercial space, technology, and life science related businesses through expansion and modernization of facilities infrastructure at the Cape Canaveral Spaceport (CCS). In fact, over the last 10 years, Florida has invested over \$500 million in financing and infrastructure at the Cape Canaveral Spaceport in support of commercial, national and state space transportation requirements (see Figure 6 for investment locations in CCS).

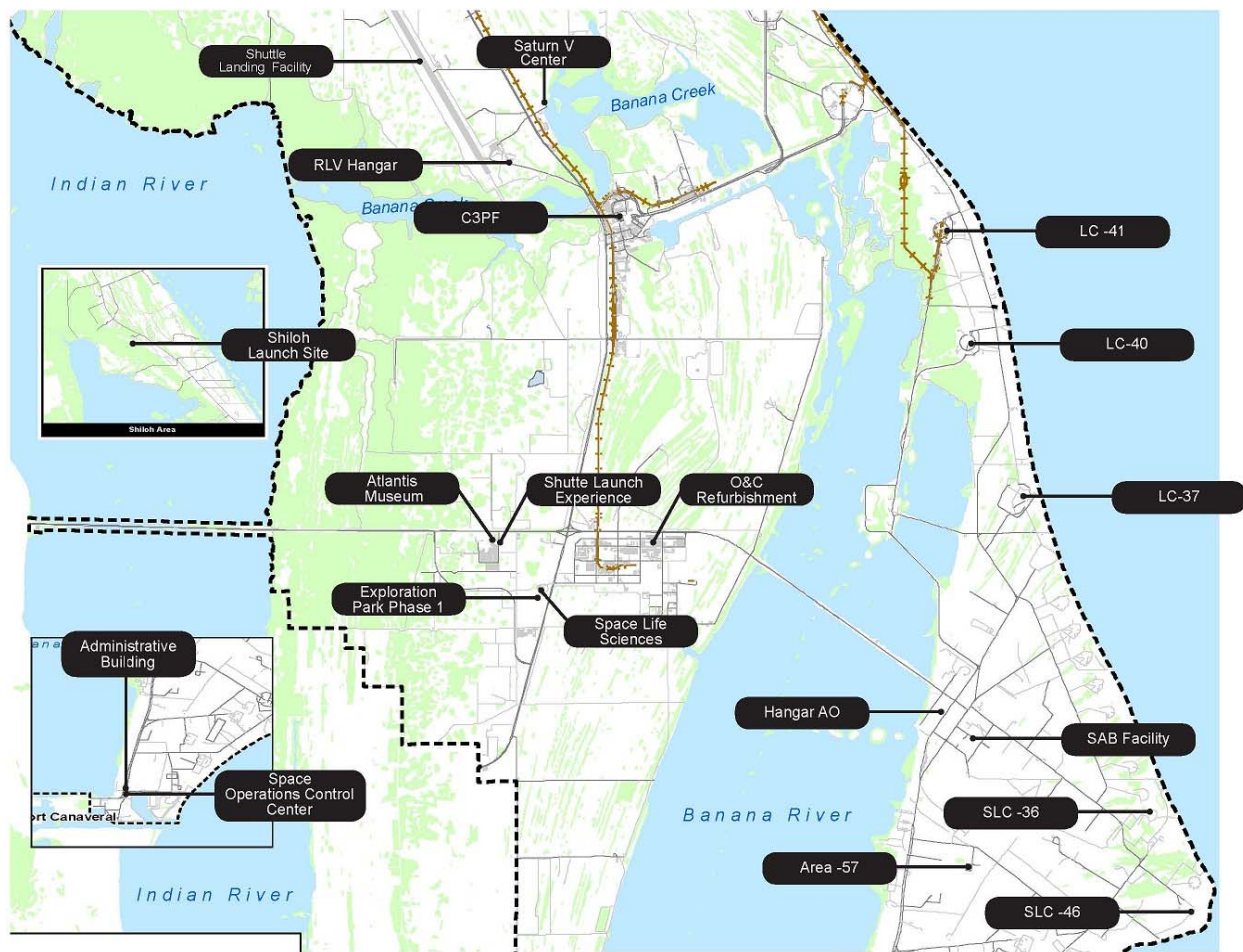


Figure 6: Cape Canaveral Spaceport facility investments by the State of Florida

Section 331.360 Florida Statutes directs the Florida Department of Transportation (FDOT) to promote the further development and improvement of aerospace transportation facilities (Florida Legislature, 2014). Within FDOT, spaceport activities and programs are handled by multiple offices. The Aviation and Spaceports Office has been assigned the lead responsibility for FDOT spaceport related issues. FDOT district offices are responsible for administering infrastructure

grant agreements with Space Florida. FDOT is working with Space Florida to create a process for funding and for identifying project requirements. Similar to the FAA, the FDOT has a number of guidelines and regulations with respect to master plans.

