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Paper Session III-C - Spaceport Florida and Other State-Sponsored Space Development Initiatives in Florida

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"Spaceport Florida" and Other State-Sponsored Space Development Initiatives in Florida

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NOTES

Dr. Shove will speak primarily regarding the development of Spaceport Florida. Spaceport Florida is the major recommendation of the Florida Governor's Commission on Space, which presented its findings to Governor Bob Martinez in July 1988. The Spaceport Florida Feasibility Analysis was conducted by United Engineers & Constructors, a Raytheon Company, under the direction of: Ralph Christie, Jr., P.E., Project Manager, Space Programs, P.O. Box 5888, Denver, CO 80217; 303/758-1122. A copy of the Executive Summary of the final report is included in the Space Congress Proceedings. Copies of the complete report, over 700 pages in length, are available from Dr. Shove at the address shown above. Copies of the final report of the Florida Governor's Commission on Space are available from: Robert Allen, Chairman, Florida Space Business Roundtable, Inc., P.O. Box 21311, Kennedy Space Center, FL 32815-0311; 407/269-3221.
SUMMARY OF FINDINGS

- Three technically feasible launch sites:
  - Cape San Blas (Gulf County) - suborbital only
  - Shiloh (north of Kennedy Space Center) - orbital
  - Cape Canaveral Air Force Station (CCAFS) inactive pads - orbital

- Launch services market evaluation:
  - Modest medium vehicle market
  - Evidence of small-vehicle market
  - Active sounding rocket market
  - Current capacity "crunch" at CCAFS
  - Competition from existing and planned launch centers

- Candidate launch center concepts
  - Initial focus on existing vehicles
  - Sounding rocket pad area
  - Small-class multi-vehicle pad (< 2,000 lbs to Low Earth Orbit)
  - Medium-class multi-vehicle pad (< 7,000 lbs to Geo-Transfer Orbit)
  - Use "building block" phased implementation to reduce risk
  - Provide services and facilities analogous to an Airport Authority

- Complementary opportunities to enhance spaceport and the state, including:
  - Space Business Incubator, to nurture start-up space-related businesses
  - Space tourism opportunities include an Analog Moon Base, live launch viewing and a space museum.
  - Encourage educational/industry synergy

- Initial implementation phase
  - Cape San Blas: 9-12 mos
  - Shiloh/CCAFS:
    - Sm.-vehicle pad: ~ 2 yrs
    - Sm. & med.-vehicle pads: ~ 3 yrs

- Phase I Capital Cost ($Millions)
  - Cape San Blas: $0.2
  - Shiloh/CCAFS:
    - Sm.-vehicle pad: $8-19
    - Sm. & med.-vehicle pads: $42-58

- Financial feasibility and benefits
  - Launch services revenues could recover all or majority of operating costs with modest market share
  - Other benefits — complementary facility revenues, employment, increased tax base, commercial space spinoffs, enhanced industry/education bond

- Next steps
  - Establish Spaceport Authority by general law
  - Pursue sounding rocket program at Cape San Blas
  - Market the incubator and tourism concepts
  - Initiate pre-development activities for Shiloh and CCAFS sites:
    - Initiate market plan
    - Commission environmental studies and preliminary engineering
    - Discussions with USAF, NASA, for facility and land usage
    - Pursue potential funding sources
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STUDY TEAM

LEAD: United Engineers and Constructors Inc.
      Stearns-Roger Division

TEAMMATES:

Baker & Hostetler, Counsellors at Law                      Legal Services

General Dynamics Services Company                       Commercial Launch Services

Leroy F. Nichalson Consulting                             Advanced Launch Operations

Martin Marietta Commercial Titan, Inc.                   Commercial Launch Operations

McDonnell Douglas Astronautics                            Commercial Launch Operations

Post, Buckley, Schuh & Jernigan                           Environmental Services

Prudential-Bache Capital Funding                         Financial Services

Space Services Inc. of America                           Commercial Launch Services

HI-TEC Associates, Inc.                                   Complementary Facilities Support

Raytheon Service Company and                             Radar Tracking, Telemetry,
Advanced Systems Development Corp.                      Command/Destruct Support
Background

National Space Policy

In 1984, President Reagan issued Executive Order 12465, entitled "Commercial Expendable Launch Vehicle (ELV) Activities", "...encouraging and facilitating commercial ELV activities by the United States private sector." Soon after, Congress enacted the Commercial Space Launch Act of 1984, signifying the government's endorsement of a U.S. commercial ELV industry. This legislation, coupled with the President's 1988 National Space Policy, has created an arena which abounds with new opportunities.

