Florida Space Authority
Master Transportation Plan

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I. EXECUTIVE SUMMARY

The Spaceport complex is approximately 160,000 acres in size and includes the John F. Kennedy Space Center, the Cape Canaveral Air Force Station, the Merritt Island National Wildlife Refuge and the Canaveral National Seashore. The National Aeronautics and Space Administration/Kennedy Space Center (NASA/KSC), U.S. Air Force 45th Space Wing and Florida Space Authority have formed a joint planning team to sponsor the development of a comprehensive master plan for the Spaceport.

In the next few years, Florida's Cape Canaveral Spaceport will have aerospace and space infrastructure needs which will cost an estimated 150 million dollars. It is imperative that the State of Florida, through Florida Space Authority, continue to support aerospace infrastructure, investing at the state level and encouraging federal, local and private investors to meet these aerospace needs in the next decade. Additional resources for the support of aerospace planning, access and on-site infrastructure development need to be provided by the legislature. Legislation, which proposes integration of the Florida Spaceport Authority's master plans with local government comprehensive plans related to aerospace planning and transportation, needs to be encouraged. The efforts of the FDOT, Florida Space Authority, Florida Aviation and Aerospace Alliance and Enterprise Florida to work within existing organizational structures and responsibilities for the promotion of aerospace in Florida need to continue. Support of commercial space transportation is already a mainstream activity within the U.S.D.O.T., and the encouragement of space as part of the national transportation system is important to the nation, as well as to the State of Florida.

The aerospace and space industry is Florida's premier high technology enterprise with over $4 billion in direct annual spending and billions more in extended economic impacts. By continuing to enhance and expand the existing infrastructure, the State of Florida can attract more communications satellite and launch vehicle industries to the vicinity. Florida Space Authority should continue to encourage FDOT to coordinate with Florida airports, other intermodal facility owner/operators, and associated metropolitan planning organizations, to ensure that the enhancement of intermodal connectivity between air cargo and freight handlers (rail and truck) is adequately addressed. The need to ensure that Florida enhances multimodal transportation opportunities for aerospace is vital. The establishment of multimodal routes and certified corridors for the transport of aerospace payloads and cargo through the state is of particular importance. This document identifies the most economical, efficient, and safe multi-modal routes for the seamless transport of aerospace cargo through Florida to aerospace businesses and facilities in proximity to the Cape.

By planning now to capitalize on the Cape's existing resources, to create and lead market changes, and to emphasize safety, security and financial feasibility in an entrepreneurial environment, we can secure a global competitive advantage and remain the premier gateway to space.

Mission Statement

The Florida Space Authority's mission is to retain, expand and diversify space-related industry throughout Florida, thereby, improving the economic opportunity for all Floridians by strengthening the state's space-based enterprise.

Florida Space Authority is dedicated to providing economic development for the state through space-related business and educational activities. The goal is to enable the state to maintain its position as the world's premiere location for space enterprise. Florida Space Authority is advancing the state of space through technology, research, education, finance, tourism and launch.

The Florida Space Authority, much like an airport or seaport authority, is empowered to support and regulate Florida's statewide space transportation industry. With regard to spaceport development and operations, Florida Space Authority is broadly empowered to own, operate, construct, finance, acquire, extend, equip and improve spaceport infrastructure.

The Florida Space Authority is focused on leading the state's space industry in new directions through partnerships, improved customer service, expanded research programs, and innovative, forward-thinking solutions to the challenges facing this evolving industry.

Florida Space Authority is a governmental partner to commercial entities. The Authority's participation adds value through the following initiatives:

Research

- Sharing infrastructure needs with other users
- Resources dedicated to developing world-renowned research programs

Education

- Providing accessible academic and research facilities

Launch

- Gaining long-term access to federal launch and support properties for our commercial users

Industry

- Customer driven focus
- Flexible, efficient and fast customer service
- Providing the level of expertise necessary to assist the insurance industry in providing for the space sector;
- Facilitating reasonable rules for safety and environmental compliance

Financing

- Developing a seamless authorization process
- Assisting in the financing the upgrade of launch sites for commercial venture

Partnerships

- Dynamic partnerships with NASA, the United States Air Force, and commercial and academic partners
- Utilizing free trade zones and export controls knowledgeably
- Facilitating dependable infrastructure
- Fully integrating into the state's transportation system

As facilitator between the commercial and government sectors, Florida Space Authority makes use of the state's extensive space-related resources. The partnership with national agencies (such as NASA, U.S. Air Force), state agencies (Enterprise Florida, Florida Department of Transportation), and private companies (Boeing, Lockheed Martin, Orbital Sciences, Command and Control Technologies) create a universe of options, flexibility, opportunity, and convenience. Florida Space Authority is committed to cultivating growth opportunities in space, nationally and internationally. As the champion for the creation and development of space-related academic and research programs throughout the state of Florida, Florida Space Authority has facilitated the development of the Space Experiment Research and Processing Laboratory (SERPL) at the Kennedy Space Center. SERPL is the collaboration between NASA and the State of Florida that consolidates and encourages state university/industry partnerships in space-based life science experiment programs.

Florida Space Authority's goals include:

- Improve Florida's space transportation infrastructure
- Attract space enterprise expansion, development, and diversification
- Improve Florida's intellectual infrastructure
- Provide policy that supports thriving space enterprise
- Develop and maintain world-class facilities
- Facilitate capital for facilities and programs
- Maintain highest standards for safety, security and environmental matters
- Operate as high-performance public-sector organization

History and Background

Florida Space Authority (FSA) was created as a state government space agency by Florida's Governor and Legislature in 1989. The Authority's mission (as authorized in Chapter 331, Part Two, Florida Statutes) is to retain, expand and diversify the state's space-related industry. Chapter 331 gives FSA governmental powers similar to other types of transportation authorities (airport, seaport, etc.) to support and regulate the state's space transportation industry. With regard to spaceport development and operations, FSA is broadly empowered to own, operate, construct, finance, acquire, extend, equip and improve the following types of spaceport infrastructure: launch pads, landing areas, ranges, spaceflight hardware, payloads, payload assembly buildings, payload processing facilities, laboratories, and space business incubators. In addition to these specific types of infrastructure, the Authority is empowered to support facilities and equipment for the construction of payloads, spaceflight hardware, rockets and other launch vehicles; and for other spaceport facilities and related systems (utility infrastructure, fire and police services, mosquito control, etc.).

Structure

FSA is administered by a seven-member Governor-appointed Board of Supervisors (two additional ex-officio members are also assigned by the Florida Senate and House of Representatives). The Authority's Executive Director reports to the board and provides day-to-day management of the agency.

Over the past ten years, the Authority has remained small (with approximately 20 employees) to maximize its ability to act quickly on project opportunities, and to serve primarily as a "facilitator" of new programs at the Cape Canaveral Spaceport and elsewhere in the state. In 1999, the Authority supported the legislative creation of two "spin-off" organizations: the Florida Space Research Institute (FSRI) and the Florida Commercial Space Financing Corporation (FCSFC). These new agencies provide specialized statewide services in the areas of space-related academic programs, and innovative financing for space-related projects.

The Florida Space Authority serves Governor Jeb Bush through his Office of Tourism, Trade, and Economic Development. Lt. Governor Frank Brogan is the Chair of the FSA Board of Supervisors. Development of the Space Industry is a priority for all of Florida. The Florida Space Authority is committed to working with Governor Bush, Lt. Governor Brogan, the Florida Legislature, and the state's Congressional Delegation to assure that the birthplace of our nation's space program continues to play a vital role in the development and implementation of the national space policy. FSA's initiatives at the federal level have resulted in state-government empowerment in various space policy directives (National Space Policy and National Space Transportation Strategy) and legislation (Commercial Space Transportation Act).

Concept

The concept embraced by the state when it created Florida Space Authority was to extend the successful quasi-governmental model of airport and seaport authorities to the emerging commercial space transportation industry. The vision for implementation of this concept at the Cape Canaveral Spaceport included a relationship/agreement with the Air Force similar to that of various civilian/commercial aviation authorities that operate on certain Air Force bases (like Eglin Air Force Base). The purpose of the agreement is to facilitate Florida Space Authority being a contributing member of a federal-state team developing a Cape Canaveral Spaceport Comprehensive Master Plan that addresses commercial space enterprise in addition to civil/military requirements. The agreement defines terms by which the Florida Space Authority can contribute funding, as well as, Florida Space Authority's roles and responsibility through the development of the Comprehensive Plan. Under this type of government-to-government arrangement, underutilized property and facilities would be conveyed to Florida Space Authority so they could be improved and provided to multiple commercial users on a dual-use, non-interference, right-of-refusal basis with Air Force programs.

The efforts of the FDOT, Florida Space Authority, Florida Aviation and Aerospace Alliance and Enterprise Florida to work within existing organizational structures and responsibilities for the promotion of aerospace in Florida has solidified the mission to remain at the forefront of space technologies. Additionally, the Cape Canaveral Space Partnership, which is a consortium aimed at promoting Florida's competitiveness in Space, will ensure that the Cape Canaveral Spaceport remains the premier site location for innovations in space, from launch site to payload processing, and from manufacturing to research and development. With the addition of satellite launches as an established transportation industry, Florida has made space transportation part of the State's official multi-modal transportation system. This allows state and federal transportation funds to be used for infrastructure at Cape Canaveral. By continuing to enhance and expand the existing infrastructure, the State of Florida can attract more space-related industry to the state. The aerospace and space industry is Florida's premier high technology enterprise with over $4 billion in direct annual spending and billions more in extended economic impacts. Over the past two years, more than $600 million in commercial investments has been used to develop launch pads and other facilities at Cape Canaveral. Support of commercial space transportation is already a mainstream activity within the U.S.D.O.T., and the encouragement of space as part of the national transportation system is important to the nation, as well as to the State of Florida.

Jurisdiction and Territories

Florida Space Authority offices are located at state-developed facilities at the entrance to the Cape Canaveral Spaceport. The Authority is authorized to support space-related projects throughout the state, but actual launch operations must be located on FSA "territories" which can be established by the Legislature or by the FSA Board of Supervisors. The Authority's territories currently include the Cape Canaveral Spaceport (defined as all of Kennedy Space Center and Cape Canaveral Air Force Station);

Patrick Air Force Base; and Eglin Air Force Base. These territorial designations also allow certain state-level tax benefits for spaceport-related business, and establish the Authority as the primary state government recipient of property or facilities that become officially designated as excess to federal needs (such property is typically offered to other federal agencies, then to state governments, local governments, and finally to commercial interests).

Facilities, Financing and Construction

Florida Space Authority has sponsored nearly $600 million in new space industry developments, including launch pads, hangars, payload facilities, control centers, storage facilities, and even tourism facilities. The Authority recently financed the $300 million Atlas V EELV launch facilities at Cape Canaveral Air Force Station for Lockheed Martin; financed and constructed a $24 million state-financed Delta IV EELV Horizontal Integration Facility for Boeing; provided $28 million in financing for a Titan IV storage/processing facility; and provided over $25 million for NASA's Apollo/Saturn V Center at Kennedy Space Center. Using various financing mechanisms, in conjunction with its state governmental status, the Authority is able to fund the construction of facilities and, while retaining ownership, lease the facilities to users who provide sufficient debt security.

In addition to providing an attractive alternative for facility investments, these "lease-back" and "synthetic-lease" financing arrangements provide significant tax and accounting benefits to the companies involved. They also can allow critical government-required facilities to be developed under alternative commercial and state-level investment scenarios.

Summary

In the last 50 years, Florida has established itself as the premier location in the world for space-related business. Florida-based space projects inject over $4.5 billion per year into the state's economy, employing more than 30,000 engineers, scientists, technicians, and other personnel statewide. The Florida Space Authority serves as both an economic development agency and a transportation authority, working to expand space-related manufacturing and technology programs by leveraging the state's strong NASA and military space presence. The Authority is poised to help Florida attract additional space business. In addition to an extensive menu of economic incentives, the Authority can also assist with academic research and development initiatives, financing and construction, and workforce training and development. This collection of services and incentives is designed to make Florida the most business friendly location in the space industry. According to a 2000 market survey, over 650 satellites will be launched worldwide over the next ten years, compared to 638 over the past decade. These launches will generate $34.6 billion in revenues for the space transportation industry, as well as, tremendous opportunities for growth at the Cape Canaveral Spaceport.

Recently, foreign commercial competition subsidized by governments has become an important part of the world's space transportation competition. Europe, Russia, Japan, and China now compete with U.S. private firms for the international space launch market. Given the growing levels of international competition in the commercial space transportation industry, it is now vitally important to increase Spaceport's capacity, decrease user costs, and establish a positive, user-friendly environment for both launch service providers and their customers. With its broad state-level powers and innovative approaches to meeting the space industry's requirements, the Authority is prepared to assist the Federal Government and industry to improve Spaceport's long-term competitiveness.

II. INTRODUCTION AND PURPOSE

What began as a government research and development program at Cape Canaveral some fifty years ago is now a highly competitive industry that serves commercial, government and international customers with an ever-expanding array of products and services. Florida's space-related businesses specialize in launch vehicle and satellite components, telecommunications and remote sensing, research and technology development, and space transportation services. From Pensacola to Homestead, Tallahassee to West Palm Beach, and Gainesville to St. Petersburg, Jacksonville to Miami, the space industry touches every region of the state and has become a statewide priority.

Twelve years ago, the Florida Space Authority (formerly Spaceport Florida Authority) was established to accelerate the industry's expansion. Florida Space Authority (FSA) has since sponsored approximately $600 million in new space projects in the State of Florida, including launch pads, processing facilities and control centers for the space transportation industry. FSA has also developed laboratories, tourism facilities, academic programs, and other initiatives designed to diversify the state's space enterprise.

Florida Space Authority serves as both an economic development agency and a transportation authority, working to expand space-related manufacturing and technology programs by leveraging the state's strong NASA and military space presence. FSA works closely with the Governor and Legislature, the Florida Department of Transportation, the Florida Space Research Institute (created by the Florida Space Authority), Enterprise Florida, and other agencies to guide the state's space programs and policies.

The Florida Space Authority, much like an airport or seaport authority, is empowered to support and regulate Florida's statewide space transportation industry. With regard to spaceport development and operations, Florida Space Authority is broadly empowered to own, operate, construct, finance, acquire, extend, equip and improve spaceport infrastructure. It is responsible for statewide space-related economic and academic development, including regulatory and operational support to the space transportation industry. FSA also works closely with industry and local, state and federal agencies and elected officials to support space-related programs and investment in Florida. FSA provides financing, advocacy, technical support, access to business incentives, and facility/infrastructure development for space-related projects, and works closely with the Florida Space Research Institute (FSRI) and with public and private universities and colleges in the State, to increase their involvement in space-related research and education. As the State's space agency, FSA provides space policy advice to the Governor, Florida's Congressional delegation, and other state-level elected officials. Specifically, FSA provides review and makes recommendations with respect to a strategy to guide and facilitate the future of space-related educational and commercial development in Florida. The Florida Space Authority recognizes the tremendous potential of commercial space flight as it relates to national priorities as well as the economic development of the State.

The efforts of the FDOT, Florida Space Authority, Florida Aviation and Aerospace Alliance and Enterprise Florida to work within existing organizational structures and responsibilities for the promotion of aerospace in Florida has solidified the state's mission to remain at the forefront of space technologies. Additionally, the Cape Canaveral Space Partnership, which is a consortium aimed at promoting Florida's competitiveness in Space, will ensure that the Cape Canaveral Spaceport remains the premier site location for innovations in space, from launch site to payload processing, and from manufacturing to research and development. With the addition of satellite launches as an established transportation industry, Florida has made space transportation part of the State's official multi-modal transportation system. This allows state and federal transportation funds to be used for infrastructure at Cape Canaveral. By continuing to enhance and expand the existing infrastructure, the State of Florida can attract more communications satellite and launch vehicle industries to the vicinity. The aerospace and space industry is Florida's premier high technology enterprise with over $4 billion in direct annual spending and billions more in extended economic impacts. Over the past two years, more than $600 million in commercial investments has been used to develop launch pads and other facilities at Cape Canaveral. Support of commercial space transportation is already a mainstream activity within the U.S.D.O.T., and the encouragement of space as part of the national transportation system is important to the nation, as well as to the State of Florida.

The Spaceport complex is approximately 160,000 acres in size and includes the John F. Kennedy Space Center, the Cape Canaveral Air Force Station, the Merritt Island National Wildlife Refuge and the Canaveral National Seashore. NASA/KSC, U.S. Air Force 45th Space Wing and Florida Space Authority have formed a joint planning team to sponsor the development of a comprehensive master plan for the Spaceport. By planning now to capitalize on Spaceport's existing resources, to create and lead market changes, and to emphasize safety, security and financial feasibility in an entrepreneurial environment, Florida can secure a global competitive advantage and remain the premier gateway to space.

This Report is an interim draft of Florida Space Authority's first ever Master Transportation Plan, a continuing work in progress. Insights provided in the following pages of this draft document, suggest that the Authority has a complex role and continuing challenge to enhance space launch and economic development activities regarding the space mode on behalf of the State of Florida well into the 21st century. This initial Master Transportation Plan is to serve as a guide for future policy direction as well as a source for trends, conditions, and statistics associated with the space mode today and in the future.

It is acknowledged that this Plan is a work in progress, and will be a dynamic ever changing framework to be refined throughout the 2002 – 2004 time period. Work on this interim plan has been conducted over the past two years and recommendations made herein will continue to be improved upon and implemented on a systematic basis by FSA staff into the foreseeable future.

III. EXISTING TRANSPORTATION FACILITIES

This section addresses the road, air, rail and transit infrastructure that moves people and cargo to/from the Spaceport. Since the on-site infrastructure is controlled by the Air Force, the road analysis is limited to off-site infrastructure. The air, rail and transit analysis concerns both on and off-site facilities, because it can be controlled by the Florida Spaceport Authority. Each modal section addresses relevant characteristics, inventories, existing operations and general planning needs.

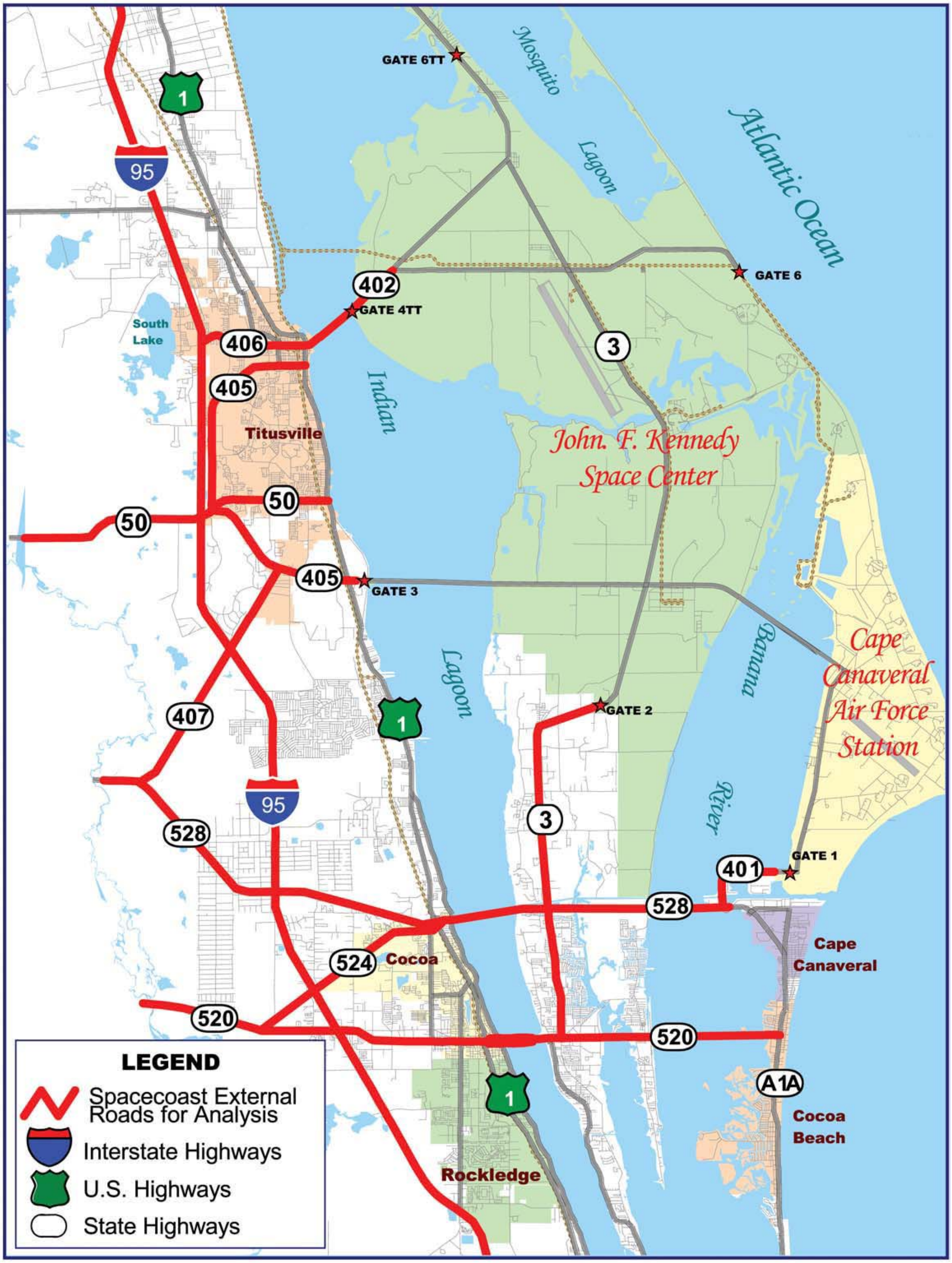
Non-Transit (Roadways)

The off-site roadway analysis concerns the major roadways that directly and indirectly accommodate Spaceport traffic. The road network provides access to Spaceport for different users with different purposes. Approximately 82 % of the users are employees at the Spaceport; 13 % are visitors; and the remaining 5 % are involved in the delivery of freight and goods or have undetermined purposes for accessing Spaceport.