The CCS Master Plan has been developed in accordance with the tenets of Federal Aviation Administration (FAA) Advisory Circulars 150/5070-6B Airport Master Plans and Section 331.360 of the Florida Statutes. Space Florida has set the following two major goals for this Master Plan:

Goal One: Create a Spaceport that provides a positive economic benefit to the People of Florida.

Goal Two: Ensure responsible environmental stewardship and an efficient, safe, and secure transportation system at the Spaceport.

The Space Florida master plan lists projects that will benefit from state infrastructure investment to “meet current and future commercial, national, and state space transportation requirements” (Sec. 331.360 of Florida Legislature, 2014). Space Florida has identified the following five infrastructure investment areas: advance commercial heavy lift, support commercial crew and cargo, attract new and emerging space systems, expand horizontal launch and landing capacity, and expand space launch capacity statewide.

4.5. Existing Spaceport Facilities and Infrastructure

While the term “spaceport” is not defined in federal law, the State of Florida has defined “spaceport” in the Space Florida Act to mean:

[a]ny area of land or water, or any manmade object or facility located therein, developed by Space Florida under this Act, which area 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 (Sec. 331.303(17) of Florida Legislature, 2014).

Spaceports are sites dedicated to launching orbital or suborbital vehicles into space. These sites often provide the capability to integrate launch vehicle components, to integrate vehicles with payloads, to fuel and maintain vehicles, and to launch vehicles. From the spaceport, an orbital launch vehicle travels over an area called the launch range, which typically includes tracking and telemetry assets. These range assets monitor the vehicle’s performance until it safely delivers a payload into orbit or returns to Earth. Tracking and telemetry assets may also facilitate recovery of reusable stages. There will also be payload processing and integration facilities, control centers, and additional facilities for participants, visitors and crew.

Florida is geographically situated in a near perfect launch location for space missions requiring access to either equatorial or inclined orbits up to 60 degrees (North or South). In addition,

several billion dollars' worth of launch infrastructure already in place makes Florida a leader in military and civil launch operations and affords entry into a burgeoning commercial market.

The CCS primarily consists of NASA-KSC and CCAFS, as geographically defined by section 331.304 of the Florida Statutes (Florida Legislature, 2014). NASA-KSC occupies approximately 140,000 acres, while CCAFS occupies approximately 17,420 acres, for a total spaceport area of approximately 157,420 acres. The large footprint of this area and relative geographic isolation has allowed for spaceflight operations to occur with minimal risk to public safety.

CCAFS is operated by the US Air Force 45th Space Wing and conducts launch operations and provides range support for military, civil, and commercial launches. NASA-KSC has served as NASA's launch site for human spaceflight. With the legacy of NASA and the USAF, the CCS offers many benefits to the emerging commercial aerospace industry. Its experienced local talent, innovative workforce, mature industrial base and suppliers make the CCS an ideal place for operations.

More than just operations, the Cape has become the hub for human spaceflight transportation development. Both the Lockheed (NASA) Orion Multi-Purpose Crew Vehicle and the Boeing CST-100 Commercial Crew Transportation System have chosen to do final assembly and test operations at the CCS. Space Florida has played a central role in securing those facilities for development and eventual operations. The SpaceX Dragon crew vehicle also will fly from the CCS. Moreover, Space Florida has partnered with commercial launch providers and operators to provide infrastructure funding, and secure and finance upgrades to existing launch and related facilities at CCS. Both NASA-KSC and CCAFS provide a number of existing facilities that can and have accommodated the commercial market. Space Florida is assisting industry in obtaining usage agreements for repurposing these excess facilities. Figure 6 (above) provides an inventory of major mission related facilities located within or near the spaceport and summarizes investments.

Space Florida has received a Real Property License to Launch Complexes 36 and 46 from the USAF at CCAFS and obtained an FAA Launch Site Operator's License for Launch Complex 46. Space Florida is upgrading the launch pads and ancillary facilities to restore operational capability to support civil, commercial, and military launch capabilities.

In the summer of 2013, NASA selected Space Florida to maintain and operate the Shuttle Landing Facility (SLF) at NASA-KSC. This historic 15,000 ft. long, 300 ft. wide launch and landing strip hosted 78 Space Shuttle landings over the last 30 years and provides a unique resource for growing commercial aerospace businesses that may have interest in operating from Florida. Space Florida will repurpose the SLF into a multi-use spaceport facility.