Florida is poised to become a national and international leader in this emerging commercial space market. Already established as the nation's premier launch site, the State of Florida undertook studies to investigate these exciting new possibilities. The Florida Governor's Commission on Space, working in conjunction with the Florida Department of Commerce, has prepared studies and reports exploring ways that the state might foster growth of its space-related industries.

As a portion of this continuing process, in July 1988, the Florida Department of Commerce awarded the "Spaceport Florida Feasibility Study" to United Engineers & Constructors Inc., Stearns-Roger Division (UE&C), and its ten teammates.

Scope of Work

UE&C and the study team began a comprehensive assessment of the operational, economic and financial feasibility of a commercial spaceport located in the State of Florida. The project included assessment of complementary space-related opportunities and preparation of a blue-print Business Plan to take Spaceport Florida from a concept to commercial reality.

This Executive Summary gives a broad overview of the issues, methods and findings which are contained in the extensive three-part report. The report is the result of thousands of hours of research and analysis by the study team, in cooperation with a broad spectrum of experts from private industry, government, education and the military.

Why Florida?

The state is uniquely positioned, with a number of key attributes which make Florida advantageous as a spaceport location. Some of these attractive characteristics are—

- Location of Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS)
Considerable space infrastructure already in-place
- Support facilities available
- Significant existing infrastructure (rail, highway, air and water transportation; propellant and industrial reagent plants)
- Space-related professional talent pool
- Sunbelt location with attractive weather and beaches
- Florida's entrepreneurial and supportive business environment
- Low 5.5 percent corporate income tax
- Fewer business taxes than most states
- 3,600 people joining the workforce each week

No personal income tax
- A significant educational system and a competitive research and development infrastructure that is working together
- Hundreds of innovative, established high-technology employers
- Florida is the number one high-technology industry state in the south-east.
- Moderate cost of living

THE FEASIBILITY ANALYSIS

Site Selection

The site selection process employed is illustrated in Figure 1. This screening process was broken into two parts: "MUST" and "WANT" criteria. Throughout the site

![Figure 1](image-url)
evaluation process, safety and environmental sensitivity were the primary benchmarks. Beginning with the entire state, potential sites were narrowed after evaluation of population density, environmental, launch safety, and infrastructure issues.

After an extensive investigation of these criteria, two alternate orbital launch sites were identified: Shiloh (immediately north of Kennedy Space Center in northern Brevard and southern Volusia counties), and the currently inactive Pads 14, 15 and 16 at Cape Canaveral Air Force Station (CCAFS). A third site on Cape San Blas (in Gulf County) was identified as a potential location for suborbital (sounding rocket) launches. These sites are shown in Figures 2 and 3.

**Site Features**

**Shiloh and CCAFS**
- Utilization of existing space/support infrastructure
- KSC shuttle landing strip and CCAFS skid strip
- Deep water ports
- Airports
- Railroads/highways
- Acceptable location for equatorial markets
- Proximity of Foreign Trade Zones (particularly important considering the large market for international satellites)
- Restricted air space established
- Space-related professional talent pool
- Positive industrial park development climate, with a focus on space-related businesses

**Cape San Blas**
- Safety, zone, tracking, and allocated launch area in existence.

**Market Evaluation**

In order to create a commercially viable enterprise, it is necessary to have an understanding of the marketplace which it will serve. Spaceport Florida's market "products" will be launch services, and the required infrastructure associated with space vehicle launches. In addition to these "products", the feasibility study identified areas of opportunity which could directly complement the Spaceport Florida operations.

*Figure 2*
Executive Summary

Launch Services

The study team evaluated the physical size, pad requirements, operations, and projected markets of launch vehicles which are currently in use, as well as selected vehicles now in the development stage. It was concluded that Spaceport Florida should initially serve existing suborbital through medium-class vehicles (up to 7,000 lbs. to Geo-Transfer Orbit, GTO), with the potential for expansion to larger vehicles when (and if) the demand warrants.