This analysis identifies roadway characteristics, inventories the main connectors, assesses existing operations, and considers future on-site and regional development planning needs. The external roadway network is shown in **Figure III-1.** The roadways inventoried are listed below:

1. SR 3 (State Road 3) from SR 520 to the KSC entrance Gate 2
2. Interstate 95 (I-95) from the Indian River County Line to The Volusia County Line
3. SR 50 from the Orange County Line to United States Highway 1 (US 1)
4. SR 405 from KSC entrance Gate 3 to SR 50 continuing north to US 1 in Titusville
5. SR 520 from the Orange County Line to SR A1A
6. SR 406 from I-95 to US1
7. SR 528 from the Orange County Line to SR 401
8. SR 524 from SR 520 to US1
9. SR 407 from 528 to SR 405
10. SR 402 from US1 to KSC entrance Gate 4TT
11. SR 401 from 528 to KSC entrance Gate 1

Figure III-1
Spaceport External Road Network



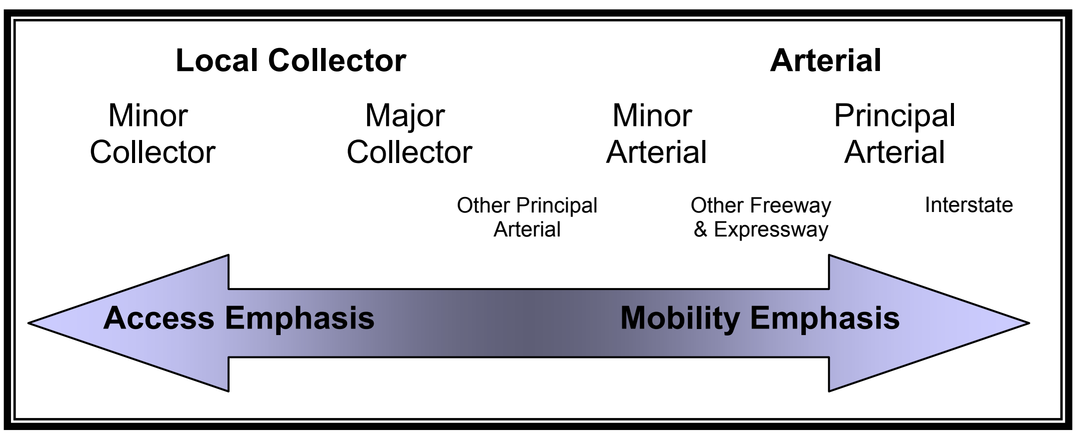
Roadway Characteristics

The information presented in this report is derived from the 2000 database of roadway characteristics obtained from FDOT for the external road network that serves the Spaceport. This database is included in tabular form in **Exhibit III-1A through III-1E.** The database includes segment location and length, number of signals, functional class, speed limits, road and median type and width, number of lanes, daily traffic volumes, level-of-service, and classification as a roadway within the Florida Intrastate Highway System. The information from this database is summarized below and shown graphically in the following figures.

Functional Classification

The role played by roads in a network is referred to by its functional classification. All roads have two major functions – local access to a particular location and mobility (i.e., convenient connections) between different locations. A road that emphasizes the mobility function is called an arterial. A road emphasizing access is called a local collector road. This relationship or trade-off between mobility and local access is diagrammed in **Figure III-2**. Florida DOT uses the functional classification methods and terminology prescribed by the Federal Highway Administration. Functional classifications are determined separately in urban and rural areas, and not all-possible classifications are used in both.

Figure III-2
Road Access vs. Mobility



Arterials are further subdivided between principal arterials and minor arterials. Principal Arterials provide long-distance mobility and very little local access. Minor arterials provide local connections and provide some access to adjacent land use. Principal arterials include interstates, freeways and expressways, and others. Between minor arterials and local roads is another class, called collectors. Collectors provide significant access while still providing mobility by connecting different nearby areas or roads. Collectors are further divided in rural areas between major collectors and minor collectors.

Posted Speed Limits

Speed limits for the roadways that serve KSC and CCAFS are largely determined by the FDOT based on their functional classification and the existing level of service. Actual posted speed limits along the roadways identified vary from 30 to 65 miles per hour. The FDOT functional roadway classifications and their corresponding assumed free-flow speed limits (speeds that a vehicle could travel along a roadway when individual users are virtually unaffected by the presence of others in the traffic streams.) are shown in **Figure III-3**.

Figure III-3

Assumed Free-Flow Speed by Functional Class

RURAL			URBAN		
FC Code	Functional Class	Free – Flow Speed (mph)	FC Code	Functional Class	Free – Flow Speed mph)
2	Principal Arterial	55	12	Freeways and Expressways	55
6	Minor Arterial	45	14	Principal Arterial	55
7	Major Collector	35	16	Minor Arterial	45
8	Minor Collector	30	17	Collector	35
9	Local	25	19	Local	25

Source: FDOT – Sourcebook, 2000

Medians and Roadway Types,

Median type and width influence the designated functional classification of each roadway. Median types vary along the roadways from wide grassed medians with a lawn, to curbed medians with a grass center. Other types of medians are painted continuous left turn lane medians, and no median or undivided roadways. Median widths vary from 0 feet to 48 feet on non-interstate roadways and are generally standard at 64 feet on Interstate-95, with one segment spanning 160 feet. Study area median types and widths are mapped in **Exhibit III-2**.

Generally, roads designed primarily for mobility purposes are constructed to accommodate heavier loads. Characteristic-like medians and roadway types affect the ability of a roadway to accommodate certain traffic types. For analysis purposes, oversize loads (i.e., weight and/or size) going to the Spaceport are concerned with all of these criteria. The roadway type and posted speeds are also shown in **Exhibit III-2**. The number of lanes for each roadway is shown on the left side of **Exhibit III-3**.

Annualized Average Daily Traffic (AADT)

AADT are traffic counts collected by FDOT at temporary or Portable Traffic Monitoring Sites (PTMSs), and at permanent or Telemetered Traffic Monitoring Sites (TTMS's) count stations within the study area. The FDOT Transportation Statistics Office's - Traffic Data Section maintains traffic data, such as AADT and vehicle classification counts (automobile, 3-axles, 6-wheel trucks, etc.). Traffic information is obtained for each traffic break on the State Highway System. A traffic break is a segment of road with relatively uniform traffic characteristics. It may go from interchange to interchange on an Interstate highway, or it may include several minor intersecting roads on a smaller highway.

There are over 45 temporary sites along the roadways identified in this study. Data is collected at each temporary site for one or two days each year. More detailed information, including counts, classification, speed and weight, is collected at the 3 permanent sites in the study area. The seasonal variations in data at the permanent sites are used to apply seasonal corrections to the spot counts at the temporary sites. This allows traffic counts to be adjusted for seasonal and time of day factors to yield a consistent AADT for all count sites.

Year 2000 AADT data gleaned from the FDOT database is mapped in **Exhibit III-4**.

The year 2020 traffic count projections were developed using the FSUTMS (Florida Standard Urban Transportation Model Structure) model. The FSUTMS model uses socio economic data collected for transportation analysis zones. The data from these zones are used to generate traffic projections or 2020 AADT projections as shown in **Exhibit III-5**. *The FSUMTS uses a straight-line growth model to extrapolate growth out to the 2020 timeframe. The risk of using this type of growth projection is that the existing circumstances could dramatically change the actual AADT in 20 years.*

The 2020 projections are notable in that less traffic growth is projected for the areas closer to the coast. The through corridors such as I-95 and SR 528 however, show as much as double the growth in AADT by 2020. This is a result of the development pattern near the coast, which is built out to near capacity. Unless allowable density requirements in the area are changed, a majority of the growth near Spaceport will occur away from the existing neighborhoods and coastal areas.

Traffic counts for individual roads are discussed below, followed by an assessment of existing operations and planning needs.

Level of Service (LOS)

LOS is a qualitative assessment of road users' perceptions of a roadway's quality of flow, and is represented by the letters "A" through "F". LOS "A" represents free flow, with individual users virtually unaffected by the presence of others in the traffic streams. "B" through "D" represents increasing declines in the freedom to maneuver within the traffic stream and lower levels of comfort and convenience. LOS "E" represents operating conditions at or near the capacity level. Speeds are reduced to a low, but relatively uniform value, freedom to maneuver within the traffic stream is extremely difficult, and comfort and convenience levels are extremely poor. LOS "F" is used to define forced or breakdown flow, which occurs where the amount of traffic approaching a point exceeds the amount which can pass that point.

For clarity, the LOS map in **Exhibit III-6** combines LOS A through C as one category – green. The other LOS – D, E and F – are shown as distinct categories and with separate colors – yellow, brown and red, respectively. Like the AADT data, this information is expanded upon below.

Accidents

As AADT increase and LOS decrease, the danger of accidents occurring increases, especially at interchanges. The number of traffic accidents in 2000 is shown in **Exhibit III-7**. Such information provides further input into how well a road system accommodates users and what constraints may inhibit cargo and/or people traffic.

Inventory of Main Connectors

Eleven (11) external roadways that directly or indirectly serve the Spaceport are described below. Additionally, an overview is included of Florida's Interstate System and the Indian River Lagoon Highway Program.

State Road 3, (Courtenay Parkway)

SR 3 is a 4-lane minor arterial that runs north-south connecting KSC with the area south of SR 520. SR 3 provides one of two southern direct access points to the Spaceport at Gate 2. The roadway is divided into two distinct segments. Running south to north Between SR 520 and SR 528 is one segment, and between SR 528 and the KSC is the second.

The first segment, Courtenay Parkway, has existing traffic counts that range between 30,000 and 40,000 AADT. Until approximately 1 mile north of SR 520, the medians are curbed with a grass center and range between 32 and 29 feet wide. Beyond this segment to SR 528, the medians are a 10-foot wide painted median with a continuous left turn lane. As shown in **Exhibit III-7**, numerous accidents have occurred in this portion of the roadway, and it is one of the worst segments for accidents in the study area. As shown in **Exhibit III-6**, this segment of SR 3 is functioning at LOS F.

In the second segment of the roadway the median width ranges from 22 to 20 feet and varies between curbed and grass type median. North of SR 528 the AADT is reduced to approximately 15,000 AADT near the KSC. As shown in **Exhibit III-6**, this segment of SR 3 is functioning at LOS C or better. Approximately 27% of the traffic entering the Spaceport use SR 3 South and approximately 2% use SR 3 North.

Interstate 95

I-95 is the major north-south interstate limited access highway along the east coast of Florida and the eastern seaboard of the United States. It is part of the Florida Intrastate Highway System (FIHS) and the National Highway System (NHS). I-95 serves as a major freight and trade corridor for the region connecting to every major roadway that provides access to the Spaceport. These roadways include: SR 520, SR 524, SR 528, SR 407, SR 50, SR 405 and SR 406. The total length of this roadway in Brevard County is 72.6 miles, and the speed limit on the roadway is 70 mph uniformly throughout the length of the county. The LOS along I-95 is C or better.

State Road 50

SR 50 is a major east-west principal 4-lane arterial from the Orange County Line to Titusville. SR 50 provides access to SR 405, which connects directly with KSC at Gate 3. The median of SR 50 ranges from 48 to 28 feet wide except for the section near I-95 where it reduces down to a curbed and grassed median section for approximately 0.5 miles. The LOS of SR 50 is C or better.

State Road 405 (Columbia Boulevard, South Street or NASA Causeway West)

The section of SR 405 north of SR 50 connects with SR 50 along the west side of Titusville and parallel to the heavily traveled I-95. This section of SR 405 serves the Spaceport by providing access to the southern section of SR 405. The northern section of SR 405, where the roadway narrows to 2 lanes and is undivided, is functioning at level of service D for just over 2 miles. The roadway is currently serving between 14,200 and 15,200 AADT. SR405 provides a direct connection to the KSC at Gate 3. At the western end of this segment SR 405 connects with SR 50. SR 405 is a 4-lane urban principle arterial with a 40 foot divided grass median. The posted speed limit of the roadway ranges from 35 to 55 mph. SR 405 is the route that payloads follow to enter the KSC. Brevard County has identified this section of SR 405 as needing improvement in order to service the companies that will transport Space related payload to the KSC. Level of Service along this portion of roadway is LOS C or better. Approximately 43% of the traffic entering the Spaceport uses this roadway.

State Road 520

SR520 is a major east-west corridor that connects indirectly with the Spaceport by connecting directly with most of the major roadways that access the west and southern entrances to the Spaceport. SR 520 varies widely in terms of number of lanes (2 to 6), and level of service (C or better to F). Geographically, SR 520 follows a diagonal northwest to southeast alignment connecting with SR 50, SR 528, SR 524, I-95, US 1, SR 3 and SR A1A. The functional classification of SR 520 ranges from rural principle arterial to rural minor arterial. The road type ranges from divided to undivided to 1-way sections. Median width ranges from 0 to 40 feet. As shown in **Exhibit III-7**, it is one of the most dangerous roadways in the study area with more accidents than any other roadway. AADT along this section of roadway also has a wide range of activity. Permanent and temporary counts range from approximately 50,000 close to SR 3 to as low as 8,600 east of SR 524. The Level of Service along the roadway ranges from LOS F directly west of I-95 to LOS C further east of I-95.

State Road 406 (Garden Street)

SR 406 is a 4-lane east-west principle arterial from I-95 to the intersection of US1 and SR 402. The total length of this segment is 3 miles. Traffic counts along this segment range between 13,500 and 17,400 AADT. Median type varies from undivided to painted continuous left turn to curbed with grass medians. The LOS along the total length of the segment is LOS B. Eastbound traffic from SR 406 spills directly onto SR 402 which provides direct access to the Spaceport at Gate 4TT.

State Road 402 (Titusville Road)

SR 402 provides access to KSC entrance at Gate 4TT and connects with SR 406 at the intersection SR 406 and US1. The Max E. Brewer Bridge is the most prominent feature of this 0.4-mile section of roadway. A Project Development and Environmental Study (PD&E) is underway in 2002 for the Max E. Brewer Bridge. Design recommendations have not been completed at this time. Preliminary indications show the bridge will provide capacity improvements for bicycle and pedestrian modes. Vehicular capacity will remain the same. However, it is anticipated that the bridge will be constructed as a fly-over bridge rather than the existing low profile bascule bridge. The roadway is an undivided 4-lane urban minor arterial functioning at LOS A. Approximately 8% of the traffic entering the Spaceport uses this roadway.

State Road 528 (Bee Line Expressway)

SR 528 is a major 4-lane east-west principle arterial/expressway that connects Orlando (Interstate 4 and Orlando International Airport) to the Spaceport and Port Canaveral. SR 528 is a major freight and trade corridor for Central Florida. SR 528 does not connect directly with the Spaceport but it does connect with SR 407, SR 401, I-95, US 1, SR 3, and SR A1A. It is part of the Florida Intrastate Highway System (FIHS) and the National Highway System (NHS). The roadway type is uniformly divided with a 40-foot grass median. A traffic count of 52,500 AADT (the highest along the segment) was recorded at the intersection of SR 528 and US 1. The LOS along this corridor ranges from A to C.

State Road 524

SR524 is a 2-lane principle arterial that follows a southwest to northeast diagonal route through the City of Cocoa connecting SR 520 to Industry Lane at SR 528. This segment of roadway is 5.2 miles and ranges from LOS A to D.

State Road 407 (Challenger Memorial Parkway)

SR 407 also follows a southwest to northeast diagonal route connecting SR 528 with I-95 and SR 405. SR 407 is an undivided 2-lane principle arterial that totals 6.7 miles, and ranges from LOS C to A. SR 407 is the most direct route from Orlando International Airport to Spaceport, handling roughly 6,500 AADT.

State Road 401 (Phillips Parkway)

This section of SR 401 is a 2.2 mile principal arterial that connects the Cape Canaveral Air Force Station entrance at Gate 1 to SR 528. Access to the Air Force Station is the primary function of this roadway with a secondary purpose of providing access to the Port Canaveral cruise ship terminals. The roadway functions at LOS B, is undivided near SR 528 and becomes divided near the cruise ship terminals. Approximately 20% of the traffic entering the Spaceport uses this roadway.

The Florida Intrastate Highway System (FIHS)

Established in 1990 by the Florida Legislature, the FIHS comprises Interstate highways, Florida's Turnpike and selected urban expressways and major arterial highways. As the centerpiece of the State Highway System, the FIHS serves high-speed and high-volume traffic movements. This includes a variety of purposes such as Tourism Development, Freight Delivery, Intermodal Connections, and Emergency Evacuation. Statewide the FIHS comprises only 3 percent of Florida's roads but carries 32 percent of all traffic. The FIHS carries 70 percent of all truck traffic using the State Highway System. The roadways that are part of the external road network that serves the Spaceport and are part of the FIHS system include I-95 and SR 528. The total length of the FIHS on the Spaceport external road network is 90.5 miles.

Indian River Lagoon Scenic Highway Program

The Program encompasses portions of the external and internal road network of the Spaceport. This scenic highway, which is part of the Florida Scenic Highway Program, is approximately 166 miles in length. It extends from County Road 510 (the Wabasso Causeway) on State Road A1A, west along State Road 528 to U.S. 1, north on U.S. 1 to Titusville, northeast on County Road 402 and into the Canaveral National Seashore and Spaceport. The route then backtracks through Spaceport property to State Road 528, and continues south on U.S. 1 to the Wabasso Causeway.

The designated scenic highways program is designed to promote a heightened awareness of Florida's exceptional resources and unique history through educational and visual experiences. The program was developed in response to legislation (Section 335.093, F.S.) "to preserve, maintain, protect and enhance Florida's outstanding cultural, historical, archeological, recreational, natural and scenic resources." It is voluntary and grass-roots based, involving strong local citizen and government support to help meet objectives. The program is perhaps best summarized by its mission statement: *"The Florida Scenic Highways Program will preserve, maintain, protect and enhance the intrinsic resources of scenic corridors through a sustainable balance of conservation and land use. Through community-based consensus and partnerships,* *the program will promote economic prosperity and broaden the traveler's overall recreational and educational experience."*

This designation impacts the Cape Canaveral Spaceport Master Plan by highlighting the importance of tourism development and environmental preservation.

Future Roadway Network Plan

As depicted in the Cape Canaveral Spaceport Master Plan, a Launch Activity Prediction Model (LAPM) was developed as a planning tool to help understand the magnitude and market sensitivity of launch activity in future years. Three specific scenarios established the planning horizons for the Master Plan; Planning Horizon 1, Planning Horizon 2, and Planning Horizon 3. The roadway network plan supports projected increases in Spaceport facilities and populations at Planning Horizons 1 and 2 – 30 and 44 annual launches respectively. Traffic counts and level of service analyses determined whether existing transportation corridors are adequate to accommodate future traffic demand. The evaluation indicates transportation corridors need to be enhanced in Planning Horizons 1 and 2. The recommended improvements include an extension of Titusville Road (SR 402) from Kennedy Parkway across Mosquito Lagoon to the Canaveral National Seashore. This extension would accommodate future growth with respect to the Spaceport's unique relationship between advanced technology and rich natural resources. The long term preservation of this unique coexistence remains a priority of the Spaceport's leadership. The 140,000 acres of the Merritt Island National Wildlife Refuge and a majority of the 57,000-acre Canaveral National Seashore (managed by the U.S. Fish and Wildlife Service and National Park Service, respectively) are located almost entirely within the limits of the Spaceport. This extension would promote tourism to the Spaceport area, since individuals traveling to the Seashore may visit the Spaceport and travelers to the Spaceport may visit the Seashore.

<u>Assess Existing Operations</u>

The overall external roadway system existing operations are assessed based on the individual roadway inventory presented above. The system's existing levels of service (LOS) and congestion are identified by route and segment. Additionally, future traffic growth (AADT) at these problem areas is presented.

The Year 1999 Level of Service Map, **Exhibit III-6**, indicates that segments of SR 520 and SR 3 are functioning at LOS F. This means the amount of traffic approaching a point is exceeding the amount that can pass through that point. In the case of SR 520, the failing segment is located between SR 524 and I-95. The failing segment on SR 3 is located between SR 520 and SR 528. Year 2000 AADT indicates a count of 39,000 on SR 3. Year 2020 projections indicate the traffic counts in the same location will increase to 44,100 AADT, which represents a 13 percent increase from the year 2000 count.

The Year 1999 Level of Service Map, **Exhibit III-6**, also indicates that segments of I-95 and SR 524 are functioning at or above LOS D. This indicates that the freedom to maneuver within the traffic stream is severely impacted. In the case of I-95, the LOS D segment is located between the Indian River County Line and SR 520. Year 2000 AADT indicates a count of 60,000 for this segment. Year 2020 projections indicate the traffic counts will increase to 102,100 AADT, which represents a 70 percent increase from the year 2000 count. In the case of SR 524 the LOS D segment is located between the I-95 and SR 528. Year 2000 AADT indicates a count of 13,000 along this segment. Year 2020 projections indicate the traffic counts will increase to 16,500 AADT, which represents a 27 percent increase.

Other roadways reviewed as part of this analysis are currently functioning at LOS C or better.

Roadway Enhancement Needs

The Brevard County Metropolitan Planning Organization adopted its Year 2020 Long Range Plan Refinement in December of 2000. This document will guide the MPO's transportation planning and decision making process as it implements needed transportation improvements over the next 20 years. In preparation for the plan refinement the MPO identified roadways projected to experience traffic volume greater than 115 percent of its capacity. These roadways were labeled as severely congested. Moderately congested roadways yield traffic volumes between 85 percent and 115 percent of capacity. This information is presented in **Exhibit III-8**. This analysis shows that I-95 is the primary roadway within proximity of the Spaceport that will be severely congested by year 2020. A small portion of SR 528, close to the Orange County Line, is also shown as severely congested. Moderately congested roadways included SR 3 and SR 528 between SR 407 and I-95. Several other roadways, particularly in the Palm Bay Area, were shown as being severely congested.

The resulting Cost Feasible Plan Refinement is shown in **Exhibit III-9**. This plan refinement addressed the congestion issues by proposing improvements to I-95 and SR 3 in proximity to the Spaceport. I-95 will be widened to 6 lanes and SR 3 between SR 528 and Skylark will also be widened to 6 lanes. Improvements such as this should ease some of the congestion in the area near Spaceport in the near term, but could also induce more growth along these corridors. Whenever a road is widened, the growth is soon to follow. Therefore, the long-term alleviation of congestion is not guaranteed by a road-widening project.