Space Florida is repurposing the Space Life Sciences Laboratory (SLSL) for commercial payload market demand. The intent is to transition the SLSL from a single purpose facility formerly leased by NASA to a multi-purpose multi-tenant facility, providing full-service capabilities to meet the broad commercial user demand for payload preparation and support to the International Space Station (ISS) National Laboratory and its future development.

Space Florida is transforming the former Orbital Processing Facility 3 (OPF3) at NASA-KSC into a fully modernized aerospace facility that is poised to meet the demands of a growing commercial space sector. Space Florida has secured full long-term rights from NASA-KSC to operate, maintain, and improve the OPF3 and transition the facility to the Commercial Crew and Cargo Processing Facility (C3PF) under purely commercial standards and make it available to commercial tenants. The C3PF has direct access to the SLF and close proximity to all Space Florida, NASA and Air Force launch pads located at NASA-KSC and CCAFS.

4.6. Strategy for Spaceport Commercial Operations

4.6.1. FAA role in future commercial spaceports

The Commercial Space Transportation Advisory Committee (COMSTAC) Space Transportations Operations Working Group (STOWG) commissioned a subgroup to make recommendations for the future structure and role of the FAA in licensing spaceports (COMSTAC, 2012). The White Paper “Commercial Spaceport Licensing Review and Recommendations” shared a consensus that “the licensing process, costs and time to complete outlined by current regulations only fit one scenario very well: orbital launch vehicles from dedicated launch ranges. For all other launch vehicles and/or spaceport scenarios, the regulations and licensing process lack the definitions, decision trees and modules to address the relevant dimensions required for each case. Thus, the derived costs and times are less than optimal and reflect over-regulation, under-regulation and/or lack of regulatory accuracy and relevance.” (p.2, COMSTAC, 2012). The white paper’s recommended next steps included approaches to amend the current regulations with an Appendix or modify Part 420 to be modular with flexible regulations related to specific vehicle types. Regardless of the regulatory changes underway, the FAA will continue to be actively involved in future commercial spaceports throughout the US.

4.6.2. Space Florida Strategy and Strategic Priorities 2014 – 2016

Space Florida’s strategic vision for the next two years (2014-2016) focuses on target markets and their value proposition in the space industry with respect to the strategic properties of the state, which as previously stated include industry growth and Florida market share. The strategic elements can be subdivided into four roles: Spaceport authority, Spaceport development; economic development; and technology development for education and the workforce (see Appendix A for details).

5. Summary

As we have discussed, some of the necessary conditions for a successful multi-user spaceport include the ability to provide:

- **Regulatory Confidence:** Users need maximum commercial flexibility with minimum regulatory duplication to enable many different customers to accomplish their objectives in an efficient, market-responsive manner
- **Operational Efficiency:** Users require a central *coordinating* authority rather than a central *approval* authority, thereby allowing all customers the most efficient use of spaceport resources.

- Schedule Assurance: All users of the spaceport require schedule assurance to routinely meet their customer requirements. This condition enables users to aggressively compete to meet the end user demands.
- Investment Confidence: structure real estate agreements for customer infrastructure needs to enable maximum return on investment, such as long lease terms, exclusive use, and minimal termination liabilities.

All of these factors will directly impact the eventual end user and potential customer. These conditions will allow a spaceport to address a diverse multi-modal transportation portfolio with multiple regulation regimes for airspace and land use, and unique funding profiles. These elements are necessary to enable a future market-facing commercial spaceport. The greater the degree to which these elements are provided for all users, the greater the probability the spaceport can contribute to a satisfied customer base and the eventual growth of the spaceport.