Most Western World market watchers are forecasting 15 to 20 satellite launches per year on medium- to large-class vehicles through the mid-1990's. Arianespace (the European Space Agency's commercial launch organization) predicts somewhat higher rates—20 to 28 launches per year.

The small orbital launch market (payloads weighing less than 2,000 pounds delivered to LEO) is not as well defined, but there appears to be a growing interest in this market. Estimates range from ten to 40 domestic launches per year through the mid-1990's. International sounding rocket launch requirements are projected to be between 70 and 100 per year during the same period.

Theoretically, sufficient world launch capacity now exists for medium- to large-class satellites. From a practical standpoint, however, domestic commercial payloads have recently been trapped in a Defense Department facility “crunch” at government launch sites. If the State of Florida moves quickly, it may be able to use this “crunch” to Spaceport Florida’s advantage to negotiate agreements with commercial launchers—before they commit to other
launch sites or building their own launch facilities.

Certainly, there will be competition for these launches from existing launch centers (such as the European Space Agency launch facility in French Guiana, and the Peoples Republic of China). Several other launch centers, including Hawaii and Australia, are under consideration.

Spaceport Florida could capture a share of this market in the near-term by providing a package of market motivators, including price, schedule, operational reliability, and logistical convenience. The market share captured by Spaceport Florida will be highly dependent on the marketing plan and strategy implemented. Some of the potential target markets include—

- Satellite communications
- Space scientific experiments
- In-space materials processing
- Space-based industrial facilities (including the Space Station program)
- Defense and other government missions

**Launch Center Concept**

Based on review of the marketplace and the requirements of existing, as well as planned launch vehicles, the study team concluded that Spaceport Florida should initially focus on the following launch vehicle classes:

- Suborbital (sounding rockets)
- Small-class vehicles (up to 2,000 pounds to Low Earth Orbit, LEO)
- Medium-class vehicles (up to 7,000 pounds to GTO)

Spaceport Florida should initially focus on servicing existing launch vehicles, considering that development of new vehicles can take several years.

One of the Spaceport’s critical functions in competing for the commercial launch services market will be to provide cost-effective operations. Multi-vehicle launch capability is proposed to achieve this competitiveness. Each pad will be able to accommodate a variety of launch vehicles, reducing the overall capital and operating cost requirements from those of conventional single-vehicle pads. This operational approach is a change from current U.S. practice, but many industry experts believe it is achievable.

Offshore launch platforms (essentially modified oil rigs) were evaluated at both CCAFS and Shiloh. The study concluded that this approach is too costly in the short-run to service the anticipated market.

**Small Vehicle Pad**

Small vehicle pads, which will service suborbital and small LEO vehicles, will require a minimum of construction. The vehicles served do not require exhaust ducts, so the pad will consist of a flat concrete slab with utilities. The vehicle-specific launch
mounts will include flame deflectors, as re­quired, and will be supplied by the com­mercial user. Core vehicle assembly and payload encapsulation will be performed off-site. Since these vehicles will probably be propelled by solid rocket motors, liquid propellant storage and handling systems will not be required. Major support installations will include a launch control center, tracking and telemetry capabilities.

Medium Vehicle Pad

Medium-vehicle pads will service a variety of vehicles which deliver payloads to LEO and GTO orbits. Because most vehicles in this class require on-pad integration of boosters, core vehicle and payload, a mobile service tower (MST) with a payload cleanroom will be required. The MST will contain movable and adjustable platforms with inserts to fit around specific vehicles, and will function as a gantry crane during assembly operations. The ground-level launch deck will have a below-grade exhaust duct.

An umbilical tower will be required to provide fueling and electrical connections. Other major installations required are a launch control center, tracking and telemetry capabilities, and liquid propellant storage tanks.

Sounding Rocket Site ..

The Cape San Blas sounding rocket area will require minimal new permanent facilities such as an allocated “safe area” with a small concrete pad and utilities.