The Cost Feasible Plan is an MPO plan and therefore approved by the MPO. The MPO prioritizes the projects that must be funded by the agency responsible for the facility. If I-95 is slated for construction then it must first be included in the FDOT work program. Such a project would not get into the work program unless it is first in the MPO Cost Feasible Plan. Inclusion in the Cost Feasible Plan does not guarantee a project will be constructed, but it is a necessary first step.

Absent from the list of proposed improvements are projects that specifically address space freight access to the Spaceport. Based on information presented in other sections of this report, such issues will become increasingly important for the Spaceport.

Transit Services

Both on and off-site facilities and operations are considered in this section. The on-site analysis primarily concerns tourist-oriented bus traffic and the employee shuttle. Conversely, the off-site transit analysis primarily concerns transit options available to commuters who work at the Spaceport.

On-Site Transit

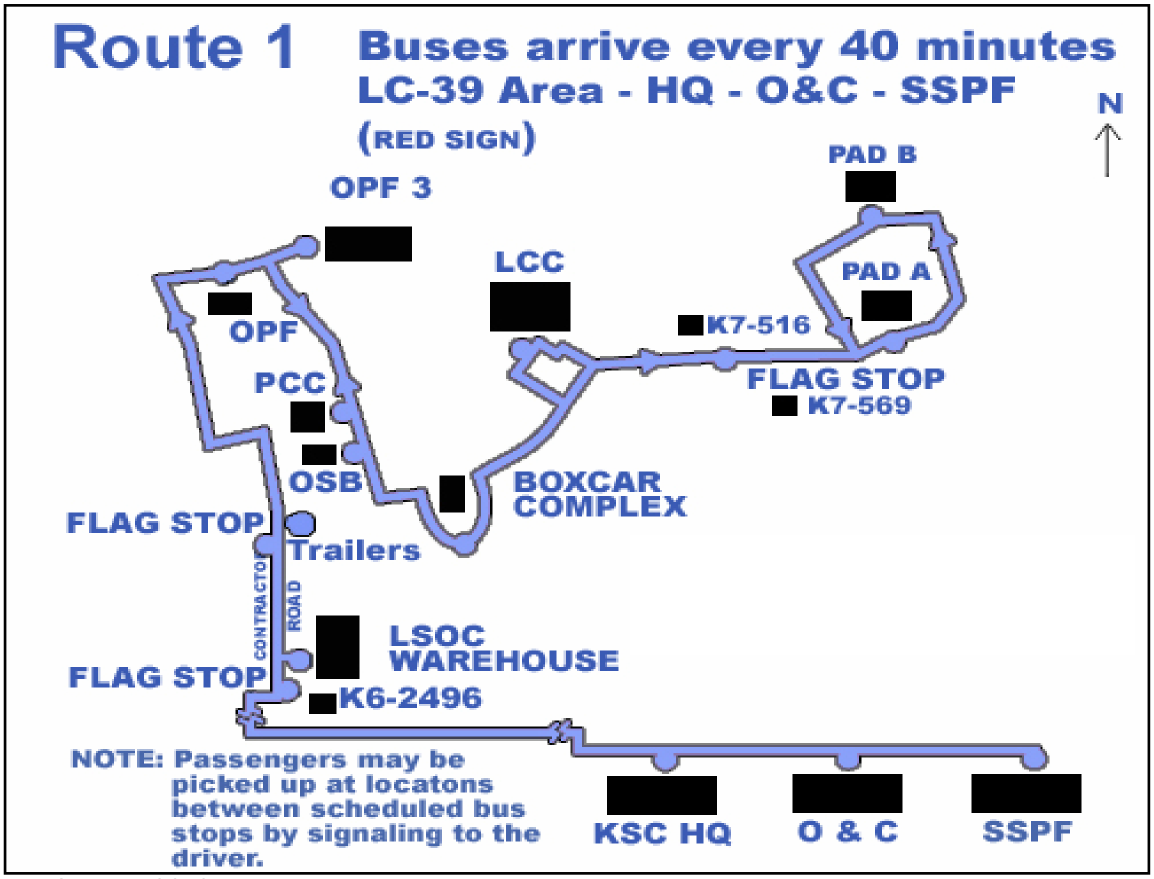
On-Site transit services at the Spaceport include services for Space Center employees and the Space Center Visitor Complex. Employees are served by the KSC employee shuttle service and the CCAFS construction worker shuttle service. Visitors to the Spaceport Visitors Complex are served by a dedicated Visitor Complex shuttle service. A review of these facilities is presented in this section followed by an evaluation of the potential to provide scheduled on-site transit service.

Visitors Complex Tour Buses

A private contractor, Delaware North Park Service of Spaceport, operates the Space Center Visitors Center shuttle bus service. Rolling stock is all 3 years old or newer and includes 44 buses on-site that are stored and serviced on Space Center grounds. Wheelchair lifts are provided on 32 of the buses. These buses can transport a total of 55 passengers. The remaining 12 buses do not have wheelchair lifts, and can transport 65 passengers at one time. On a regular day following a regular predefined route, the buses have a 60 mile round trip. Average duration for each tour is approximately 3.5 hours. Typical tours stop at three different locations on the Space Center grounds. Approximately 30 to 35 buses are operating on non-launch days. The cost of the bus shuttle is included in the entrance fee to the Space Center Visitor Complex. Space Center visitors in 2000 averaged about 7,700 on a daily basis and a total of 2.8 million annually. In 2001 the Space Center Visitor's Complex had 1.6 million visitors. They anticipate approximately 1.65 million visitors in 2002. They attribute the decline from 2.8 million to a general drop in Tourism in Central Florida since the events of September 11, 2001.

Employee Shuttle Kennedy Space Center

Employees of the Kennedy Space Center have access to an internal shuttle bus service that provides access to the primary worksites within the Space Center. Creative Management Technologies Incorporated (CMT) operates the shuttle as a subcontractor to Space Gateway Support (Base Operations Contractor). The purpose of the shuttle is to allow employees to move from site to site for non-personal travel to multiple worksites on KSC property. There is no fee for riding the shuttle. Average ridership per day is approximately 40 to 50 passengers. On a rainy day, this may increase to approximately 100 per day. Currently, three nineteen passenger buses service a consolidated route that incorporates Route 1 and Route 2 depicted in **Figure III-4** and **Figure III-5**. Route 1, the longer of the two, covers 25 miles per trip and provides service every 40 minutes. This route provides service to Pads A and B, as well as the VAB and NASA Headquarters, including CIF, O&C and SSPF.



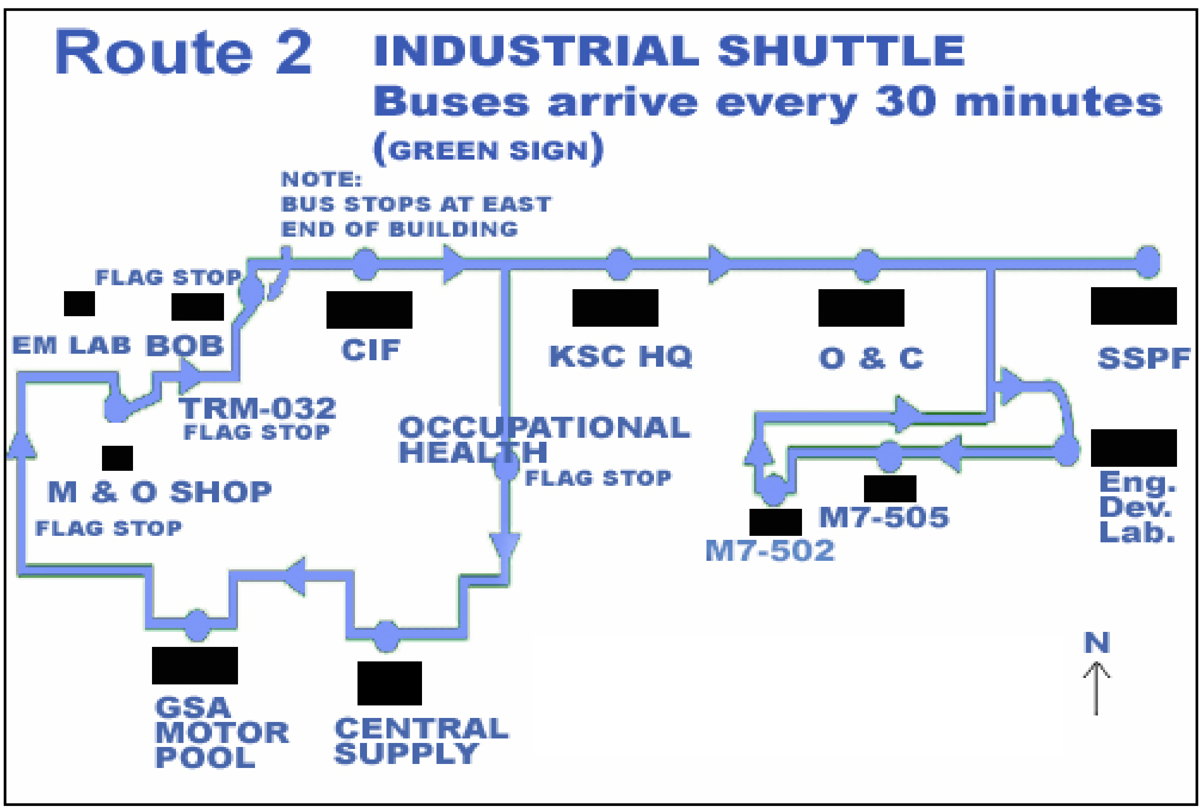
Source: KSC- Creative Management Technologies

The Operations Support Building is by far the busiest stop for the shuttle system. Approximately 37 percent of the passengers that ride the shuttle embark at this location. Other key points of embarkation include the KSC Headquarters and the Orbiter

Processing Facility. The Facilities served by the Route 1 shuttle are listed below, followed by the full name of the facility:

SSPF	Space Station Processing Facility
O & C	Operations and Checkout Building
KSC HQ	Kennedy Space Center Headquarters
K6-2496	Security Police
LSOC Warehouse	Logistics Support Operation Center
OSB	Operations Support Building
PCC	Processing Control Center
OPF	Orbiter Processing Facility
OPF 3	Orbiter Processing Facility 3
LCC	Launch Control Center
K7-516	Propellant Lab High Pressure Gas
K7-569	Converter Compressor Operation Building
PAD A	Launch Pad A
PAD B	Launch Pad B

Route 2, called the Industrial Shuttle, covers a smaller route distance, approximately 10 miles, which is completed every 30 minutes. This system currently has 2 buses operating on this route and overlaps with Route 1 along "C" Street.



Source: KSC- Creative Management Technologies

This route also provides service to CIF, KSC HQ, O&C and SSPF. The Key to Map definitions for Route 2 Industrial Shuttle is listed below:

GSA Motor Pool	Government Services Administration Motor Pool
M& O Shop	Maintenance and Operations Shop
EM Lab BOB	Base Operation Center
TRM-032	Temporary Facility
CIF	Central Instrumentation Facility
KSC HQ	Kennedy Space Center Headquarters
O & C	Operations and Checkout Building
SSPF	Space Station Processing Facility
M7-502	Industrial Area Modular Office Building
M7-505	Payload Support Building
Occup. Health	Occupational Health

The peak hour for passengers is between 11 and 12 a.m. Approximately 24 percent of all passengers embark during this time. This peak hour indicates riders are using the shuttle for lunch hour activities. The hour between 9 and 10 a.m. is also a smaller peak hour that has approximately 14 percent of the shuttle riders. In August of 2001, the employee shuttle services were significantly reduced. A nearly 50 percent reduction in bus operations resulted in a 30 percent decrease in the number of passengers.

Evaluation of Transit Options

Transit options at the Space Center are limited to the employee shuttle.
Ridership data provided by Delaware North indicates that the Operations Support Building is by far the most common destination along the transit route. Approximately 37% of the riders embark or disembark at this location. Other frequent destinations are: the Orbiter Processing Facility 3 (13%), The KSC Headquarters (10%), The Space Station Processing Facility (8%), Orbiter Processing Facility (8%) and The Processing Control Center (8%). The ridership data also indicates that the majority of the destinations are clustered in two activity centers. The Industrial Area is one activity center for transit ridership, and the Orbiter Processing Facility/Operation Support Building Area is the other. Based on the frequency for boardings and exits at these locations (Origin and Destination O/D Surveys were not conducted) it appears that trips between these activity centers are the primary drivers for ridership of the on-site transit system.

Projections of ridership for the on-site transit system would not be reliable since the headways and the frequency of the vehicles changes periodically. For example, after September 11, 2001 the frequency of ridership was drastically curtailed due to the terrorist activities in New York and Washington.

Ridership on the employee shuttle is low for the following reasons:

- Service headways are 30 minutes or longer. Unless the rider is going a long distance, they are unlikely to wait 30 minutes for the shuttle.

- In the buildings, where a majority of the employees are located, there are internal cafeterias. In the case of KSC HQ, there are stores and vendors for personal services. These facilities eliminate the need for employees to travel outside the building at lunchtime.

- Many of the major employee centers/buildings in the Industrial Area are located within walking distance of each other, which minimizes the likelihood of using a shuttle to access another building.

- Free and available parking surrounds most of the buildings in the Industrial Area. These facilities are easily accessible for automobiles.

- A number of entities at KSC provide their employees with vehicles while at the facility. This eliminates the need for employees to use the shuttle. NASA and NASA Contractors have current leases for over 1,700 vehicles from Government Services Administration for employee transport and conduct of work within KSC.

The cost per rider of operating the KSC employee shuttle is assumed to be similar or more than other employee shuttles. Employee shuttles in other parts of the country can cost as much as $10 per rider.

Based on the level of ridership of the KSC employee shuttle, other alternatives should be evaluated along with existing operations. An alternative that may be viable includes the use of a modified small electric vehicle that would be appropriate for short trips within the confines of the Spaceport boundaries. Several of the electric vehicles could be assigned to each building at the industrial complex and used by any employee on an on-demand basis. Employee users could drive the vehicle to another building, park it in front and use it or another vehicle when they return. Since the vehicles would be located in a secure area, loss of vehicles due to theft would not become an issue for this type of use.

Off-Site Transit

This section provides an analysis of the transit options available to access the Spaceport. Transit options include both fee (i.e., bus and van pools) and non-fee (i.e., car-pooling) based. Fee based service is primarily provided by the Space Coast Area Transit (SCAT), with some vanpool service also organized by VoTran and LYNX. This section begins with an overview of the SCAT services, followed by a detailed description of all vanpool services, and concludes with brief discussions of car-pooling and a proposed Maglev system.

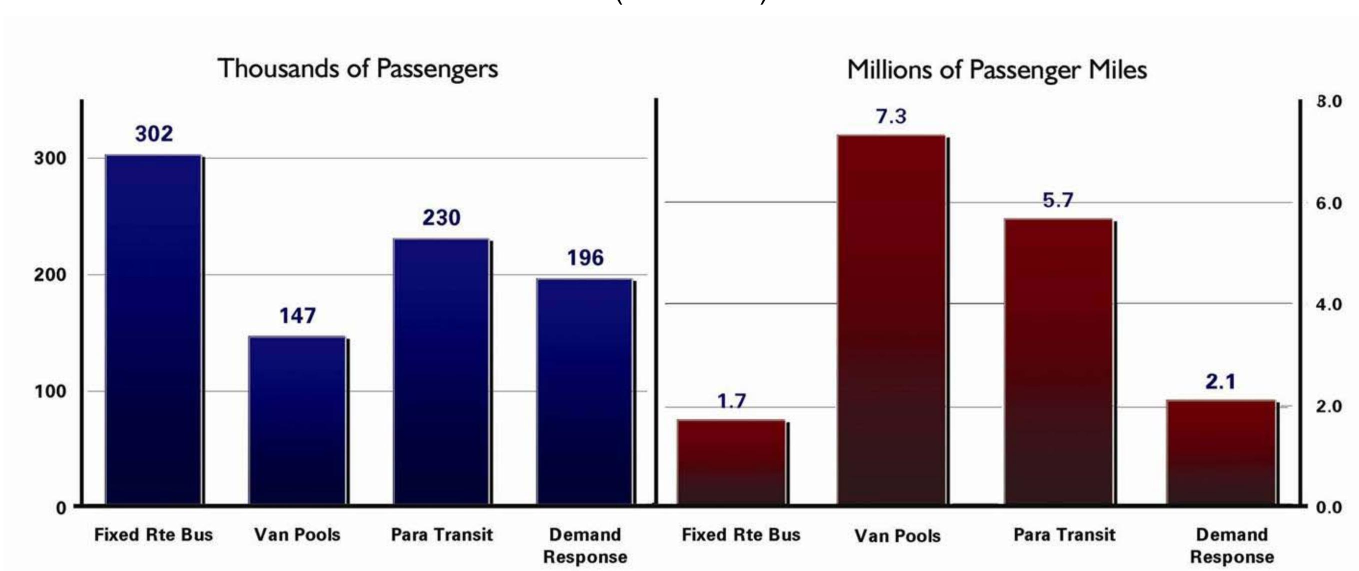
Space Coast Area Transit

Space Coast Area Transit (SCAT) provides transit services throughout Brevard County and to the area surrounding the Spaceport. Primary transit services are comprised of:

- Fixed Route Bus Services (27 buses over 19 routes)
- Vanpools (31 vans)
- Demand Response Services (15 routes)
- Para Transit Services

A breakdown on SCAT's Year 2000 passengers served and passenger miles traveled is shown in **Figure III-6** on the following page. Fixed-route bus passengers account for the largest ridership share, 302,322 (35%), while vanpool passengers account for the lowest share, 146,522 (17%). However, vanpool passengers account for the largest share of passenger miles, 7.3 million (44%), while fixed-route bus riders accounted for the smallest share of passenger miles, 1.7 million (10%). SCAT does not have updated information indicating the purpose of their riders. They have indicated that they will be collecting this type of information within the next year.

Figure III-6
SCAT Passenger and Passenger Miles
(Year 2000)



Source: SCAT National Database Report, 2000

Fixed Route Buses operate on a set schedule at designated stops. Twenty-seven transit buses provide extensive coverage throughout the cities within Brevard County as well as unincorporated areas. SCAT provides public bus service on 19 routes, weekdays, from Mims to Micco. **Exhibit III-10** shows the routes in the SCAT service area in proximity to the Spaceport. SCAT service begins at 6:00 a.m. and ends at 6:45 p.m. Weekend service is also available in some areas. All transit buses are wheelchair lift equipped, and all fixed route buses are equipped with bike racks. SCAT provides service to a variety of destinations including major shopping centers, government centers, service agencies, and local attractions. However, SCAT does not provide service directly to the Spaceport. **Exhibit III-11** shows SCAT Sub-routes number 2, 5, 6, 7, 9, 11, 12 and 13. Route number 5 is the fixed-route bus service that comes within walking distance *(0.3 miles)* of the Spaceport at Gate 3. SCAT does not track the number of Spaceport employees who use their system to access the Spaceport via the bus transit system. Vanpools are the only SCAT vehicles that enter or service Spaceport. Ridership of the SCAT bus system to access the Spaceport is limited by two factors. First the routes do not deliver riders to the gates at the Spaceport. Secondly, gates are remote from the concentrations of worksites, and therefore require an additional ride of some sort for Spaceport workers to reach their worksite. If these impediments for transit were improved then ridership may improve. SCAT officials have indicated that they would consider offering bus service to the gates of the Spaceport, if the on-site transit service met the SCAT Bus at the gates of the Spaceport.

In Brevard County, the Vanpool Leasing Program is operated jointly by SCAT and VPSI, Inc, a private company. SCAT provides the vehicles and VSPI manages the program, vehicle maintenance and billing of the participants. SCAT operates between 29 and 32 vanpools depending on need, approximately 90 percent serve either KSC or CCAFS. Vanpooling operates like a mini-transit service, with an organized route, schedule and passenger fare charges. A Vanpool is typically comprised of 7 to 15 people. Fares depend on the commute distance, the total number of riders and the type of van. Typically, the vanpool driver rides free of cost in exchange for driving, collecting fares, and managing maintenance for the van. One of the group vanpool members is the designated driver. The driver picks up riders at specific points, takes them to nearby employment sites and then picks them up and drops them off at the end of each work day. The cost of the van is shared between all participants. The typical vanpool can be as low as $65.00 per passenger, per month, depending on the number of riders. Different types of vehicles are used to support the various needs of a specific group. Seven passenger “minivans”, eight passenger “mini commuter” vans, eleven passenger “executive” vans with individual seats, and fifteen passenger “maxi-vans” are offered to commuters. In 2000, SCAT vanpools are traveled over 600,000 passenger miles per month while transporting over 12,000 passengers. **Exhibit III-12** shows origination points and routes used by various transit agencies, including SCAT Vanpools, to access the Spaceport.

Para-Transit Services provide curb-to-curb services for disadvantage and disabled citizens, with Spaceport service provided on an as-needed basis. Demand Response, or Contracted Routes, provide services for not for profit agencies. These agencies have developed 15 such routes with SCAT to transport riders to client centers in the morning with afternoon return. Both Para-Transit and Demand Response services to the Spaceport occur on an as-needed basis, and are not major factors in the transport of Spacecoast employees

Transit Services – Van Pools Operated by Other Agencies

Transit agencies from Orange and Volusia Counties also provide transit service to KSC. LYNX (Orange County) and VoTran (Volusia County) operate VanPool services that serve KSC. **Exhibit III-12** also shows origination points and routes used by LYNX Vanpools. Information on VoTran's routes could not be included because it is not documented by the agency. Currently, LYNX sends approximately six vans per day to the Spaceport area. The number of VoTran van pools has increased dramatically over the past year from 2 to 11 vans. This increase is due VoTrans efforts to market their services directly to the trade and construction unions in the Daytona Beach area. The vanpool riders are members of trade unions working at Spaceport. The union halls serve as excellent embarkation points for vanpool riders because the hall parking lots are free and available for the use of their members. They are also usually centrally located for the riders/workers. With such dramatic results, the other transit agencies serving the Spaceport with vanpools should consider marking union halls in their area.