6. References

- Buchen, E. (2014): “SpaceWorks’ 2014 Nano/Microsatellite Market Assessment.” SpaceWorks Enterprises, Inc. Available Online: http://www.sei.aero/eng/papers/uploads/archive/Small%20Sat%20Paper_SSC14-I-3.pdf
- COMSTAC (2012): “Commercial Spaceport Licensing Review and Recommendations White Paper”. Commercial Space Transportation Advisory Committee (COMSTAC), Space Transportations Operations Working Group. Available Online: https://www.faa.gov/about/office_org/headquarters_offices/ast/advisory_committee/meeting_news/media/2012/oct/Spaceport_Licensing_White_Paper_Final.pdf
- Federal Aviation Administration (FAA, 2013): “Commercial Space Transportation: 2013 Year in Review.” Available online: http://www.faa.gov/about/office_org/headquarters_offices/ast/media/FAA_YIR_2013_02-07-2014.pdf
- Florida Legislature (2014): “The 2014 Florida Statutes, Chapter 331 Part II Space Florida”. Available Online: http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&URL=0300-0399/0331/0331.html
- NewSpace Global: “2014 SmallSat Report.” Available Online: www.newspaceglobal.com
- Silver, J. (2014): “Houston, We Have A (Liability) Problem.” 112 Michigan Law Review 833,834. Available Online: <http://www.michiganlawreview.org/assets/pdfs/112/5/Silver.pdf>
- Snow, A., Buchen, E., and Olds, J.R. (17 July 2014): “Global Launch Vehicle Market Assessment: A Study of Launch Services for Nano/Microsatellite in 2013” (Presentation). SpaceWorks Enterprises, Inc. Available Online: http://www.sei.aero/eng/papers/uploads/archive/2013_Global_Launch_Vehicle_Market_Assessment_July2014.pdf
- Space Florida (2013): “Cape Canaveral Spaceport Complex Master Plan 2013”. Available Online: <http://spaceflorida.gov>
- Space Foundation (2013): “The Space Report 2014: The Authoritative Guide to Global Space-Activity.” Available online:

http://www.spacefoundation.org/sites/default/files/downloads/The_Space_Report_2013_overview.pdf

- U.S. Government Printing Office (1984): “Commercial Space Launch Act.” Public Law No. 98-575, section 3, 98 Stat. 3055. Available online:
<http://www.gpo.gov/fdsys/pkg/STATUTE-98/pdf/STATUTE-98-Pg3055.pdf>
- U.S. Government Printing Office (2010): “United States Code, 2006 Edition, Supplement 5, Title 51 - NATIONAL AND COMMERCIAL SPACE PROGRAMS.” Available online:
<http://uscode.house.gov/view.xhtml?path=/prelim@title51/subtitle5/chapter509&edition=prelim> or <http://www.gpo.gov/fdsys/granule/USCODE-2011-title51/USCODE-2011-title51-subtitleV-chap509/content-detail.html>

Appendix A: Space Florida’s 2014-2016 Strategic Vision

Spaceport Authority Role

- Space & Spaceport Policy (Federal & State)
 - Develop statewide policy and standards for spaceport territory, spaceport operations, liability and safety
- Federal & State Agency & Organization Coordination
 - Airspace management & Next Generation system requirements
 - Florida Unmanned Aerial Systems coordination
 - Adapt air space management, planning & coordination
 - Components & Responsibilities
 - Flight planning, coordination & Airspace management
 - Safety & environmental
 - Facilities Ops & Management / IDIQ
- Range & Operational Safety
 - Range & Weather Safety Analysis --Applied Meteorology Unit Weather Capability
 - Autonomous Flight Safety System development/implementation
 - Minimal infrastructure – range assets
 - Define & validate range instrumentation requirements
 - Work from USAF Launch Enterprise Transformation Concept
 - State wide emergency operation protocols
- Emergency Response
 - State Emergency Response Commission /Local Emergency Planning Committees including state wide emergency response
- Instrumentation (Commercial Range)
 - Mobile range development, implementation, operations & maintenance
 - “Lean, mean & flexible staffing”
 - Functional Alignment & Leverage across UAS, Horizontal, & Vertical Launch Business Lines
- State-wide Spaceport System Plan

- Adopt a long-range consensus and plan for evolution of an independent Cape Canaveral Spaceport.
- Ensure space is an integral part of state transportation planning.
- Integrate state and private sector capital formation into the plan for future spaceport infrastructure.
- Intermodal system integration / Integrated spaceport plan
- Spaceport system Infrastructure process / prioritization
 - Standardized process including Return on Investment
- Market analysis to drive investment in growth enabling infrastructure

Spaceport Development Role

- Secure & upgrade key NASA/AF infrastructure for future operations and support with a focus on commercial.
- Achieve near-term creation of a responsive commercial vertical and horizontal launch capability.

Economic Development Role

- Develop financing capabilities and tools required to support statewide aerospace economic development efforts.
- Build a reliable network of financing institutions and trading partners to support investment and debt syndication for deal opportunities.
- Develop proficiency and market confidence in Florida's use of tools to support economic development efforts.
- Ensure consistency of state commitment and funding to support ongoing "viability and credibility" of state (Space Florida) as a financing partner.

Technology Development/Education/Workforce

- Support demonstrations of technology to enable market growth (Centers of Excellence).
- Grow depth and breadth of the aerospace supply chain.
- Facilitate innovation growth and capital formation with a focus on small and medium-sized enterprises (SMEs).
- Facilitate advanced space/aerospace curriculum development/tools.