Launch Concepts

Cape Canaveral Air Force Station

Launch Complex 15 (LC-15) was chosen as the primary Spaceport Florida launch site at CCAFS. Initially, the small- and/or medium-vehicle pad could be located on LC-15. As launch rates increase, LC-14 and LC-16 would be used as expansion sites.

The use of inactive pads on CCAFS would eliminate the purchase of large tracts of land to establish a controlled Spaceport Florida area. The Spaceport would need to control only the launch site itself. Many existing support facilities, such as vehicle assembly buildings, hazardous operations, tracking, and the like, could be shared with NASA and the Air Force.

A perspective view of the medium-class multi-vehicle pad concept envisioned for the CCAFS site is shown in Figure 4.

![Figure 4](image-url)
Shiloh

The preliminary Shiloh site arrangement provides a small vehicle pad, a multi-vehicle pad, and an area to accommodate planned expansion for additional pads. Permanent facilities which serve all launch pads, like the launch control center, will be located away from the launch pads. Launch operations and security could be better tailored to commercial needs at Shiloh than at CCAFS. An area for the development of private industrial facilities is available to the north and west of the site.

This site's proximity to KSC could allow the use of the existing Space Shuttle landing strip at KSC for the support of "fly-back" vehicles like the proposed Space Van, if deemed appropriate.

A perspective view of the medium-vehicle pad concept proposed for the Shiloh site is shown in Figure 5.

Complementary Opportunities

The study team evaluated complementary space-related activities with the potential to provide economic development and other benefits to the state. Based on numerous discussions with industry professionals, the study team concluded that there are three specific areas of opportunity: space-related tourism, a Space Business Incubator, and fostering educational involvement in Spaceport Florida.

Space-related Tourism

Tourism is Florida's largest industry, and space tourism could be a major stimulus and integral portion of the overall tourism infrastructure. Existing space-related tourist attractions capture a small share of the total tourist market. There is certainly significant potential for market growth with space-related attractions.

The space-related tourist attractions identified by the study team are—

- A Space Experience Attraction (see Figure 6), including
  - An Analog Moon Base (a working training/experimental center incorporating educational and amusement facilities) See Figure 7.
  - An Information Retrieval Center (a commercial satellite data retrieval and analysis center with public displays and demonstrations)
A Commercial Applications Pavilion (an exhibit which highlights the benefits derived from space activities)

Launch Activities, including

- Live viewing of Spaceport Florida launch operations
- A Model Rocket Park adjacent to the Spaceport (for amateur model rocket launches and education)
- A Space Museum (coordinated in conjunction with the U.S. Air Force Space Museum at CCAFS)

Space Business Incubator

Business incubators provide an opportunity for small, startup businesses to be nurtured into "going concerns". The State of Florida already has the largest number of Small Business Development Centers in the nation, fostering the growth of hundreds of new businesses. The state has an active referral and support network for entrepreneurs and investors...

Based on this impressive track record, a Space Business Incubator, located near Spaceport Florida, could provide specific support and encouragement for companies...
that might eventually become Spaceport customers, suppliers or service providers. The concept of the Space Business Incubator is shown in Figure 8.

A brief review of the market for a Space Business Incubator suggests that there is more than sufficient interest in this kind of facility to justify its creation. A Space Business Incubator program could even be successfully initiated as a stand-alone program.

**Educational Involvement**

The Governor's Commission on Space has indicated that Florida must strengthen its educational system to meet the current and future demands of the space industry. The entire Spaceport Florida scenario will stimulate the state's academic institutions at all levels.

Spaceport activities will encourage participation in joint research and experimental
programs, as well as development of specialized educational programs to meet industry's demand for qualified personnel. The Space Business Incubator will probably include companies which will rely on universities to carry out contract research and development. Even the space-related tourist attractions will emphasize education about space and its technological advancements.

While it is difficult to quantify the educational opportunities and benefits of Spaceport Florida, the synergy created by such a project should have state-wide (as well as national and even international) positive effects on the education system.

Organizational Structure and Strategy

A "Spaceport Authority" is recommended as the appropriate legal structure to provide leadership and coordination of Spaceport Florida's development. Such an Authority would be established by general law. A recommended organizational structure and some potential responsibilities for
the Spaceport Authority are shown in Figure 9. Because the activities shown are interrelated, the Authority could serve as the focal point to create synergy among business and industry, the Space Business Incubator, space tourism, the educational community and the commercial launch facilities. This synergy is illustrated in Figure 10.