Exhibit III-12 shows the rider-determined routes utilized by the vanpools to reach the Spaceport area. The vanpools do not use I-95, north of the Spaceport, or the Bee Line (SR 528) to access the Spaceport area. It appears these limited access highway routes are avoided to enable multiple stops and collect additional riders along the route.

Other Transit Options

Access to the Spaceport through carpooling is another mode of transportation that reduces the use of single occupancy vehicles. Carpooling is usually 2 to 6 people sharing a ride in an automobile. The most common carpool approach is rotating automobile use among carpoolers with no exchange of money. Another method is a carpooling group, using one car and sharing commute expenses. Either way, the driver of the carpool has the vehicle available for use during the workday. The extent to which carpooling occurs at the Spaceport is unknown.[1] Nationwide commuters used carpooling including vanpools for 11.23 percent of their trips. Florida ranks 16th in the country, in terms of percent of commuters who utilize carpooling or vanpooling to get to work. Carpooling/vanpooling in Florida exceeds the national average slightly at 11.86 percent of all trips.[2] As noted earlier, vanpooling in the Central Florida Region far exceeds any other region in the state. The same conditions that cause vanpool use to exceed the national and state average at the Spaceport will also cause carpool use to exceed the national average at the Spaceport. These factors include the following:

- Spaceport is remote from the population centers in central Florida, which requires a longer commute, and enhances the option of ridesharing.

[1] Reliable data for carpooling and vanpools are linked together. There is no reliable statewide or national data that separates carpool use from vanpool use.
[2] Center for Urban Transportation Research

- The facility has a campus-like development pattern that reduces the need to leave the grounds during the middle of a shift.
- The distance from the entrance gates to the worksites reduces the likelihood of leaving the worksite during the shift.

Maglev (Magnetic Levitation) is a mode of transport in which high-speed vehicles are magnetically levitated and propelled along elevated guide-ways. Maglev can transport passengers and freight over long distances at speeds of hundreds of miles per hour. The Maglev 2000 of Florida Corporation has proposed development of this mode of transport to service the Spaceport and Cape Canaveral. The Maglev 2000 of Florida Corporation asserts that the M-2000 system is low-cost, includes freight transport, and is capable of high speed (300 mph) electronic switching. They have proposed development of the first M-2000 route for Central Florida, and development of a Maglev Network connecting all of the major population centers in the United States. **Exhibit III-13** displays three alternative alignments proposed by the Maglev 2000 of Florida Corporation for service to the Spaceport.

In November of 2000, voters approved an amendment to the Constitution of the State of Florida signaling the beginning of a high speed ground transportation system in the State and starting a connection to Florida's future. The amendment requires the use of train technologies that operate at speeds in excess of 120 miles per hour and consist of dedicated rails or guide ways separated from motor vehicle traffic. The new high speed rail system is to link the five largest urban areas in Florida, and construction must begin by November 1, 2003. In March 2001, the Florida Legislature enacted the **Florida High Speed Rail Authority Act** and created the Florida High Speed Rail Authority. The Authority is charged with responsibility for planning, administering and management of preliminary engineering and a preliminary assessment of a high-speed rail system in the State of Florida. Members to the Authority were appointed by Governor Jeb Bush, the Speaker of the Florida House and the president of the Florida Senate in July 2001. Since its first meeting in Tallahassee in July 16, 2001, the Authority has focused its efforts on the initial segments of the system between St. Petersburg, Tampa and Orlando with future service to Miami as defined in the High Speed Rail Act. The Florida High Speed Rail Authority has considered the initial segments in the context of a statewide vision plan that ultimately could connect to a national high speed ground transportation network.

Air Services

Businesses and government agencies shipping air cargo to the Spaceport historically have had the option of using the on-site or off-site facilities. This section addresses the infrastructure characteristics, conditions and documented planning needs of these major facilities. The underlying objective is to gain insight on the ability of these facilities to accommodate air cargo transport needs. The locations of the airports within the service area of KSC are displayed in **Exhibit III-14.**

<u>On-Site Air</u>

Both the Shuttle Landing Facility and the Skid Strip are available for the receipt of air-shipped space cargo for military operations, and, in the past, those assets have been made available for some commercial space cargo flights. The Shuttle Landing Facility (SLF) is a 15,059 foot-long runway (nearly 3 miles long) operated and maintained by NASA with the primary purpose of accommodating Space Shuttle Landings. The Skid Strip (SS) is a 10,000 foot-long runway located at the Cape Canaveral Air Force Station (CCAFS) and is operated and maintained by the 45th Space Wing. The runway layouts for each facility are shown in **Exhibit III-15.**

Both of these facilities are capable of handling the largest, heaviest-loaded aircraft. However, due to their government and military orientation, they are not considered for routine air cargo use by private sector shippers. Given the recent heightened security posture at all facilities in the spaceport complex, limited access to aviation facilities for commercial operations should be assumed. Nonetheless, massive air shipments that could not be accommodated by off-site facilities do have an on-site option. The number and frequency of such shipments is difficult to foresee.

To enhance the operational capabilities of the Skid Strip, the projects listed below in **Figure III-7** have been proposed. Project funding is currently being sought from state and federal agencies. In addition to the capital improvements listed, navigational aids and precision approaches should be developed and implemented for the Spaceport to enhance the Instrument Meteorological Conditions (IMC) capability of the two landing facilities.

Figure III-7
Proposed Paving Projects at CCAFS

Prog. FY	Project Number	Project Title	Est. Cost	Project Description
2004	DBEH 00 1652	OVERLAY SKID STRIP	$4,000,000	Mill, pave and stripe the Skid Strip
2003	DBEH 04 1711	IDIQ-RPR. ACCESS RD/PARKING, SKID STRIP	$60,000	Mill, pave and stripe the access Road from the Forward Security gate at the Skid Strip to the Aircraft Parking ramp, the west end overrun and vehicle parking lot, including the vehicle parking lot.
2004	DBEH 01 1714A1	IDIQ-MAINT LIGHTHOUSE RD, WEST	$200,000	Mill, pave and stripe the section of Lighthouse Road between Phillips Parkway and Launch Complex 17.
2005	DBEH 01 1714A2	IDIQ-MAINT LIGHTHOUSE RD, EAST	$250,000	Mill, pave and stripe the section of Lighthouse Road between Launch Complex 17 and Central Control Road.
2005	DBEH 01 1715A2	IDIQ-MAINT PHILLIPS PKWY, NORTH BOUND	$200,000	Mill, pave and stripe two sections of the northbound side of Phillips Parkway that were deferred during previous projects.
2006	DBEH 01 1717A1	IDIQ-MAINT SKID STRIP ROAD	$75,000	Mill, pave and stripe the section of Skid Strip Road between Phillips Parkway and the forward security gate at the Skid Strip.
2004	DBEH 931601	CONST TRANSPORT ROADWAY	$275,000	Construct a two-lane asphalt roadway between the Skid Strip and Area 59 (Delta) to facilitate transfer of Delta space hardware.

Source: Keith Witt, Florida Space Authority, 2001

<u>Off-Site Air</u>

Five regional airports were identified as potential air cargo service-providers. These include four commercial service airports and a general aviation (GA) designated airport. The GA airport, Space Coast Regional, happens to be the closest facility to the Spaceport. The commercial facilities include Orlando International, Orlando Sanford, Melbourne International, and Daytona Beach International airports. The ability of these facilities to accommodate Spaceport shipment needs depends on proximity, runway infrastructure, and support and handling capabilities. This information is first summarized and addressed for all five airports, and is followed by an airport-by-airport description of the facilities and cargo-handling capabilities.

Airport Characteristics

Characteristics evaluated at the five regional airports include proximity, runway information, aircraft operation demand and capacity, cargo buildings and ramps, and cargo tonnage.

Proximity

To measure proximity to the Spaceport, a central location at the intersection of SR 405 and SR 3 was used. Distance to the intersection is measured in terms of direct distance (i.e., “as-the-crow-flies”) and most direct driving distance via the major arterial road network, as shown by airport in **Figure III-8**. Located across the Indian River Lagoon, the Space Coast Regional Airport (TIX) is a short 9 mile-drive. Given the road congestion issues addressed in the Non-Transit, Off-Site discussion, TIX is easily the most preferred off-site facility from a proximity standpoint. Daytona Beach International Airport is the furthest drive (62 miles), while the two Orlando airports and the Melbourne Airport are virtually the same drive distance from the Spaceport.

Figure III-8
Distance from Spaceport (Intersection of SR 405 and SR 3)

Airport	Direct (miles)	Drive (miles)
Orlando Int’l	41	44
Orlando Sanford	39	46
Melbourne Int’l	29	46
Daytona Beach Int’l	52	61
Space Coast Regional	9	9

Source: FDOT and WSA

Runway Information

Available data regarding runway dimensions and weight-bearing capacity is summarized in **Figure III-9**. As expected, Orlando International has the longest/widest/strongest runways – indicating the ability to accommodate any oversize aircraft that may need to deliver Spaceport cargoes. Also of note is the 7,320-foot long Space Coast Regional facility that could handle most all aircraft, such as Boeing 727s and 737s, given review of aircraft manufacturers’ published guidelines on aircraft performance. Similarly, the other three commercial service airports could accommodate virtually all aircraft.

Figure III-9
Airport Runway Information (2002)

Airport	Orientation	Dimensions: Length (ft.)	Dimensions: Width (ft.)	Weight Bearing Cap. (lbs.) by Landing Gear Type: Single Wheel	Dual Wheel	Dual-Tandem	Dbl-Dual-Tandem
Orlando Int'l	RW 18L-36R	12,005	200	165,000	200,000	400,000	-
	RW 18R-36L	12,004	200	100,000	200,000	400,000	
	RW 17-35	10,000	150	75,000	210,000	400,000	-
Orlando Sanford	RW 09L-27R	9,600	150	30,000	170,000	300,000	-
	RW 18-36	6,002	150	30,000	170,000	300,000	-
	RW 09C-27C	3,578	75	12,000	-	-	-
	RW 09R-27L	3,500	75	12,000	-	-	-
Melbourne Int'l	RW 09R-27L	10,131	150	100,000	165,000	300,000	
	RW 09L-27R	6,000	150	60,000	60,000	-	-
Daytona Beach Int'l	RW 07L-25R	10,500	150	130,000	210,000	420,000	870,000
	RW 16-34	6,001	150	75,000	170,000	260,000	270,000
	RW 07R-25L	3,195	100	30,000	-	-	-
Space-Coast Reg.	RW 18-36	7,320	150	80,000	110,000	190,000	-
	RW 09-27	5,000	100	50,000	80,000	-	-
Example Aircraft	NA	NA	NA	DHC6-300, Shorts 360 CASA 212, EMB 110	Boeing 727,737 DC-9, Bae 146	Boeing 757, 767, DC 8, Airbus A300, A310, A320, A330	Boeing 747

Notes: Runway weight bearing capacity is a realistic estimate of capability at an average level of activity. It is not intended as a maximum allowable weight or as an operating limitation. Permissible operating weights, insofar as runway strengths are concerned, are a matter of agreement between the owner and user. Omitted data represented with a "-" is currently unavailable.
Source: Airport Facility Directory, Southeast U.S., US Dept. of Transportation, Effective 3 Oct, 2002.

Based Aircraft and Aircraft Operation Demand and Capacity

Aircraft operations and based aircraft data for the five airports is presented in **Figure III-10**. The Orlando airports are the busiest of the five, although the types of operations differ significantly – 89 percent of Orlando International's operations are commercial, versus 1.2 percent for Orlando Sanford. The strong General Aviation emphasis at Sanford is also evident by the high number of based aircraft (232). The Orlando Sanford Airport's demand for air travel services is reflected in its recent 363,224 annual aircraft operations (landings + takeoffs). The airport operates at 80 percent of its annual throughput capacity and can effectively support 470,000 operations annually. This percentage of its annual throughput capacity is called the Demand Capacity Ratio (D/C Ratio) and it is a measure of the maximum number of annual operations that can be accommodated by the airport.

Daytona Beach International indicates a similar level of aircraft operations and GA presence as Sanford, led by the strong presence of the Embry Riddle flight training facility. However, with a lower operational capacity (355,000) than Sanford, the demand capacity ratio at Daytona Beach surpasses 100%. Although periodic large shipments of air cargo are unlikely to be impacted by the high ratio, it does underline an obstacle in attracting future air cargo carriers. Both Space Coast Regional and Melbourne International Airport have plenty of capacity available to accommodate future air cargo carriers.

Figure III-10
Based Aircraft and Aircraft Operations (1999-2000)

Airport	Based Aircraft	Aircraft Operations (Demand)			Acft. Ops. Service Vol. (Capacity)	Demand/ Capacity Ratio
		Commercial	General Aviation	Total		
1999						
Orlando Int'l	14	322,256	41,600	363,856	471,000	77.3%
Orlando Sanford	232	4,319	358,905	363,224	468,100	77.6%
Melbourne Int'l	212	7,105	150,126	157,231	375,000	41.9%
Daytona Beach Int'l.	188	6,438	356,427	362,865	355,000	102.2%
Space Coast Regional	229	0	121,357	121,357	200,000	60.7%
Total	**875**	**340,118**	**1,028,415**	**1,368,533**	**1,869,100**	**73.2%**
2000						
Orlando Int'l	1	330,775	35,502	366,278	471,000	77.8%
Orlando Sanford	232	5,654	366,130	371,784	468,100	79.4%
Melbourne Int'l	174	7,365	184,788	192,153	375,000	51.2%
Daytona Beach Int'l	270	7,036	364,979	372,015	355,000	104.8%
Space Coast Regional	229	0	149,110	149,110	200,000	74.6%
Total	**906**	**350,831**	**1,100,509**	**1,451,340**	**1,869,100**	**77.6%**

Source: Florida Aviation System Plan (FASP 2000)

Air Cargo Buildings and Ramps
The breadth of Orlando International Airport's cargo handling infrastructure relative to the other regional airports is evident in **Figure III-11**. Currently, 17 buildings provide over 800,000 square feet of warehouse space and the dedicated cargo ramp spans 880,000 square feet. Melbourne also has significant infrastructure currently in place with 3 buildings covering 146,000 square feet and a 170,000 square foot cargo ramp.

Figure III-11
Air Cargo Buildings and Ramps

Airport	Cargo Buildings		Cargo Ramps	
	Number	Sq. Ft.	Number	Sq.Ft.
Orlando Int'l	17	820,842	1	880,000
Orlando Sanford	1	48,000	--	--
Melbourne Int'l	3	146,000	1	170,000
Daytona Beach Int'l.	1	3,104	--	--
Space-Coast Regional	--	--	--	--
Total	**22**	**1,017,946**	**2**	**1,050,000**

Source: Florida Aviation System Plan (FASP 2000)

Air Cargo Tonnage

The vast majority (96%) of regional air cargo (both freight and mail) for the five airports goes through Orlando International as shown in **Figure III-12**. The majority of the air cargo is freight (73%) versus mail (27%). To understand how the air cargo is moving, Official Airline Guide (OAG) tonnage data for scheduled movements was reviewed.[3] The data indicates that most scheduled operations at the four commercial service airports carry cargo in the belly of narrow-body, passenger aircraft. Additionally, scheduled wide-body, passenger aircraft and full-freighter cargo service movements occur only at Orlando International.

[3] Scheduled movements account for roughly 44 percent of all air cargo movements, versus the other "unscheduled" (56%) for which aircraft data is not available

Figure III-12
Annual Cargo Tonnage - 2001

Airport	Freight	Mail	Total Cargo (Freight and Mail)
Orlando Int'l	202,808	43,859	246,667
Orlando Sanford	9,431	-	9,431
Melbourne Int'l	282	118	400
Daytona Beach Int'l	180	2	182
Space Coast Regional	-	-	-
Total	**212,701**	**81,240**	**256,680**

Source: Florida Aviation System Plan (FASP 2004)

Airport Inventory

These airport characteristics and other relevant data are discussed below by airport:

Orlando International Airport (MCO)
Orlando International Airport handled 287,819 tons of airfreight and mail in 1999, ranking as the 65th busiest in the world according to Airports Council International. Since 1990, air cargo has more than doubled (110%), evolving from belly cargo in passenger aircraft to include all-cargo carriers with little charter activity. This trend has been supported by two converging trends: first, the growth of the small package, time-definite business that requires regularly scheduled all cargo aircraft, and second, the downsizing of aircraft (and consequently, cargo capacity) by Delta and other passenger carriers operating in the Orlando market. Additionally, Orlando has experienced significant growth in the airport-to-airport cargo business, with most of Central Florida's mail (within 500 miles) trucked to the Orlando sorting facility.

Most of the air cargo activity occurs at the Tradeport, a 1,400-acre parcel on the west side of the airport, as are shown in **Exhibit III-16**. The Tradeport includes a U.S. Department of Agriculture inspection station, a perishables center, a 205-acre Foreign Trade Zone, 140 acres of cargo ramp, over 500,000 square feet of cargo warehouse space[4], and aircraft parking that can accommodate up to 27 freighters. Orlando also has the largest capability to expand of all of the Florida Airports. For these reasons, FedEx is currently building a large 160,000 square foot multiplex, truck-sorting facility located close to the existing U.S. Postal Service facility. An important synergy will undoubtedly occur between the two as FedEx implements its recent agreement to handle priority and express mail for the U.S. Postal Service.[5]

Given the substantial and growing air cargo activity, the Airport maintains an active marketing staff dedicated to targeting airlines, forwarders and brokers. While, Miami

[4] A total of 820,842 square feet is currently available at the Airport - see Figure III-11.
[5] Emery Air Freight had held the priority mail contract and had used an 180,000 square foot facility with a 350,000-piece throughput/night.

looms as a formidable competitor for international air cargo, Orlando is pursuing its own market niche in European and Canadian trade. The United Kingdom, the Netherlands and Germany are Central Florida's largest trading partners. These trading patterns are distinctly different from Miami and form the basis for Orlando's focus on trade with Europe as its future air cargo growth path. Orlando also wants to capitalize on the wave of e-commerce and hopes to increase warehouse distribution activities at the industrial park across from Boggy Creek Road.

Orlando Sanford Airport (SFB)
Air cargo activity at the Orlando Sanford Airport has been wholly associated with charter flights. The airport is working to attract an all cargo carrier to the airport and to fill remaining cargo space. The recently constructed 48,000 square foot cargo building on the southwest corner of the main ramp is fully leased to TBI Cargo, which handles belly cargo from international charter flights. Although no other expansions are planned in the near term, the Master Plan does call for additional cargo facilities as needed. The Airport Layout Plan is shown in **Exhibit III-17.**

Melbourne International Airport (MLB)
Air cargo flown from the Melbourne International Airport has grown slightly over the past five years due to an increase in local businesses. Delta ships all of Melbourne's airfreight in the baggage compartments of MD88 aircraft to Atlanta, with area funeral homes being the major shippers. For these purposes, the main 120,000 square foot cargo building, as shown in **Exhibit III-18**, is adequate to handle current and future volumes. The Airport also has two other smaller facilities of about 10,000 square feet each, and a cargo apron of about 4 acres. Most cargo is trucked from the Melbourne area to Orlando, which has created a major challenge in attracting cargo carriers to MLB. However, an additional cargo building of 60,000 square feet is planned within the next 10 years.

A recent air cargo service analysis conducted for the Airport found that substantial local demand for air cargo services exists within the Melbourne area with ten area companies generating over 75 percent of all local air cargo. The existing Runway 9R-27L is capable of supporting heavy cargo activities. The runway has been extended to 10,181 feet and is able to accommodate all domestic and most international operations. A Category I ILS system also permits operations 99.7 percent of the year. However, located within 100 miles of Orlando, negative diversion could continue, especially given the new FedEx hub at Orlando. Additionally, lack of freight forwarders at the airport and limited passenger service hamper significant growth.

Daytona Beach International Airport (DAB)
Cargo activity has declined significantly in recent years due to a decrease in passenger activity. Additionally, economic development in the Daytona Beach area has lagged behind other areas, with no significant manufacturing to drive demand for air cargo services. However, current activity levels are expected to remain stable over the next ten years, with the largest use of air cargo being human remains.

Currently one dedicated airfreight facility of 3,104 square feet currently exists, shown in **Exhibit III-19**, which is used by Delta for processing belly cargo. The building also houses the airport maintenance office and has some vacant space. The building is not adjacent to a taxiway or apron and there is no dedicated cargo apron. Given the limited cargo volume and growth, no major cargo facilities are planned. Nonetheless, Daytona Beach seeks air cargo development based on its following strategic assets: it's location north of Miami, low airport costs, schedule flexibility, room to grow, and the local labor market (Embry Riddle Aeronautical University graduates).

Space Coast Regional Airport (TIX)
Space Coast Regional Airport has no scheduled air cargo service, but has the capability to handle small corporate/business type aircraft. In the past, the airport has also provided services to military cargo aircraft transporting space cargo to the Spaceport. Several space-related businesses also operate general aviation services out of the airport. Given the very close proximity to the airport, the Space Coast Regional Airport offers relatively quick, easy access for all aircraft. Cargo destined for the Spaceport can use the facility; however, lack of any scheduled air cargo services constrains use of the Airport for smaller, routine shipments. The Airport Layout Map in **Exhibit III-20** shows the cargo handling area located on the west end of the airport.

Summary

The five airports in the immediate vicinity of the Spaceport have the infrastructure and capacity to accommodate all the air shipment of space-related cargo anticipated to be transported to the Spaceport in the foreseeable future. Each of these airports is poised to provide service to the Spaceport when called upon.

Railroad Services

The On-Site rail analysis reviews the infrastructure and cargo operations of the two rail facilities. The Off-Site analysis reviews Florida's overall rail system with an emphasis on the Spaceport's immediate connectivity with the Florida East Coast (FEC) Railroad. In addition to cargo operations, the Off-Site Analysis addresses the market potential of Spacecoast passenger rail service.