An appropriate role for the Spaceport Authority is to act as a facilitator and provider of the necessary site infrastructure to develop Spaceport Florida. The Authority must take the lead in obtaining the necessary environmental permits, and assembling the land required to meet current and future market needs.
The Authority’s management and operational approach could be very similar to an Airport Authority. For instance, at an airport, the Authority attracts airline companies to its facilities by providing the general services and infrastructure required—an airline company does not build runways and terminal buildings. Similarly, the Spaceport Authority would provide launch pads, and operations support buildings. (See Figure 11).

Although airline operations face different technical and managerial constraints than would a space launch operation, the analogy holds for many services and facilities. The Spaceport Authority must develop a commercial relationship with the launchers very much like an airport arrangement. In both cases, the private sector can be relied on to assist in building many of the required support facilities (for instance, hotels for airports, and payload processing facilities for a Spaceport).

**Phased Development Approach**

The development of an orbital launch center at either Shiloh or CCAFS should be phased. The Spaceport Authority should implement a “building block” approach, with the extent of development dependent on prevailing market potential, funding availability and technology changes. Two

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**Figure 11**

<table>
<thead>
<tr>
<th>AIRPORT AUTHORITY</th>
<th>SPACEPORT AUTHORITY</th>
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<tr>
<td>Runway</td>
<td>Launch Pad</td>
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<td>Control Tower</td>
<td>Launch Control Center</td>
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<td>Operations Support Building</td>
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options for such a phased development strategy are illustrated in Figure 12, and could be used for either the CCAFS or Shiloh site. The first option illustrates the response to a moderate, but growing demand for launch services, starting with small vehicles. The second option would satisfy an initial demand for both small- and medium-class launch services.

Relative timetables for development of the two orbital sites, and the Cape San Blas suborbital launch site, are shown in Figure 13.
Capital and Operating Costs

The study team estimated and analyzed Spaceport Florida's capital and operating costs, and used the information to develop pro forma financial statements for the prospective launch sites. The table below shows the Phase I cost estimates developed.

These capital and operating costs are all in January 1989 dollars, without escalation, and exclude land acquisition and off-site infrastructure costs. These preliminary estimates reflect the conceptual nature of the Spaceport Florida Feasibility Study. Final budget figures cannot be determined until preliminary engineering is completed for a specific site and timetable.

Potential Launch Services Revenues

Launch revenues for Spaceport Florida will be dependent on many factors, including but not limited to vehicle size, insurance requirements, the services and facilities required by launchers, and business conditions. Again, the analogy to airport operations holds true: airport landing and use fees vary with similar factors. The launchers interviewed during the study indicated that an appropriate range of fees for spaceport services would be $50,000 to $200,000 for sounding rockets, $300,000 to $600,000 for small-class vehicles, and $3 million to $5 million for medium-class vehicles.

Financial Feasibility and Benefits

Financial Feasibility

The Spaceport Florida Feasibility Report addresses two major issues: available financing methods and financial projections. The state’s ultimate concern is whether the

<table>
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<th>Site</th>
<th>Facilities</th>
<th>ESTIMATED CAPITAL COSTS</th>
<th>ESTIMATED ANNUAL OPERATING COSTS</th>
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<td>Small &amp; medium pads</td>
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<td>&lt;0.5</td>
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</tbody>
</table>
benefits of the Spaceport will be greater than the costs. Figure 14 shows the funds inflows and outflows of the Spaceport. Without considering specific dollar figures, two types of economic benefits are available to the state. First, there is the profit potential (or net revenues) of the operations. Second, indirect benefits to the state include higher employment, an increased tax base, economic growth, etc.

The financial feasibility of Spaceport Florida's launch center is extremely sensitive to the number of launches and the fees charged. Using conservative launch rates and fees, the study's financial analyses indicate that the direct cash benefits from launch operations are not sufficient to recover the capital and operating costs completely. With a less conservative launch rate or fee assumption, the medium-

![Funds Inflow & Outflows for Spaceport Authority Diagram]

Figure 14
vehicle pad should recover annual operating costs, but probably will not recover capital costs. The small-vehicle pad option would require a very optimistic launch rate to recover all operating costs.