On-Site Rail

The On-Site rail facilities consist of two separate operations. The Kennedy Space Center (KSC) Railroad is owned by the Florida East Coast (FEC) Railway and has three sections - the "Main Line", the "East Leg" and the "West Leg", as shown in **Exhibit III-21**. The East and West Legs connect to the Main Line, which feeds into the national rail network via the FEC near Titusville in Brevard County. This connection to the FEC mainline was completed in 1963. The second on-site rail facility, the Cape Canaveral Air Force Station (CCAFS) Railroad, connects to the south end of the KSC's East Leg. Combined, the total on-site rail trackage totals just less than 40 miles.

Main Line (KSC)

A full two-legged wye that opens to the east connects the KSC Main Line to the FEC. Just east of the KSC Mainline/FEC interchange lays a parallel storage track owned by the FEC. A fence and gate east of the wye delineates the change in ownership from FEC to KSC. Beyond the gate and still on the mainland side lies the "Jay-Jay Yard", which consists of three storage tracks used as the interchange point for all rail cars delivered from or picked up by the FEC railway.

A long concrete railway bridge, with a lift span for the Indian River Lagoon Intracoastal Waterway connects the KSC track on the mainland with the causeway to the KSC/CCAFS facilities on Merritt Island. From the FEC main line, through the Jay-Jay yard and across the bridge is approximately one-mile. In total, the Main Line track extends 12 miles east from the Jay-Jay Yard to the wye north of the Wilson Yard turnout. Located at Milepost 7 just west of the connection of the east and west legs, the Wilson Yard is a principal staging area for shipments along both legs, and provides an over flow area to store empty cars awaiting shipment to the Jay-Jay Yard.

West Leg (KSC)

Originating at Wilson Junction (Milepost 7.5), the West Leg runs down the middle of the Island for about 10 miles (Milepost 17.5W). It receives the most freight deliveries (over 75%) and extends south past the VAB area. The West Leg terminates at the vehicle Loading and Unloading Ramp (M7-651) in the Industrial Area. A number of spurs and sidings have been constructed along this leg, as described below:

- Suspect Car Siding (Milepost 8.1W) - Located at the north end of the Shuttle Landing Facilities (SLF), the siding extends westward from the main line. This facility is in an isolated area, which was installed to store leaking cars or those containing hazardous materials. Its primary use is for staging cars containing fully fueled Solid Rocket Motor (SRM) segments.

- CCF Spur and Wye (Milepost 12.1W) - This spur for the Converter Compressor Facility (CCF), begins at the wye north of the VAB and extends 1.5 miles (2.4 kilometers) eastward. This spur carries SRM segments to the Rotation Processing and Surge Facility (RPSF) via several sidetracks. East of the RPSF is the CCF area containing three sidetracks where numerous helium rail cars are changed out each month. This spur also supports a railcar for solvent delivery.

- VAB Spur (Milepost 12.5W) - The VAB spur leads to two tracks inside the VAB. These tracks were installed to deliver SRM segments prior to construction of RPSF. This spur is currently out of service and is used to store both mechanized and non-mechanized track maintenance equipment.

- Contractors Road Yard (Milepost 13.1W to 14.1W) - This yard contains three, one mile-long tracks that parallel the main line, two on the east side and one on the west. It is adjacent to Contractors Road and provides space for the primary service yard. The Locomotive Maintenance Facility serves as operational center for all rail services. South of this area, expended SRM casings and other oversized equipment are loaded onto or off of railcars. Spare equipment and rolling stock are stored at this yard.

- Orsino Siding (Milepost 16.1W) - This siding sits adjacent to the Communications Distributions and Switching Center (CD&SC), one block North of NASA Parkway East and is used to stage railcars into the Industrial Area. Its most important function is to position engines for delivering cars into the various Industrial Area spurs.

- Industrial Area Sidings (Milepost 17.5W) - A majority of rail cargo for the Industrial Area is processed at supply warehouses, which have small sidings for unloading the cars. Rails terminate at a ramp used for flatbed railcar delivery operations.

East Leg (KSC and CCAFS)

The East Leg includes track owned by both the KSC and the CCAFS. The track is considered a secondary main line extending nine miles eastward from Wilson Yard and paralleling Beach Road. In 1992 the railroad and old Beach Road were switched. The east leg was moved south and track was placed onto the westbound lane of old Beach Road. The previous tracks were removed and the roadbed was paved to become the new Beach Road, allowing public access to Canaveral National Seashore when Pad 39B is in use. This new east leg utilizes the old Beach Road to cross through swamp marsh before turning south at Playalinda Beach. This line continues southbound along the eastern side of Samuel C. Phillips Parkway passing pads 39A and 39B. KSC's responsibility terminates south of Pad 39A at the Balloon Yard. The major spurs and sidings along this leg are described below:

- Pad LC-39B Spur – This line was first developed for moving construction materials to Pad LC-39B and is now used to deliver liquid hydrogen to the Pad's propellant storage sphere.

- Pad LC-39A Spur – This spur was constructed for the same purposes as Pad LC-39B. It is also currently used for the delivery of liquid hydrogen.

- Beach Siding – This short siding is used for staging liquid hydrogen tanker cars and occasionally the area is used by the Air Force. It is located between pads LC-39A and LC-39B.

- Balloon Siding – The siding serves as an interchange between the KSC and CCAFS railroads, and as a temporary storage facility for railcars containing materials used by the Air Force.

At the "Balloon Siding" KSC transfers railcars to CCAFS control. The Air Force constructed this rail causeway and rail yard on KSC property north of Launch Complex LC-40 and LC-41 to handle railcars carrying Titan rocket components into the Integrated Test and Launch (ITL) facilities supporting Titan vehicle operations. The Air Force also delivers nitrogen tetroxide (N204) to LC-40 and LC-41 using railcar tankers. The KSC provides delivery service from the Jay-Jay Yard to CCAFS under a cooperative agreement. Milepost markers have not been installed.

Operations and Movements

The FEC, through its subsidiary, maintains Space Center roadbeds and tracks, and has created a skilled workforce of about a dozen people to repair locomotives and restore rolling stock. Additionally, the KSC performs reimbursable services for CCAFS. Railway equipment includes three, four-axle, diesel electric locomotives acquired in 1985, and approximately 82 railway cars. KSC has a variety of rolling stock including liquid hydrogen (LH2) cars, tanker cars, flatbed cars, and various cars built to carry space hardware. Segment cars are provided by the SRB contractor and are not owned by the Space Center. Of the 82 cars, 44 cars are suitable for interchange with the FEC. The other 38 cars are used in-house and never leave the KSC rail network.

Rail car movement activity at the Spaceport has consistently averaged between 200-250 cars per year over the past five years with the vast majority (greater than 85%) being inbound or outbound revenue movements. Rocket motors, the major inbound commodity, comprise 35 of the 84 inbound revenue movements (43%). Outbound revenue materials consist of various earth materials and related products (i.e., bricks, limestone, ballast rock, etc.). Inbound and Outbound movements by type are summarized on the next page in **Figure III-13**.

Figure III-13
Annual Car Movements – 2000

Movement Type	Inbound	Outbound	Total Cargo
To Interchange (i.e., Revenue)	84	126	210
Local	2	2	4
Non-Revenue	5	25	30
Total	**91**	**153**	**244**

Source: Waybill Sample

On-Site Improvements

Various improvements have been undertaken in the past ten-years to fix and/or upgrade KSC railroad facilities.

- Main Line Improvements - In the early 1990's, the Center proceeded with an ambitious project of replacing existing wood crossties and jointed rails. These old rails were of light to medium capacity (6 different sizes). The new material is a single size, of continuously welded, heavy-duty rail combined with concrete crossties. This project has reduced the maintenance required and increased crosstie life from 15 years to 50 years. The six road crossings equipped with flashing warning lights have been upgraded with all new equipment, so all such devices will be interchangeable with each other.

- Repairing the Jay-Jay Bridge - Extensive improvement projects were conducted between 1988-1992 to repair the Jay-Jay Bridge. This entailed extensive maintenance, anticorrosion protection, and replacement of degraded structural members.

- LH2 Tanker Car Operations - Four Hydrogen tanker cars have been modified to improve safety levels. These upgraded, tankers are being used to Economically haul liquid hydrogen (LH2) to storage tanks at LC-39.

In addition to these improvements, the following have also been identified:

- Suspect Car Siding (West Leg) - It is planned to extend this track by around 1,000 feet. This additional trackage would parallel the SLF.

- West Leg Main Line - The west leg or beach side trackage from near Gate 6 to the Balloon Area is currently being improved with concrete ties replacing wood ties and good quality 112-lb. welded rail replacing corroded 115-lb. rail.

- Road Crossings (System Wide) - It is planned that all road crossings will be numbered to bring them into compliance with the National – DOT Crossing Inventory process.

Access to Port Canaveral

In the past, service to Port Canaveral was planned using the East Leg or beach side trackage. The trackage would generally follow the existing highway road system: Phillips Parkway, ICBM Road, and Pier Road. During launch times on Pad 39A and 39B, this East Leg trackage could be closed to rail traffic for as long as ten days at a time. Based on this operating scenario and other factors, Port Canaveral has declined to emphasize rail access utilizing the KSC line.

However, a port access viable option exists from the south end of the West Leg. In the northeast quadrant of the Kennedy Parkway South and NASA Causeway East intersection, the track can be extended eastward. This new track would parallel the NASA Causeway. It could use expanded roadbed fill on the same causeway used by the road to cross the Banana River. A small bridge, similar to the highway bridge, would need to be constructed. Once across the Banana River, the new track could continue east along Central Control Road (NASA Causeway East extended) to provide access to any or all of the launch pads in that area. Alternatively, the track could swing south along the west side of Hangar Road and Phillips Parkway to provide direct and uninterrupted service to Port Canaveral.

Off-Site Rail

The off-site rail analysis addresses both cargo and passenger rail service in the region.

Railroad Freight Service

The Florida rail system comprises 13 line-haul railroads and four terminal or switching companies (Exhibit III-14) range in size from fairly small intrastate railroads to members of large rail systems extending from Florida into Canada. Of the line-haul railroads, two are Class I carriers, one is a Class II, and the remainder are Class III carriers. The Florida rail system is displayed in **Exhibit III-22 (left side).** These railroads comprise approximately 2,900 route miles. CSX Transportation's (CSXT) 1,619 Florida route miles represent 56 percent of the statewide rail system. The Florida East Coast Railway (FEC), with 386 route miles, is the second largest carrier in terms of Florida mileage accounting for 13 percent of the State rail system.

The Florida East Coast Railway

From the Jay-Jay Yard, the KSC connects to the national rail network via the Florida East Coast Railway (FEC), as shown in **Exhibit III-22 (left side)**. The FEC is a Class II railroad with its main line running from Jacksonville to Miami. The railroad operates over 386 route miles of track, and interchanges with both CSXT and Norfolk Southern Railway (NS) in Jacksonville. Major commodities handled by FEC are non-metallic minerals, vehicles and various commodities moved in containers and trailers. Two off-site intermodal facilities are in proximity to the Spaceport. The FEC operates the City Point Reload Center in conjunction with Ambassador Services in Cocoa, which has 20 car spots with both closed and open storage to handle building materials and general/bulk commodities. The FEC also formerly operated a piggyback ramp in the Cocoa-Rockledge area, which has been closed for several years. Such a facility could provide off-dock service for Port Canaveral containers if needed.

Figure III-14
Florida Freight Railroads - 2000

Railroad	Miles in Florida		Percent of Florida Rail System Owned/Leased
	Owned/ Leased	Trackage Rights	
Alabama and Gulf Coast	44		1.5
Apalachicola Northern	96		3.3
Bay Line	63		2.2
CSX Transportation[1]	1,619	131	56.1
Florida Central	66	10	2.3
Florida East Coast	386		13.4
Florida Midland	40		1.4
Florida Northern	27		0.9
Florida West Coast	14		0.5
Georgia and Florida	48		1.7
Norfolk Southern	96	53	3.3
Seminole Gulf	119		4.1
South Central Florida	158		5.5
South Florida Rail Corridor	81		2.8
Terminal Companies	30		1.0
TOTALS	**2,887**	**244**	**100.0**

(1) Amtrak also operates over 1,098 route miles in Florida but does not own any mainline trackage in the State. It operates over CSXT main tracks from Alabama and Georgia to Jacksonville and from Jacksonville to Tampa and Miami. Trackage rights includes the 81mile South Florida Rail Corridor owned by the State of Florida, but maintained and dispatched by CSXT on behalf of the State, for its own freight trains, Amtrak intercity passenger trains and Tri-Rail commuter trains.
Source: 2000 Florida Rail System Plan, Wilbur Smith Associates

The CSX Transportation (CSXT)

The CSXT is a Class I railroad that operates approximately 19,000 route miles and serves 20 states, the District of Columbia and one Canadian province. As Florida's largest railroad, it operates 1,750 route miles in Florida, covering virtually every area of the State. In addition to the 1,619 miles it owns, it also operates over the SFRC, the Georgia and the Florida Railroads. Major CSX Commodities transported are non-metallic minerals, chemicals and allied products, and coal.

The Norfolk Southern Railway (NS)

The NS, also a Class I railroad, operates a total of approximately 14,500 route miles and serves 20 states and one Canadian province. In Florida, NS operates 96 route miles comprised of lines of two former subsidiaries -- Georgia Southern and Florida, and Live Oak Perry and South Georgia -- and trackage rights over CSXT from Jacksonville to Palatka. The NS-owned mileage is comprised of two lines -- one running from Georgia into Jacksonville, and the other from Georgia to Navair. The railroad also has a haulage agreement with the FEC and markets to all of the east coast of Florida. The Norfolk Southern Railway Company is owned by the Norfolk Southern Corporation. Major commodities transported over the NS in Florida are nonmetallic minerals; food and kindred products; pulp, paper, and allied products; and, various commodities moved by piggyback.

For years, the railroad industry's standard weight limit has been 263,000 lbs., the nominal weight for the 100-ton capacity car. Now, in an efficiency move, the industry is raising the limit to 286,000 lbs. Many of the same concerns over bridge and track capability to handle the increased weights that accompanied introduction of the 100-ton car have surfaced again. Railroad mainlines have been cleared or are being improved to handle the new cars which are currently being produced. The problem lies with the light density line system comprised principally of the state's short line rail carriers. Maintenance on many of these lines was deferred by the previous Class I owners before they were spun off to short line operators, and with marginal traffic levels, infusion of the significant amounts of capital to upgrade them has not occurred.

Railroad Commodities

In 1999, 169 million tons of rail freight originated and/or terminated in Florida. Of the total, 111 million tons were intrastate traffic (both originating and terminating within Florida). As seen in **Figure III-15,** non-metallic minerals dominate traffic statistics with 52 percent of total originating and terminating tonnage. Chemicals or allied products are a distant second with 12.2%, and coal ranks third with 9.1%. Commodities that terminate in the state from origins outside of the state (excluding intrastate traffic), 44.5 million tons, far outweigh those that originate in the state and are shipped out of it (13.7 million tons).

Figure III-15
Florida Rail Freight Traffic -1999 (1,000 tons)

STCC	Commodity Description	Originated	Terminated	Totals	% of Total
11	Coal	w/d	w/d	15,301	9.1%
14	Nonmetallic Minerals; Except Fuels	42,980	45,261	88,241	52.2%
20	Food or Kindred Prod.	2,470	3,941	6,411	3.8%
24	Lumber/Wood Prods; Except Furnt.	864	2,909	3,773	2.2%
26	Pulp, Paper or Allied Prod.	1,871	1,961	3,832	2.3%
28	Chemicals or Allied Prod.	11,086	9,573	20,659	12.2%
32	Clay, Concrete, Glass or Stone Prod.	1,258	2,206	3,464	2.1%
46	Misc Mixed Shipments	2,080	4,456	6,536	3.9%
	All Others (1)	6,204	14,348	20,552	12.2%
	Totals	**68,979**	**99,790**	**168,769**	**100.0%**

(1) Includes all commodities comprising less than 2 percent of total.
w/d - withheld due to disclosure concerns.
SOURCE: 1999 STB Waybill Sample.

Passenger Rail Service

Conventional intercity rail passenger service in Florida continues to be operated by the National Railroad Passenger Corporation (Amtrak). Florida is fortunate, as it has a variety of Amtrak services linking it with the Northeast and the West, but no passenger rail service is currently available in the Space Coast area. Rather, the nearest service is in Orlando. However, plans are underway to connect the state's major urban centers, world-class tourist attractions, and intermodal transportation centers. The Florida Intercity Passenger Rail Service Vision Plan[6] proposes to do so with incremental investments in rail infrastructure.

The recent history of passenger rail service can be traced back to 1991 when the FDOT assumed responsibility for Florida's high-speed transportation program. Options for future rail system development were completed and a franchise was awarded in 1996, but the program was subsequently terminated in 1999. Voters then approved a constitutional amendment in the November 2000 election requiring the state to develop and operate high-speed ground transportation. However, it is unclear, at this point, what the Department's role might be in this latest effort.

The 2000 Florida Rail System Plan reviewed Florida's market for inter-city passenger rail demand. In the study, a travel demand model (developed for FDOT in 1992 and updated with 1997 data) was used. The model indicated a very large travel market for Intercity Space Coast traffic. Trip distance, rail ownership, and person trips for all modes (primarily, automobile and airplane trips) for the years 2000 and 2010 are summarized for the Space Coast trips in **Figure III-16**.

Regarding Space Coast's intercity travel markets, the Orlando Space Coast is the largest with 13.77 million trips (17.71 by 2010). However, the relatively short distance will deter automobile drivers from diverting to rail. Additionally, no rail corridor is currently established. Along the existing FEC, another 2.2 million trips were estimated for the Miami Space Coast travel market, and 1.21 million for the Jacksonville Space Coast travel market. Study is also underway regarding the potential of a Coast-to-Coast railway from Port Canaveral to St. Petersburg.

Figure III-16
Potential Travel Markets for Intercity Passenger Rail Service

Intercity Travel Markets	Existing Rail Corridor	Distance (miles)	Year 2000 Person-Trips (millions)	Year 2010 Person-Trips (millions)
Orlando Space Coast	No	45	13.77	17.71
Southeast (Miami) Space Coast	FEC	210	2.20	2.65
Jacksonville Space Coast	FEC	130	0.95	1.21

Source: Florida Department of Transportation.

Ultimately, the Vision Plan envisions four phases of development to address the various statewide needs. Service improvements to the Port Canaveral area were identified for Phase 3, a ten-year period between 2006 and 2015. This includes new construction of an Orlando to Port Canaveral section, as well as, initiating passenger Amtrak service along the FEC's Jacksonville to Miami track.

[6] *The Florida Intercity Passenger Rail Service Vision Plan*, prepared for FDOT by Amtrak, May 2000, from which this discussion is taken.

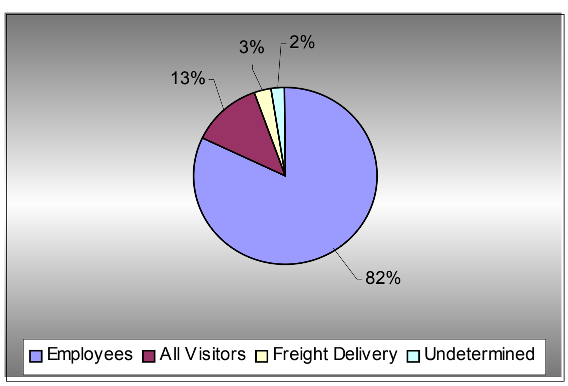
IV. USER CHARACTERISTICS

From a transportation perspective, Spaceport "users" consist of the people and cargo that move to/from the Spaceport. **People movement** includes Spaceport employees, including both shift and support workers. People movement also includes visitors to the Spaceport, including both official visitors and general public visitors. **Cargo movement** concerns space-related cargo and support cargo that is transported to the Spaceport. How people and cargo access the Spaceport will be addressed in this section.

People Movements

People movements consist of, both, those who work at and visit, the Spaceport. The number of shift workers at the Spaceport can vary weekly based on launch status. The current official employment number provided by the Spaceport is approximately 27,000 employees.[7] This figure includes NASA civil service employees, military employees, and contractors at KSC and Cape Canaveral Air Force Station. Workers that access the Spaceport to deliver goods are estimated to total between 800 and 900 per day. Visitors to the Spaceport and Merritt Island National Wildlife Refuge average approximately 9,000 on a daily basis. This figure includes 7,700 visitors to the Visitors Complex. Visitors to Merritt Island National Wildlife Refuge average approximately 1,300 per day. **Figure IV-1** shows an estimate of the daily trips by users of the Spaceport. The basis for this estimate is the daily traffic counts and the total number of employees that work at the Spaceport. Other factors include: assumed fluctuations in daily workers, the percent of daily truck trips and passenger density of vehicles transporting visitors.

Figure IV-1
Daily Trips by User Groups



Source: Wilbur Smith Associates

[7] CCAFS General Plan – October 2001

Employees

Employees include regular-shift workers, both full-time and contractors, who typically arrive in the morning or at the beginning of a shift. These regular-shift workers leave in the evening or at the end of a shift. Conversely, support workers come and go throughout the day. As noted earlier, approximately 27,000 workers are employed at the Spaceport.

Shift Workers

Regular-shift workers comprise the vast majority of employees entering the Spaceport. United Space Alliance (USA) is the largest employer at the Spaceport and utilizes three shifts. The first shift allows several variations for beginning and ending times. Workers can begin from between 5:30 a.m. to 8:00 a.m. and leave from between 2:30 p.m. to 5:00 p.m. The second shift is less flexible begining at 3:00 p.m. and ending at 11:00 p.m. The third shift begins at 11:00 p.m. and ends at 7:00 a.m. USA estimates that approximately 75 percent of all its employees are on-site during the first shift. The second shift (the swing shift) brings in approximately 15 percent of all employees. The third shift (the graveyard shift) has approximately 10 percent of all employees on site.[8]

Shift worker movements typically consist of arriving at the worksite and remaining at the primary location for the duration of the shift. The primary transportation mode used by shift workers is a personal vehicle. Alternatives could include arriving in an organized vanpool or carpooling with one or more other individuals. The major employers interviewed for this report had no knowledge of the extent their employees used carpools or vanpools to access the Spaceport. Currently, there are 500 employees using vanpools to access the Spaceport on a daily basis, comprising approximately 2 percent of all Spaceport workers. Based on the limited vanpooling and carpooling at Spaceport, it is assumed that most vehicles carrying workers to the Spaceport average just over 1 occupant car per vehicle.

Support Workers

Support workers typically work for off-site vendors and agencies providing support to Spaceport facilities and programs. The most visible type of support worker at the Spaceport delivers goods to on-site facilities. Since as many as 3 percent of the vehicles entering the Spaceport are trucks, it is assumed that at least 3 percent of the trips entering the Spaceport are transporting support workers. Some support workers drive vehicles other than trucks, such as Federal Express drivers who can make deliveries in vans. Therefore, the number of support workers entering the Spaceport on a daily basis is assumed to be greater than 3 percent of all trips.

Support worker movements do not follow a defined pattern as do shift workers. A support worker movement could involve one entry into the Spaceport and an immediate

[8] Estimate based on an Interview with Linda Bradley, USA

exit, or multiple stops at locations throughout the Spaceport. Another scenario for support worker movement is multiple entries in a single day. Off-site support workers would typically require the use of a vehicle to access the Spaceport. Carpooling or vanpooling is generally not an option for support workers.

Exhibit IV-1 (left side) shows the location of employees located in proximity to the Spaceport. This map shows a clustering of businesses in proximity to Port Canaveral and in the Titusville area. Employment centers are also located along the major arterials in the area such as SR528 and US1. **Exhibit IV-1 (right side)** shows the location of major off-site businesses and vendors that serve the Spaceport. These businesses employ over 3,100 workers. The businesses included in this exhibit were identified using 4-digit Standard Industrial Classification (SIC) codes. These SIC codes were identified as aerospace-related businesses.[9] Business that serve the Spaceport, but that do not fit into the space-related SIC Codes, were identified from NASA's Vendor list. The names of businesses and agencies that have worked for NASA over the last five years were obtained from the NASA website. These businesses were then surveyed for their location and number of employees, and added to the database of space-related businesses. Only off-site businesses were included in the map. These businesses comprise the base list of off-site support workers to the Spaceport.

<u>Visitors</u>

A total of 2.8 million visitors entered the Spaceport in 2000. Visitors include general public visitors, who come to the Visitor Complex, and Official visitors, who come at the invitation of the Spaceport. Approximately 500,000 visitors come to the Merritt Island National Wildlife Refuge annually.

<u>General Public and Visitors</u>

The general public and visitors access the Spaceport at the Kennedy Space Center Visitors Complex. On an average day, 7,700 visitors enter the Visitor Complex and tour accessible Spaceport facilities. During the year 2001, visitors have decreased considerably, but visitors typically increase each year at a rate of 3.5 to 4.0 percent per year. [10] The number of tourists expected to visit the Spaceport by year 2025 is projected to fall in a range of 3.6 million at the low end and 5.7 million at the high end. [11] This range is closely tied to tourism in Central Florida and assumes the range would be adjusted based on changes to the following factors: stable average U.S. economic growth, no major local or international disruptions, U.S. leisure time constraints are expected to remain stable at current levels, continued consumer demand for theme park products, and continued investment in new attractions and entertainment capacity.

The Visitor Complex is the first point of entry for visitors to the Spaceport. Visitors access this site from Titusville along NASA Causeway west. Vehicles carrying visitors have been observed to carry an average of 3.0 to 3.5 persons per vehicle. Therefore,

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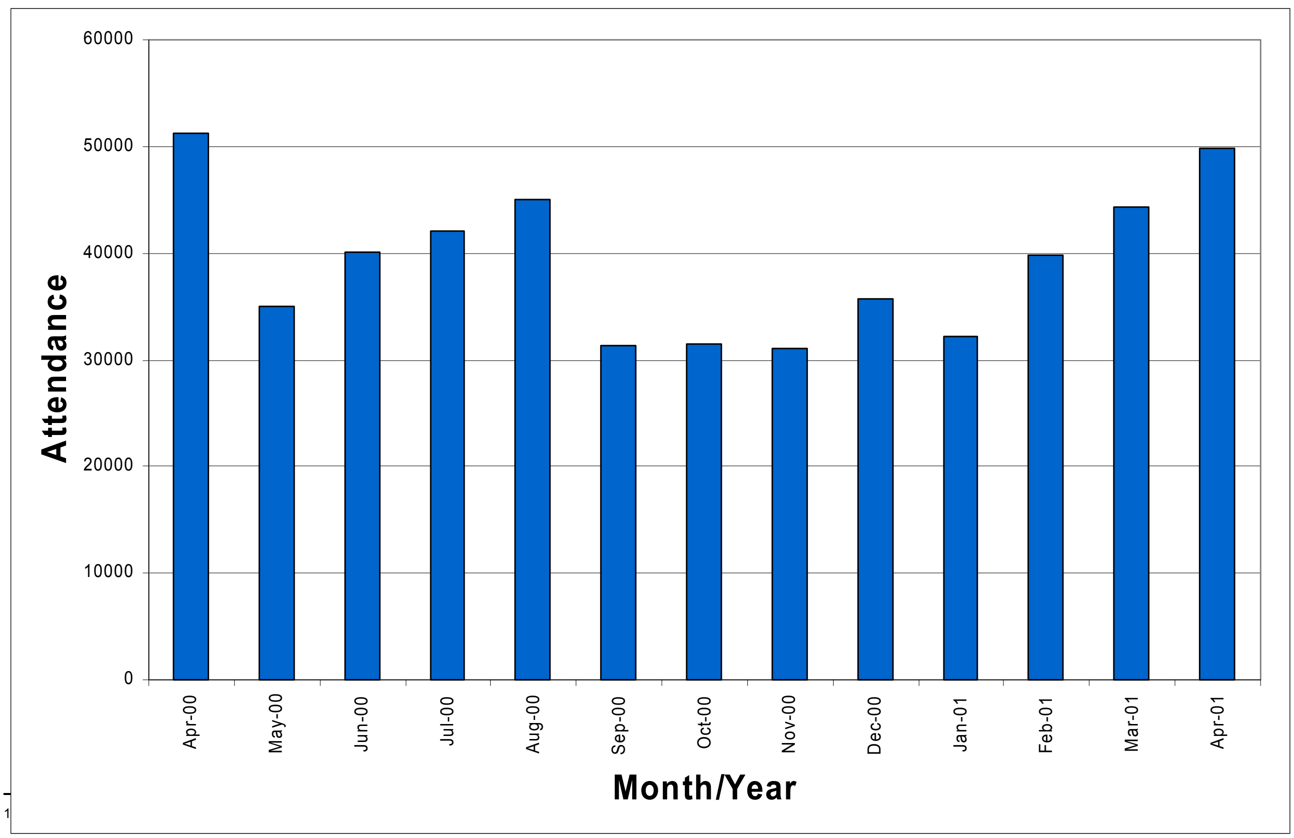
[9] Standard Industrial Classification (SIC) Major Work Groups used to establish this list were 36, 37, 38, 82 v and 87.
[10] Steve Geise, Delaware North
[11] Range defined by ZHA Incorporated using ERA – Economics Research Associates data.

visitors to the Spaceport Visitors Complex account for approximately 4,400 trips per day. Nearly all of the visitors that come to the Visitors Complex take a tour of the Spaceport that originates from the Visitors Complex. The tour buses, operated by Delaware North Park Service of Spaceport, take visitors on 3.5-hour tours of the Spaceport facilities. Movement of the general public is restricted to the routes utilized by Delaware North Park Service of Spaceport tour buses. The buses currently visit 3 locations at the Spaceport, including Apollo/Saturn V Center, the LC-39 Observation Gantry and the Space Station Center in the Industrial Complex. Approximately 30 to 35 buses carry as many as 55 to 65 passengers on the tours. Operating Hours for the Visitor Complex vary depending on the time of the year and degree of sunlight. Summer month hours are from 9:00 a.m. to 8:00 p.m. Winter hours are shortened to 9:00 a.m. to 5:30 p.m.

The highest peak time of the year for visitors is the Holiday period, between the 25th of December and the 1st of January, when visitors exceed normal activity by a factor of 3. Other peak periods are triggered by bike week and spring break activity from mid- February to mid-April. There is also an increase in attendance during the summer months around late July and August. During launch periods, which average over six (6) per year[12], there is also a dramatic increase in attendance at the Visitor Complex. **Figure IV-2** shows the monthly totals for visitors to the Spaceport from April 2000 to April 2001.

FIGURE IV–2
Monthly Visitors To KSC
Visitors Complex 2000 - 2001

Note: The period between December 25 and Jan 1 is typically the highest peak activity period of the year.
Source: Delaware North



Official Visitors

Official visitors come to the Spaceport as individuals or in a group at the invitation of a Spaceport employee or agency. Recent changes in security measures have reduced the number of tours that can be offered at the Spaceport. Creative Management Technologies (CMT) provides as many as 10 to 15 tours per month for this type of tour. The average number of such official visitors is approximately 250 per month. When a Shuttle launch is planned the number of official visitors increases to as many as 1,500 visitors per month.[13] Typical movement of Guest Visitors follow a similar route as the General Public Visitors, however they have more flexibility of stopping in locations of special interest to the group or Public Affairs guide.

Cargo Movements

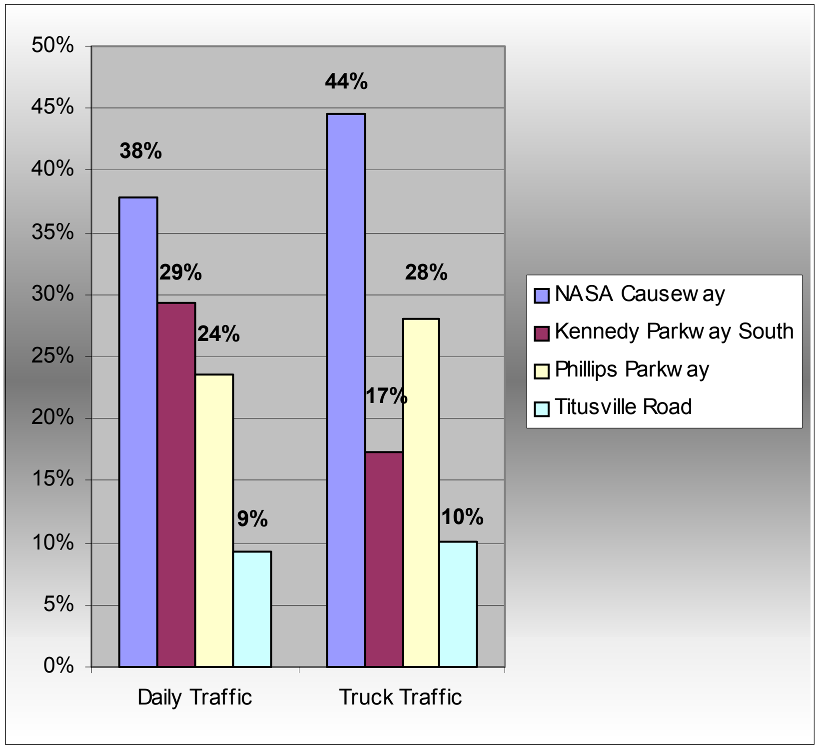
Cargo delivered to the Spaceport can be categorized into two distinct groups – support cargo and space-related cargo. Support cargo includes all items brought to the Spaceport in support of the space facilities, headquarters offices and launch sites. Space-related cargo includes launch vehicles and their payloads. The movements of support cargo and space-related cargo are described in this section. Traffic counts conducted on-site at the Spaceport indicate that daily truck trips at the Spaceport average between 800 and 900 trips per day. Since movement of large space-related cargo to the spaceport account for fewer than 50 trips per year, it is reasonable to assume that most of the daily truck trips are carrying support cargo for the Spaceport.

Support Cargo

Support cargo delivered to the Spaceport produces more trips in a day than space related cargo produces in a full year. Essential items such as food, printed material, cleaning supplies (chemicals) and petroleum arrive as space support cargo via the external road network or by rail. Cargo movements by rail are addressed in the rail segment of this report, as shown in **Figure IV-3.** The NASA Causeway West is the preferred entrance point for freight delivered by truck. While it accounts for only 38 percent of the daily traffic of all vehicles, it carries over 44 percent of all truck traffic into the Spaceport. This graphic also demonstrates that Kennedy Parkway South is the least preferred truck route. In terms of daily traffic, Kennedy Parkway South carries 29 percent of all traffic on the selected roadways. Yet, only 17 percent of the truck traffic uses this route.

[13] Debbie Frostrum, Director of Special Guest Services

Figure IV-3
On-Site Vehicle Classification Counts



Source: ZHA and GMB

Space-Related Cargo

Space-related cargo movements concern the commercial-related launch vehicles and cargo payloads that are shipped to the Spaceport. The cargo shipments originate from throughout the United States and arrive at the port by road, rail, air and sea. Cargo shipments include vehicles (i.e., the rockets) and payloads (i.e., the satellites).

The Spaceport has maintained significant launch activity over the last eleven years. Between 1990 and 2001, satellite launches averaged just fewer than 16 launches per year. A total of 172 vehicles launched 208 satellites from Spaceport. Space Shuttle launches over the same period have totaled over 72 missions, or roughly 6.6 missions per year.

Satellite vehicle, Shuttle components and payloads are transported to the Spaceport by air, rail, truck or sea. The variables that determine which mode will be used to execute the safest and most cost-effective move include:

- Location of origin and destination points
- Time available for transit
- Time required for transit by mode
- Value of the shipment
- Sensitivity of the shipment to movement impacts
- Size of the shipment[14]

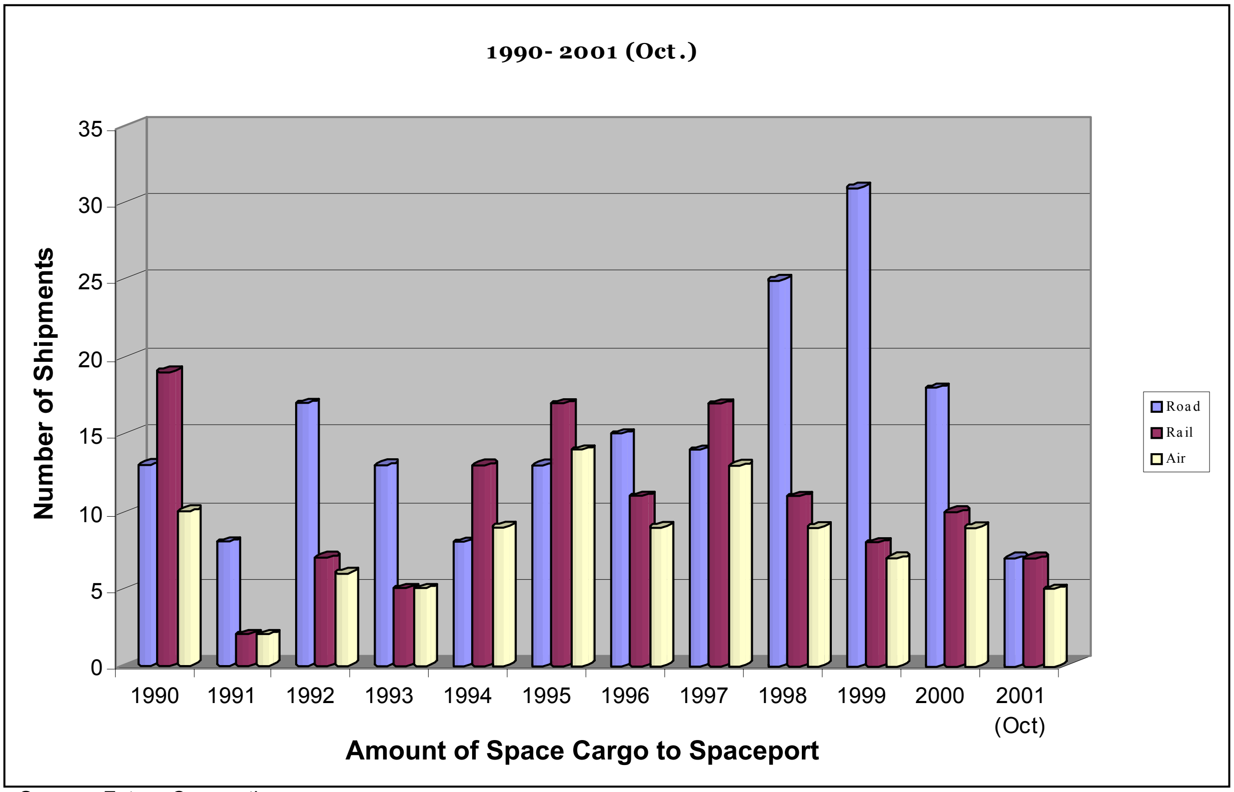
Each mode of transport has advantages and constraints. **Air** transport is costly, but reduces transit time. Air transport also requires additional handling because the cargo must be trucked to the airfield, loaded on the plane, off-loaded and then trucked to the final destination. **Truck** transport has some size restrictions, but can be less costly than other modes. Direct delivery to the destination is an advantage of truck transport. **Rail** transport is an economical method of transport, but size restrictions and heavy jarring impacts to the cargo reduce the desirability of this mode of transport, depending on the sensitivity of the cargo. **Sea** transport can handle any size vehicle or payload, but can take longer to deliver to a destination. Increased delivery time coupled with the extra cost of using a dedicated vessel for a delivery can increase the cost to the point that sea transport is not a viable option.

Figure IV-4 displays how often the three primary modes of shipment, rail, air and over land were used for transporting space cargo to the Spaceport from 1990 to 2001. This figure shows data collected for satellite launch vehicles and their payloads. Shipments by rail competed strongly with roadway and air in the mid 1990's. Then, roadway transport was utilized to a much greater extent than any other mode during the late 1990's. In 2001, this trend was reversed and, again, rail and roadway are nearly equal in terms of providing transportation services to access the Spaceport. Utilization of air transport has been less frequent than both modes through the majority of this period.

Industry representatives for oversized transport have indicated that modifications to the roadway network in Florida would greatly improve access to the Spaceport via truck transport. In the case of I-10 in Florida, a modification to two bridges would drastically change the route that is currently used to haul greater than 16 foot tall by 16 foot wide oversized cargo containers around Jacksonville. Similarly, the modification of two bridges that pass under I-10 in western Florida would change the overland route "haulers" use to transport 17 by 17 foot containers. **Exhibit III-3 (right side)** Identifies five choke points in Florida where vertical or horizontal clearances associated with bridges have inhibited the ability of oversized freight haulers to transport space-related cargo in the shortest possible timeframe.

[14] Interview with Bill Cantillon, Yowell International

Figure IV-4 Year and Mode of Transport



Source: Futron Corporation

Vehicles

Vehicles launched from the Spaceport typically carry only one payload. About 88 percent of all satellites launched from the Spaceport during the last eleven years were launched as single payloads. However, there has been a trend in recent years toward multi-manifesting or increasing the number of payloads launched per vehicle, while decreasing the total number of vehicles launched. In the last five years, there have been six launches with two payloads each.

The weight of launch vehicles, is measured in mass classes. **Figure IV-5** shows the parameters of the vehicle mass classes, and the percentage of launch vehicles that were launched in the different mass classes.

Figure IV-5
Parameters of Vehicle Mass Classes

Mass Class	Pounds	Percentage of Payloads in Class
Small:	0 to 5,000 lbs	2 percent
Medium:	5,001 to 12,000 lbs	44 percent
Intermediate:	12,001 to 25,000 lbs	39 percent
Heavy:	25,001 + lbs	15 percent

Source: Futron Corporation and WSA

Titan rockets are launched as heavy vehicles and account for nearly 15 percent of the launches in the last eleven years. Atlas rockets, along with three Delta rockets, accounted for 39 percent of the launches that fall into the Intermediate mass class of launches. The medium class of rockets (Delta rockets) accounted for 44 percent of all launches from 1990 to 2001. Finally, small rockets (Athena rockets) represented only 2 percent of all launches during that period.

Payloads

The weights of satellites delivered by the launch vehicles are measured in payload mass classes. **Figure IV-6** shows the parameters of the mass classes and the percentage of launches that were carrying the different mass classes.

Figure IV-6
Parameters of Mass Classes and Percentages of Launches

Mass Class	Pounds	Percentage of Payloads in Class
Microsat:	0 to 200 lbs	6 percent
Small:	201 to 2,000 lbs	21 percent
Medium:	2,001 to 5,000 lbs	38 percent
Intermediate:	5,001 to 12,000 lbs	30 percent
Large:	12,001 to 20,000 lbs	1 percent
Heavy:	20,001 + lbs	3 percent

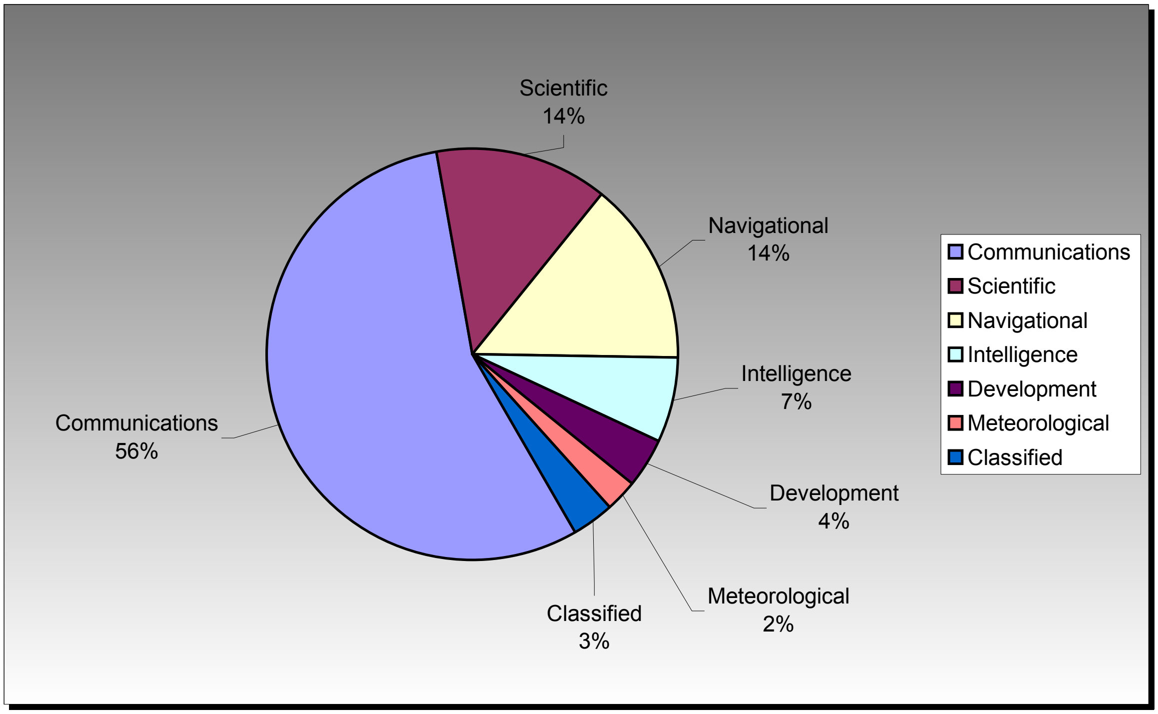
Source: Futron Corporation and WSA

The Small (21 percent), Medium (38 percent) and Intermediate (30 percent) satellites represent nearly 90 percent of the payloads launched from 1990 to 2001. Small satellite launches have especially increased in recent years. During the four-year period from 1998 to 2001, approximately 84 percent of all small satellites were launched compared to the 16 percent launched during the eight-year period from 1990 through 1997.