The State of Florida, or some other source of grant funds, will probably have to provide a “capital contribution” to the Spaceport’s operations. This contribution will be returned only in the form of the indirect benefits described above. The estimated amount of this contribution varies from $15 million for a small pad at CCAFS to $58 million for medium and small pads at Shiloh.

Secured debt is probably the appropriate financing instrument for the launch facilities. The feasibility study includes an in-depth review of equity and other financing alternatives, but concludes that the Spaceport probably will not interest investors who require high rates of return. Four potential debt financing options are:

- Tax exempt general revenue bond, with credit support
- Tax exempt special facility revenue bond
- Taxable special facility revenue bond
- Corporate debt privatized facility

Each option has advantages and disadvantages. The final financing approach will depend on the state’s evaluation of various factors.

Executive Summary

Options to finance the complementary facilities were studied, with conclusions generally similar to the launch facilities. Each opportunity should be studied separately. Those that can provide reasonable rates of return to investors can be financed without state support.

Benefits

On a stand-alone basis, Spaceport Florida will attract modest revenues. In addition, it can act as the catalyst to stimulate other demand for commercial space activity in the state. Florida’s cost to maintain a leadership position in commercial space might well be equated to the capital cost of the proposed Spaceport. It is recommended that an off-site impact analysis be performed to identify all potential benefits to the State of Florida from commercial space-related industries.

Development of the Spaceport will stimulate employment in many economic areas. While the directly-related space sector opportunities are obvious, increases in retail employment, service businesses, housing and other segments could be expected. Facility construction and employment growth as a result of the Spaceport will also increase state and local tax bases.

Spinoffs from the commercialization of space can be expected to spawn new businesses, services and products, some of which can be expected to be Florida-based. These developments will, in turn, stimulate employment and increase the tax base.
New technology developed for space has already contributed significantly to many other areas of everyday life. Expansion in the technology base can be expected to continue at an even faster pace with exploitation of commercial space opportunities. It is sometimes difficult even to imagine the ways in which the quality of life will be improved by these developments.

**NEXT STEPS**

The State of Florida can move forward immediately without incurring large costs or significant risks. The state should immediately take the following steps.

- The State of Florida should establish the Spaceport Authority by general law, in order to position itself to benefit from commercial space business.
- A dialogue should be established with Eglin Air Force Base regarding the commercial use of Cape San Blas for sounding rockets.
- The state should encourage collaboration between the educational community and the commercial space industry, and begin to market the Space Business Incubator concept.
- Refine the concepts for the Space Experience Attraction and other space tourism opportunities, and begin discussions with potential developers, investors, and educators.
- As a catalyst, penetrate the launch services market quickly with a sounding rocket launch. Pursue a joint agreement between the educational community and private industry.
- Florida should not wait for the market to become clearer before commencing strategic development activities, considering the progress of the competition. The state should immediately pursue the activities listed below:
  - Initiate follow-on market surveys with small- and medium-vehicle launchers to assess the sincere level of interest in utilizing Spaceport Florida.
  - Begin the process to obtain a Memorandum of Agreement with the U.S. Air Force for use of the inactive CCAFS Pads 14, 15 and 16, as well as appropriate support services.
  - Begin the process to obtain use of Shiloh from NASA.
  - Establish a dialogue with the U.S. Department of Transportation on operating and safety procedures and permits.
  - Begin the required environmental studies of the Shiloh and CCAFS sites to evaluate their relative benefits and constraints for development as a launch center.
Executive Summary

- Commission the preliminary engineering effort necessary for each site to assist in the environmental efforts. Sufficient launch concepts should be developed to position the state to move quickly into detailed engineering and construction of the selected site(s), if desired.
- Pursue potential funding sources to finance the launch center(s) and complementary facilities.

Florida should maintain an “open eye” during the pre-development phase to be prepared to respond appropriately to the market. The Authority should do the necessary development and “grease the skids” to make the Spaceport attractive and convenient to potential launch companies. Undertaking this up-front development could be the signal necessary to obtain firm commitments to Spaceport Florida from launchers.