Satellite Payloads are categorized by function in **Figure IV–7** for the period from 1990 to 2001. This graphic shows that more communication satellites (54 percent) are launched from the Spaceport than any of the other types of satellite functions combined. Scientific and Navigational are both distant seconds at 14 percent followed by Intelligence, Development, Meteorological and Classified satellites.

Figure IV-7

Payload Function of Launches 1990 - 2001



Source: Futron Corporation

Transport of Space Cargo to Cape Canaveral

Boeing, Lockheed Martin, and Orbital Sciences Corp. have manufactured launch vehicles and launched from the Spaceport during the period between 1990 and 2001. Each manufacturer has developed their own system for delivery of launch vehicles and launch vehicle components to the Spaceport. **Figure IV-8** outlines the manufacturing locations of major launch vehicle components and the various modes of transportation used for transport to the Spaceport.

Figure IV-8

Major Launch Vehicle Component Assembly and Transport

Manufacturer	Location Manufacturer Final Assembly	Mode Of Transportation To Spaceport
Boeing Delta 2, 3, and 4		
Booster and Main Engine	Canoga Park, CA	Truck
Orbital Sciences Corp		
Pegasus	Vandenberg AFB, CA	Air L1011
Lockheed Titan		
Solid Rocket Motor	Magna, UT	Rail
Upper Stages	Denver, CO	Rail
Engines	Sacramento, CA - Denver, CO	Air C-5A
Fairings	Huntington Ranch, CA	Air C-5A
Lockheed Atlas		
Tanks and Avionics	Denver, CO	Air
Engines	Canoga Park, CA	Air
First Upper Stages*	Denver, CO	Air 36A and 36B
Fairings	Huntington, TX	Truck
Strap on Solid Rocket Motor 5	Magna, UT	Rail
Lockheed Athena		
First and Second Stages	Salt Lake City, UT	Truck/Rail
Third Stage	San Jose, CA	Truck
Upper Stage	Huntington, TX - Seattle, WA	Truck
Fairings	Denver, CO	Truck 46
	Huntington, TX	Truck 46

Source: Futron Corporation

Rockwell International Space Transportation Systems Division (now Boeing) constructs the Space Shuttle. The Space Shuttle is made up of 11 major components. Each major component, except for the main engines, is transported to the Rockwell Palmdale, California facility for final integration. The Shuttle is, then, transported overland to Edwards Air Force Base, CA, and, then, by Shuttle aircraft carrier to Kennedy Space Center. **Figure IV-9** lists each major space shuttle system component, the manufacturing location and the mode of transportation to the destination.

Figure IV-9
Space Shuttle Components, Manufacturing Locations and Transportation

Major Components - Rockwell Int'l (Boeing)	Manufacturing Facility	Mode of Transportation to Palmdale, California
Shuttle and Components	Magna, UT	Shuttle Aircraft Carrier
Forward Fuselage	Rockwell, Downey, CA	Truck
Crew Compartment	Rockwell, Downey, CA	Truck
Reaction Control System	Rockwell, Downey, CA	Truck
Aft Fuselage	Rockwell, Downey, CA	Truck
Midfuselage	General Dynamics, San Diego, CA	Truck
Wings (including elevons)	Grumman, Bethpage, Long Island, NY	Ship to Long Beach, CA and then overland to Palmdale, CA
Vertical tail	Fairchild Republic, Farmingdale, Long Island, NY	Overland
Payload bay doors	Rockwell, Tulsa, OK	Overland
Body Flap	Rockwell, Columbus, OH	Truck
Aft Orbital Maneuvering system/reaction control system pods	McDonnell Douglas, St. Louis, MO	Aircraft
Main Engines	Rockwell, Rocketdyne Division, Canoga Park, CA	Classified

Major Component	Manufacturing/Final Assembly Facility	Mode of Transportation to Edwards Air Force Base
Assembled Space Shuttle	Palmdale, CA	Truck Overland

Vehicle	Holding Facility	Mode of Transportation to Spaceport
Assembled Space Shuttle	Edwards Air Force Base	Shuttle Aircraft Carrier

Source: Futron Corporation

The Space Shuttle main engines were manufactured at Rockwell International's Rocketdyne Division in Canoga Park, CA then shipped to the National Space Technology Labs and then to Kennedy Space Center.

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V. TRIP GENERATION CHARACTERISTICS

The proposed Spaceport future land use categories are unique to a space launch facility. Land use categories such as: spaceport management, launch, and launch support are typically not incorporated in a land use master plan. Therefore, these land uses do not have an established trip generation rate. Trip generation rates can be used to evaluate the traffic implications of alternative future land use scenarios. The number of trips a future land use will generate can be estimated based on standardized trip generation characteristics established for an existing land use. In this section, the proposed future land uses established for the Spaceport are matched with similar existing land use categories that have established trip generation rates. The purpose of this task is to develop trip generation rates for proposed future land uses at the Spaceport.

The trip generation rates used for this task are derived from the International Traffic Engineers Handbook (ITE).[15] **Exhibit V-1** list the spaceport land uses, and the corresponding ITE land use category that most closely matches the Spaceport future land use. The table also identifies the units used to calculate the trip generation rates and the actual rates. In some cases, a trip generation rate can be calculated using two different measures such as trips per employees and trips per acre of land. As noted in **Exhibit V-1,** the launch site is the only spaceport future land use category that did not have a corresponding ITE land use category. Actual traffic counts from these facilities must be utilized to determine trip generation rates for this land use.

Existing Land Use in Brevard County

The land uses outside of the Spaceport in Brevard County also have implications for the future traffic impacts at the Spaceport. **Exhibit V-2** shows the existing land use categories in Brevard County, outside of the Spaceport. This map shows two land use features that will have implications for traffic impacts at the Spaceport.

First, nearly 30 percent of the vehicles entering the Spaceport utilize SR 3 (Kennedy Parkway South). Much of the land south of KSC along this entrance is undeveloped, agricultural and upland forestland. How this land develops, and how access is provided for future development, will impact traffic at the Spaceport.

Second, **Exhibit V-2** shows three pockets of industrial development located near major transportation facilities in proximity to the Spaceport. These pockets are clustered near:

- SR 528 and US 1
- SR 407 and SR 405
- SR A1A near Port Canaveral and SR 528

If these pockets of industrial development expand in providing service to the Spaceport, then the transportation facilities that serve these pockets of development must maintain their current level of service. **Exhibit IV-1 (left side)** also documents that space-related businesses are located in these industrial pockets. The 1999 Level of Service Map, **Exhibit**

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[15] Trip Generation, 6th Edition, Institute of Transportation Engineering, 1997.

III-2 (left side), shows that the road network surrounding these pockets of space-related industrial development are functioning at Level of Service (LOS) C or better.

VI. CAPE CANAVERAL SPACEPORT LAUNCH AND LABORATORY SPACE REQUIREMENTS FORECASTS

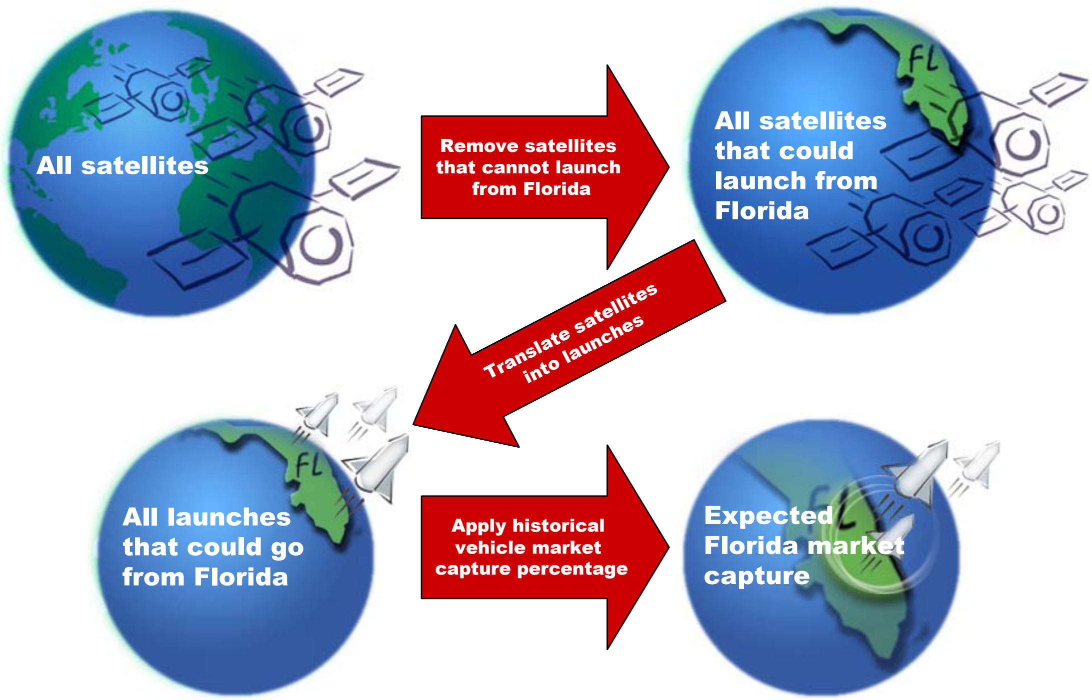
Launch Forecast

The goal of this Launch Forecast was to develop a forecast of likely launch activity at Cape Canaveral Spaceport for 2001 to 2010 and 2025, using proprietary launch forecasts and taking into consideration orbital limitations, captive and manifested launches, and potential market share.

<u>Methodology</u>

To produce the launch forecast for Cape Canaveral Spaceport, the effort began with the total demand for satellites during the forecast period (2001-2010 and 2025) and removed those satellites with orbit requirements, political restrictions, or other factors that would prevent them from launching from Florida's spaceport. The remaining satellites formed the pool of payloads that could possibly launch from Florida. These payloads were then converted into launches, taking into consideration payload mass, vehicle mass capacity, and multi-manifesting. The result was the number of possible launches that could go from Florida, assuming no competition. This total was then reduced by a vehicle market capture percentage based on historical percentages, leaving the expected Florida market capture for launches over the forecast period. Figure VI-1 shows this graphically.

Figure VI-1



Overall Methodology

Each step in the methodology "pictured above" is described in detail on the following pages.

<u>Global Satellite Forecast Methodologies</u>

The basic Florida launch forecast methodology described above was applied to both commercial and government launches of payloads to geosynchronous orbits (GEO) and non-geosynchronous orbits (NGSO). The methodologies for these four categories of satellites were based on demand, supply, or a hybrid of the two.

Most forecasts of the satellite industry focus on supply rather than demand. These forecasts survey satellite manufacturers and service providers to determine the number of satellites planned to be launched or built over the next several years and extend those numbers over a given forecast period. In many cases, a supply-side forecast can be useful, especially when satellite launches are not directly related to demand for service, such as with commercial NGSO and government satellite systems.

The approach to forecasting commercial GEO satellites is unique, in that it begins with a definition of the distinct applications that utilize commercial GEO satellite capacity, and forecasts the markets for these applications, utilizing a unique methodology for each and beginning with the fundamental unit of demand, which is usually the individual household or enterprise. When added together, the bandwidth required to meet the demand for each application is summed up both regionally and globally. This approach has the benefit of exposing regions that are oversupplied or undersupplied with satellite capacity, thus making it easier for service providers to decide when and where to launch new satellites to meet demand.

The following sections discuss the methodologies for the four satellite forecasts in more detail.

Commercial GEO

Utilizing a proprietary demand-based satellite forecast model that consists of a country-by-country analysis of demand for both mature and evolving markets for data, voice, video and radio, determined the global demand for commercial GEO satellites from 2001 through 2010. The forecast was extended to 2025 by considering the expected growth trends in each sector, the introduction of new satellite applications, and the end –of-life schedule for on-orbit GEO satellites.

The forecasting approach baselines the forecast according to the current satellite utilization on a transponder-by-transponder basis. Next, fundamental drivers of demand were identified for telecommunications services, using historical trends for existing applications and analogous markets for emerging applications. Satellite demand is constrained by terrestrial competition, price of service and affordability, and the regulatory environment of each country. Finally, the demand for bandwidth is translated into demand for transponders, taking into account satellite technology trends in data compression and frequency reuse, and resulting in a communications payload profile.

Commercial NGSO

The forecast for commercial NGSO satellites was based on a supply-demand hybrid methodology because there is no direct relationship between demand for service and the number of NGSO satellites launched. The methodology considered announced systems and their probability of go, augmented with knowledge of demand for NGSO services. The 10-year forecast was extended to 2025 by considering follow-on systems and what the market could support.

Government GEO and NGSO

As with commercial NGSO satellites, there is no direct relationship between demand for services and the number of satellites launched for the government market. Rather, governments launch satellites based on available funding and perceived need. U.S. government satellite systems were forecasted using the National Launch Forecast published by the U.S. Air Force and other current information. Non-U.S. government systems were forecasted using a database of all present, past, and planned launch activity, augmented with knowledge of historical government space programs and planned space budgets in each country. This takes into consideration space activities of both existing and emerging national space programs. The 10-year forecast was extended to 2025 by considering historical trends, planned and follow-on systems, and estimates of future space budgets and priorities.

Satellite Forecast Results

Commercial Satellites

GEO satellites are generally in higher demand than NGSO satellites for commercial services, with NGSO satellites constituting about a third of the total satellites demanded for the forecast years.

Analysis of the market for commercial GEO satellites showed that the demand for GEO satellite services is expected to more than double over the forecast period, resulting in a stable demand for new satellites throughout the forecast period. Data communications markets should experience the fastest growth, while it is expected that video and audio markets will grow at a steady, moderate pace and still comprise nearly half of satellite demand in the forecast period. Voice services account for a small and stable portion of satellite capacity, comprising only 20% of total on-orbit capacity projected for 2010.

NGSO satellites have been launched in anticipation of demand for services, which has not materialized over the last five years. Analysis of the NGSO market over the next ten years shows that there will be demand for NGSO satellite launches to support selected satellite applications. Moving into 2025, the market for commercial Low Earth Orbit (LEO) satellite services is expected to support only one “Big LEO” system, providing mobile telephony; subscribers acquired by all current systems should support one low-cost telephony system. Smaller LEO satellites, called “Little LEOs”, that provide asset tracking, paging, and other low-bandwidth data services are not expected to continue as an NGSO application. It is projected that, in the long term, these services will be provided terrestrially or from GEO. Satellite broadband services (providing high-speed Internet and other data communications) will be served both terrestrially and by GEO infrastructure, but demand is expected to exceed supply from these sources, enabling an NGSO broadband system. It is also expected that steady deployment of commercial remote sensing and foreign scientific payloads to NGSO will continue.

Figure VI-2
Commercial Satellites by Orbit

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	--	2025
GEO	29	23	22	10	13	27	17	12	15	18		30
NGSO	8	12	23	13	7	11	11	7	15	6		15
Total	**37**	**35**	**45**	**23**	**20**	**38**	**28**	**19**	**30**	**24**		**45**

Government Satellites

Demand for government launches is driven by planned missions and government budgets. The demand for U.S. government payloads is dominated by NGSO payloads intended for launch by Shuttle to build and support the ISS. Additional government satellites will continue to be demanded as replacement satellites for both civil and military space systems. Worldwide demand for satellites performing scientific missions will continue to be a driver of demand for government missions.

Figure VI-3
Government Satellites by Orbit

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	--	2025
GEO	9	10	9	7	7	3	7	7	4	9		7
NGSO	87	103	88	98	109	84	105	87	88	117		83
Total	**96**	**113**	**97**	**105**	**116**	**87**	**112**	**94**	**92**	**126**		**90**

Figure VI-4
Total Satellites

Total Satellites by Orbit

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	--	2025
GEO	38	33	31	17	20	30	24	19	19	27		37
NGSO	95	115	111	111	116	95	116	94	103	123		98
Total	**133**	**148**	**142**	**128**	**136**	**125**	**140**	**113**	**122**	**150**		**135**

<u>Potential Florida Launches – Methodology</u>

The purpose of this activity was to reduce the pool of forecasted satellites to only those that could potentially go from Florida. External issues both political and technological were factored in that affect the demand for launches from Florida. After forecasting satellites for each of the commercial and government categories, satellites were excluded from consideration that required orbits that cannot be achieved from Florida. Also excluded were satellites that were already manifested on non-Florida launches. For government payloads, non-U.S. government satellites were removed if they were considered to be captive to an indigenous launch capability, or would likely never launch on a U.S. vehicle; these included Russian, Japanese, Chinese and European satellites.

After reducing the pool of satellites to those that could potentially go from Florida, those satellites were converted into launches using FAA-defined mass classes. The six mass classes for satellites are determined by the mass of each satellite, while the four mass classes for launch vehicles are determined by the vehicle's lift capacity to LEO. A multi-manifesting factor, based on historical trends and planned launch manifests, was applied to the satellites that could be launched from Florida; and the resulting mass of each manifest determined the types and number of vehicles required to launch the payloads. In some cases, multi-manifesting resulted in fractions of launches being calculated. Analysis of these calculations enabled conversion of fractions to whole launches based on a maximum period in which a satellite would wait for its multi-manifesting partner(s) before being launched alone. Government launches, such as ISS and Shuttle payloads, were grouped together based on knowledge of those missions.

Expected Florida Launches – Methodology

Florida market share for commercial launches was based on an analysis of 10-year historical trends. As part of this analysis, various factors were considered for Florida's varying market share statistics for payload types by orbit and launch mass class, historical and recent trends in market share capture, the introduction of new vehicles throughout the forecast period, and planned phase-outs of existing vehicles within the forecast period. Each of these factors is important in determining Florida's market share, especially the latter two. New vehicle designs could have a significant impact on market share if the existing infrastructure cannot accommodate the launch pad or landing area needs of such vehicles.

For the government market share, calculations also took into consideration continued Shuttle operation through the forecast period. Because the market share breakout is based on a historical analysis, factors such as launch throughput and launch pad delays are taken into consideration for both commercial and government launches.

Expected Florida Launches – Results

The final numbers show a greater percentage of GEO launches for the Florida market capture than for the potential launches, with 45% of the expected launches for 2001-2010 going to GEO. For 2025, there are 32 launches forecasted as the most likely number with a variance of 4 launches, or 13%. This provides a window of 28 to 36 launches expected to go from Florida in 2025, about half of which have been allocated to GEO.

The forecast of launch pad acreage required to meet the forecasted demand for launches was based on existing launch complex sizes and throughput constraints. It assumes that the current available (and near-term planned) launch complexes will be used until the forecasted launch demand exceeds the maximum throughput. Surge capacity of existing pads can handle forecasted launches through 2025.

A scenario analysis for heavy launch vehicles in the 2025 timeframe was conducted and two possible scenarios were considered: continued operation of an enhanced Shuttle or Shuttle follow-on or a second-generation RLV-type manifest. In the baseline scenario of continued Shuttle operations, the forecast includes about 45 manifested payloads, from micro-sized to crewed missions. In the alternative scenario, where a second-generation RLV replaces the Shuttle as the primary U.S. government access to space for human activity, such a vehicle would likely carry smaller loads than the Shuttle, resulting in more launches for the same number of payloads; however, a greater variety of launch vehicles would make it less likely that Florida would continue the market share dominance it enjoys under the current Shuttle scenario.

Conclusions

Florida launch level is likely to increase slightly over the current historical average of 20 launches per year. These launches are likely to be evenly split between GEO and NGSO. The majority of demand will be for medium class vehicles, with continued strong level of demand for Shuttle-type heavy launches. This assumes that launch prices and government priorities will remain stable over the forecast period. It also assumes that there will be no emerging markets within the forecast period to change the types or priorities of launches.

Forecast of Research and Development Space Requirements

The goal of this R&D Space Requirements Forecast was to estimate future facility requirements for research and development at Cape Canaveral Spaceport, taking into consideration budget trends, employment trends, and facility use patterns for government and commercial research and development.

Methodology

In order to forecast government R&D facility requirements, a thorough analysis with budget and employment trends for both NASA and KSC was conducted. These trends for both CCAFS and KSC were compared with information on growth of R&D facilities at KSC to determine the relationships.

After significant analysis, it was determined that there was little to no correlation between R&D and employment levels and the addition of new R&D facilities at KSC, but instead, when analyzed over multiple decades, R&D space grew at a relatively constant rate. For this forecast, an analysis of facility growth patterns over the last 20 years and forecasted out that historical growth trend to the 2010 and 2025 time periods was used.

For the private sector R&D facilities forecast, current uses of R&D space was used and combined that knowledge with planned movements of facilities to CCS to develop a comprehensive forecast of likely private R&D facilities.

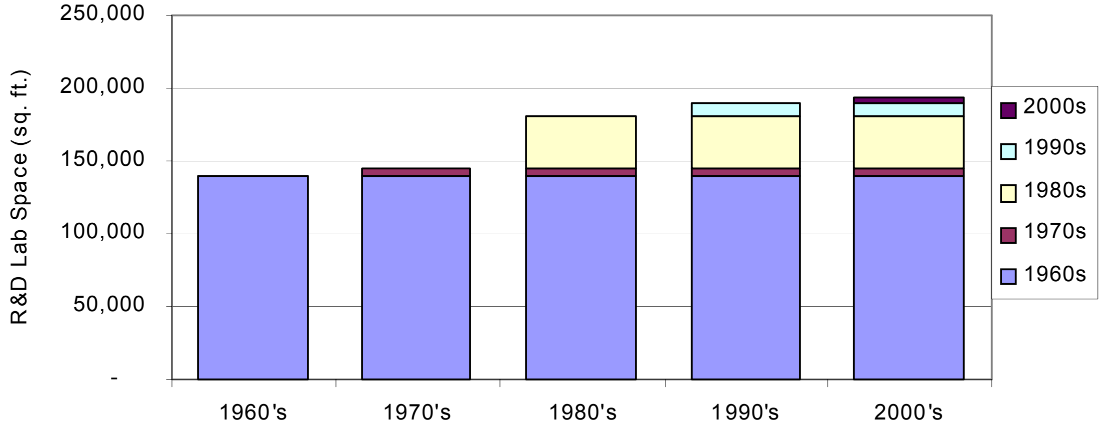
Government Research and Development

NASA spent about 6% of its total budget on KSC activities in 2000, about 12% of which was spent on research and development activities by KSC. This amounts to just over $97 million, which employs about 1,200 personnel. Translating this into land use shows that KSC had about 153 square feet of research and development space per employee in 2000, down from 187 square feet in 1997. Lab facilities occupy all but 6% of the total R&D space.

The growth of R&D facilities is shown in Figure VI-5. The majority (72%) of current R&D facilities were built in the 1960s, with only 8,000 square feet (6%) added between 1990 and 2000. This is expected to change with the construction of the Space Experiment Research and Processing Laboratory (SERPL), which is expected to combine resources of universities, NASA, and industry to meet the anticipated increase in scientific and technological ground support associated with the International Space Station. SERPL will add 100,000 gross square feet / 62,000 net square feet of R&D space, and is expected to be operational by mid-2003.

Figure VI-5
KSC R&D Facility Growth

zoom



Note: For square footage where the year of construction was unknown, square footage was distributed equally among the 60s, 70s, 80s.

Industry and University Research and Development in Florida

Private sector expenditures on research and development have an impact on the land use plan for Cape Canaveral Spaceport because those research and development programs that relate to the space industry may wish to relocate to the Cape to take advantage of close proximity to the spaceport.

Because federal government research and development expenditures have remained relatively flat since 1993, industry and university research and development expenditures are likely to be the major source of growth in laboratory facilities at Cape Canaveral. From 1993 to 2000, national expenditures by industry for research grew 50% and university expenditures grew 30%. Between 1991 and 2000, resources spent nationally on basic research increased 90% while applied research spending rose by 39%.

Growth in funding within the state of Florida outpaces even the national levels discussed above. Industry expenditures grew 54% from 1987 to 1998 while university expenditures grew 155% over the same period. In a similar fashion, funding for Florida Atlantic University's Communications Space Technology Center grew from $1.5 million in 1992 to $4.4 million in 2000, with expected funding for 2002 reaching $5.5 million. This Commercial Space Center's (CSC) budget is especially important, since they have expressed an interest in establishing a presence at Cape Canaveral Spaceport of up to

20,000 square feet of research and development space. In addition to this CSC, several colleges and universities receive funding directly from KSC and could benefit from having an on-site laboratory presence.

Research activities discovered 19 companies that have expressed an interest in relocating to Cape Canaveral Spaceport, which could translate into over 35,000 square feet of facilities. SERPL could also attract additional non-civil activity when the facility achieves operational status in mid-2003.

Results

The future development of the International Space Research Park, a campus-like and ecologically friendly environment for world-class research and technology development will add additional square footage for research at CCS. The proposed park contains the Space Experiment Research and Processing Laboratory (SERPL), a 40-acre site currently under development which includes a 100,000-square-foot laboratory, scheduled for completion in 2003. An additional 320 acres will also be available for additional research and technology facilities, university labs and classrooms, and commercial activities.

Total additional square footage required for research at CCS in 2010 will amount to approximately 50,000 square feet above the current level, for a total of over 240,000 square feet of space. Based on historical growth of lab space, KSC is likely to add about 21,000 additional square feet; Florida Commercial Space Centers' need for additional space could result in 10,000 square feet located at CCS; and assuming one half of commercial enterprises that expressed interest in relocating to CCS actually relocated, approximately 17,500 square feet of additional space would be required. Another 1,700 square feet may also be required to account for the net loss in square footage as a result of Hangar L retirement.

These results assume that the priorities and funding levels for both NASA and industry will remain constant, with no net loss of research area resulting from lab consolidation that is currently planned. Based on historical trends, it was assumed that an average of 2,300 square feet of space would be added each year. Also, there is no direct correlation between budgets or employment levels and square footage requirements.

For 2025, total square footage required for activities at CCS is expected to reach 77,500 square feet above the projected level for 2010, for a total of over 320,000 square feet. This forecast is based on 15,000 square feet to accommodate CSC or similar organizations relocating to CCS; 17,500 square feet for additional commercial research activities; 10,000 square feet for a smaller SERPL-type follow-on facility; and 35,000 square feet based on historical growth trends of 2,300 additional square feet per year on average.

The 2025 forecast assumptions are similar to those for 2010, but over such a long timeframe, NASA and industry priorities may change and affect the levels of research taking place at Cape Canaveral Spaceport.

VII. SPACEPORT-RELATED MULTI-MODAL NEEDS AND ISSUES

Background

This chapter discusses the land side needs of the U.S. fleet of launch vehicles, especially for Florida. Space in Florida is a $4 billion business rivaling tourism as an economic generator and deserving of as much attention to nurture its success. The illustration below depicts the development of past and current U.S. launch vehicles.

Figure VII-1
U.S. Launch Vehicle Evolution

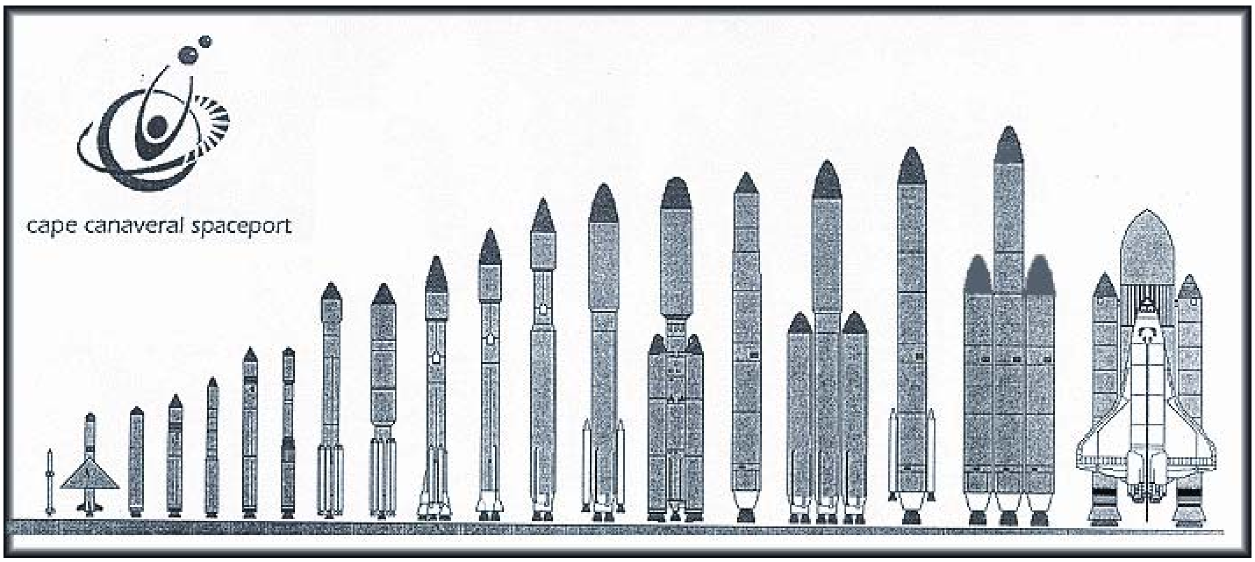
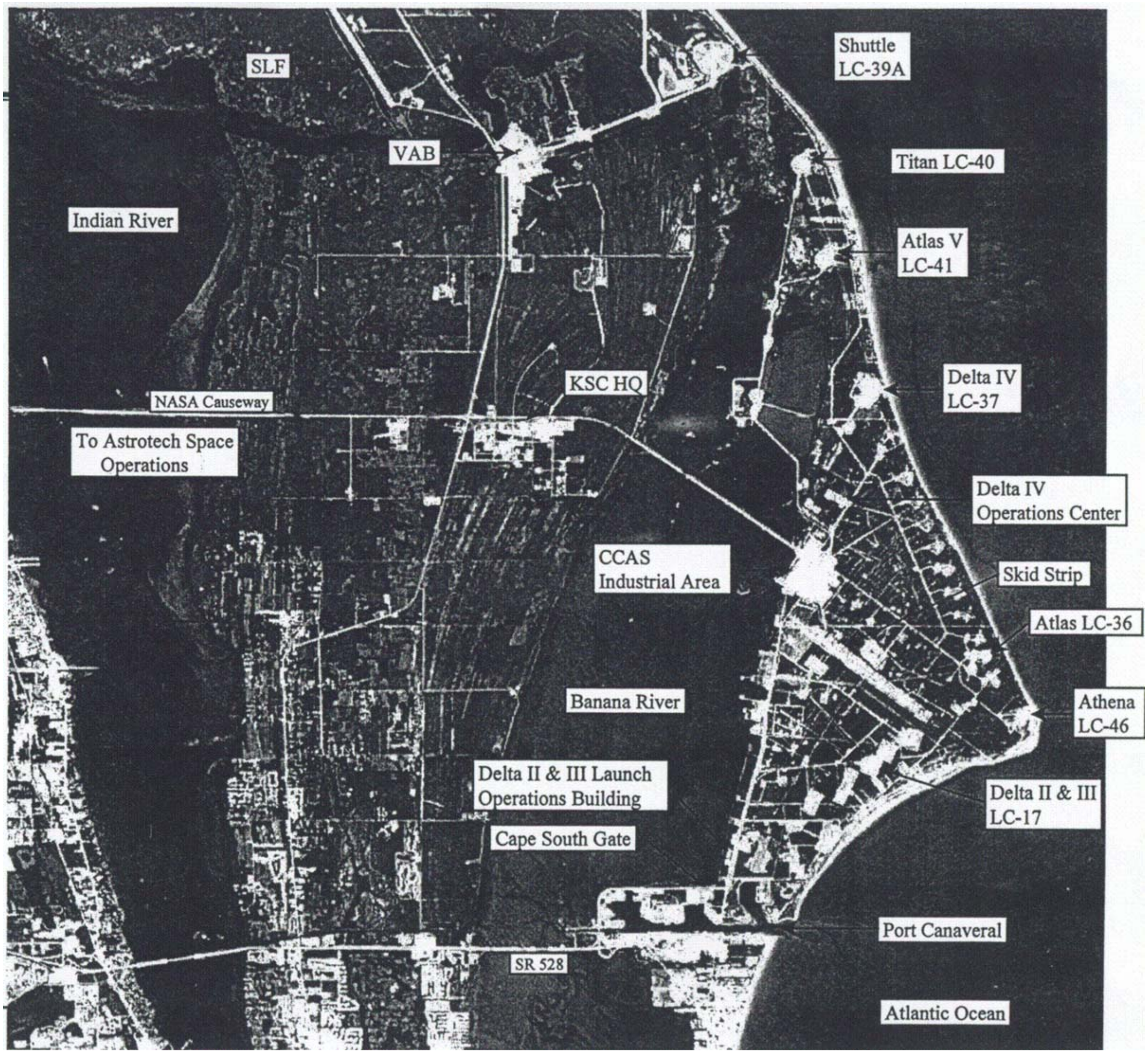


Figure VII-2
Spaceport Infrastructure and Launch Facilities

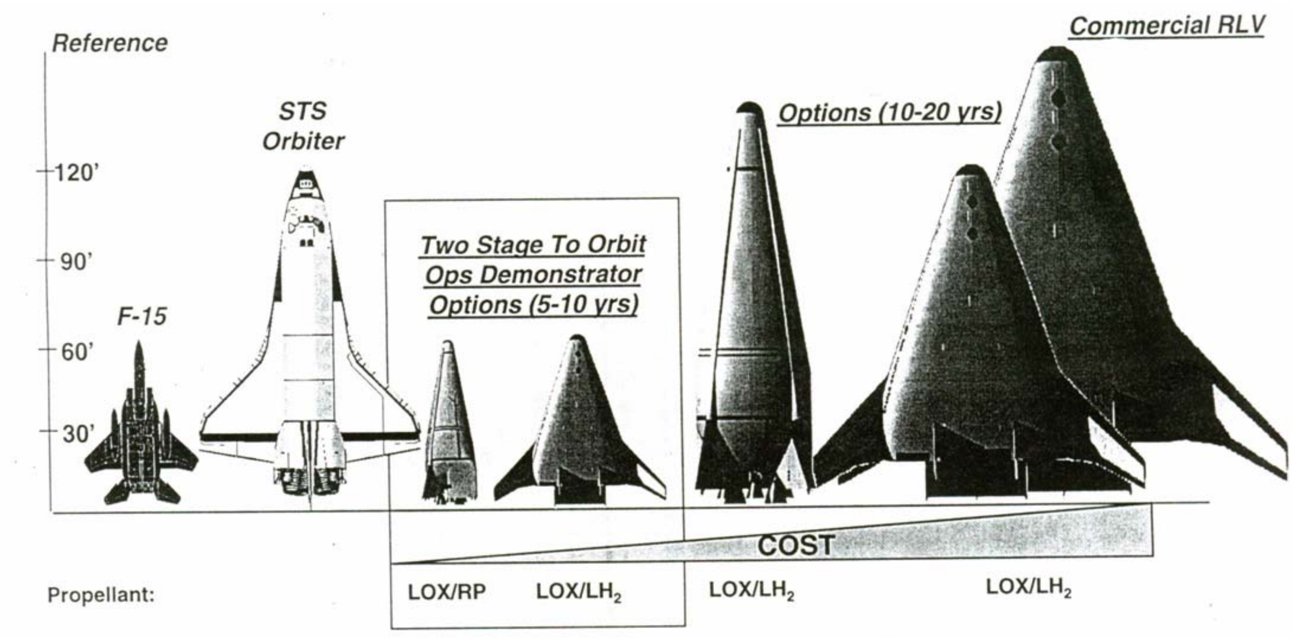


This plan view of the Florida Spaceport indicates the multifaceted nature of government and commercial launch facilities.

Surface Movement Constraints

Constraints to surface movements into the Spaceport include the 84' width of the locks connecting deepwater Port Canaveral to the Banana River and the drawbridge opening on the NASA Causeway. Evaluation of choke points was made by Yowell International for the think tank planners of Lockheed Martin's Skunk Works with the recommendation for either widening passage capability of both the locks and the drawbridge or constructing a shoreside "runway" ramp to the Atlantic Ocean east of the Crawlerway at LC-39A.

Figure VII-3
Future Reusable Launch Vehicles



SOURCE: Yowell International

Surface Movement Study

To provide a better understanding of the problems involved in the movement of large cargoes via highway to the Kennedy Space Center and Cape Canaveral launch facilities, a study of issues, including brief examinations of other modes of transportation, was conducted in 2000/2001 by Yowell International in cooperation with Wilbur Smith Associates.

Space

Although the transport of large items via space vehicle is not yet practical, movement of items launched from Russia and returned from space to Florida for subsequent return to Russia is a reality. At this time, currently available terrestrial transportation modes are required to supplement space transportation.



SOURCE: Yowell International

Water

In general, almost any item of any size or weight can be transported by barge if it can be loaded onto and unloaded from the barge. Transport of large items by barge is an extremely costly operation in terms of transport movement from fabrication facility to the barge dock, equipment and manpower required for on/off load operations, and movement from the barge dock to the destination facility. The water mode towage cost of a round trip mission utilizing a NASA barge from its home port at Michoud, LA, is $120,000. This price excludes barge usage and fees borne by the government, insurance, or port fees. Similarly, the charter fee when utilizing the Delta Mariner for a typical ten-day trip from Mobile, AL, to Port Canaveral (and return) is $200,000, excluding port costs and insurance. The Mariner has been encountering grounding in low water as of this writing and is in dry dock due to hull damage. Such events cause program planners to view highway with increased interest for their outsized movements. The Mariner will be detailed later as noted in this report. Some examples of extremely outsized items moved by barge include the Shuttle external tanks from New Orleans (an ongoing program), the Orbiter Processing Facility platforms from Vandenberg AFB to KSC, and the Delta IV launch platforms from Brunswick, GA, to the Delta IV launch facility at Cape Canaveral Air Force Station (CCAFS). Movement of these items by any other means is not a practical option. Delta IV Common Booster Cores (CBCs) are to be moved from Decatur, AL, to Port Canaveral via barge or Delta Mariner. Use of highway for transport of these items (all exceed 30' in width and length) seems to be impractical due to extensive infrastructure impediments.

Figure VII-4
Inland Waterway System

Atlantic/Gulf of Mexico
SOURCE: Yowell International

NASA Barge

In the mid-1990's, NASA contracted to tow the ocean-going NASA barges with Shuttle External Tanks as the cargo from the Michoud Facility to the wharf located adjacent to the Vehicle Assembly Building. It was noted that, frequently, the barges "bottomed out", while navigating the shallow depth of the Banana River channel. It has been many years since the Army Corps of Engineers has dredged this waterway. The barges are modified US Navy, all steel construction, with a cargo cover. Our nation's space program, whether public or private sector, relies on sufficient navigable depth in these waterways (minimum 12 foot draft recommended).

Figure VII-5
NASA Barge
External Tank Delivery

SOURCE: Yowell International

General specifications are:

Overall length	266' 0"
Length between perpendiculars	266' 0"
Breadth at 9'0" waterline	48' 0"
Max breadth at 15'-0" waterline	52' 6"
Depth amidships from baseline to main deck	15' 0"
Ocean Draft	9'-10.5"
River Draft	7' 6"
Displacement – ocean	2929 Long Tons
Cargo cover height above the river (air draft)	56' 6"

Delta Mariner

This self-propelled barge is intended for use in the transport of Delta IV launch vehicle program outsized components between Decatur, AL, and the Cape Canaveral Spaceport. The vessel is intended for relatively lightweight, large volume cargo. In order to enhance the vessel's capability for backhaul cargo, the deck is designed for a maximum uniform deck load of 1000 pounds per square foot (psf). This allows it to support use of Hyster 150E or Caterpillar DP 70 lifting equipment. Steel plates or lumber mats can be used for higher loads.

Figure VII-6
Delta Mariner

SOURCE: Yowell International

General specifications are:

Overall length	312' 7"
Beam – max molded	82' 0"
Depth - main deck	20' 0"
Ocean Draft	12' 0"
River Draft	8' 0"
Displacement – river	3300 Long Tons

Other Marine Assets

A variety of other "common" marine assets (deck barges, supply ships, ramped roll-on/roll-off (RO/RO) barges, etc.) to support Spaceport requirements are currently utilized. The astronaut recovery vehicle (Figure VII-7) used at KSC to safely and efficiently remove the astronauts from the Shuttle is an example of an item that could have moved by highway. Recently, it moved by highway from Denver, CO, through OK, TX, LA and MS to Mobile, AL, where it was loaded onto a barge for transport to Port Canaveral (at increased cost).

Figure VII-7
Astronaut Recovery Vehicle

SOURCE: Yowell International

Railroad

Railroad service is extremely effective for use in transporting heavy items. Multi-axle cars can accommodate weights approaching 1 million pounds. NASA utilizes rail exclusively for the movement of the Shuttle Solid Rocket Boosters from Utah to Kennedy Space Center. A combination of rail shipments and truck shipments move cryogenic fuels (LH2 and LO2) onto KSC. Although rail service itself can be cost effective, the costs associated with equipment and manpower required to on-load and off-load the rail cars and subsequent transport to/from railhead can be significant. Many shippers are reluctant to use rail because of the lengthy transit time and possibility of cargo damages due to shock and vibration. Routing of cargo widths exceeding 12’ and heights exceeding 15’ is severely limited. Throughout the U.S., rail cargo dimensional constraints are the result of the limitations of the bridges and tunnels constructed in the nineteenth century. Florida, however, is fortunate to have few such limitations with its relatively “new” transportation infrastructure.

A recent example involves rail transport of the Delta IV Retention Ring. This space hardware was shipped “upright” from Knoxville, TN, via rail to within 50 miles of the Spaceport. Original loading of the piece was onto a standard railcar. This configuration caused the cargo to hit utility lines and was subsequently reloaded onto a drop center railcar and moved to the Spaceport area. This piece could have been shipped safely by tractor-trailer in the horizontal position at 17’9”W from Knoxville, TN, had pertinent permits been made available. Delivery of the Ring at 17’9”W to the Spaceport from an FEC team track was successfully accomplished utilizing a tractor-trailer with police escorts. This is accorded through a 50-mile radius limited permit issued by FDOT.

Figure VII-8
Delta IV Rings via Railroad

SOURCE: Yowell International

Another example is a Titan Centaur Catwalk, shown below, loaded onto a step deck trailer for movement from the local railhead to a facility on Cape Canaveral Air Station. The Catwalk was shipped from the NASA Plumbrook facility in Ohio via rail to the local railhead. This is another shipment which could possibly have been shipped by truck from Ohio to Florida had there been an institutional mechanism available in Florida to obtain necessary over-width permits.

Figure VII-9
Titan Centaur Catwalk via Railroad

SOURCE: Yowell International

Figure VII-10
NASA Super Guppy

SOURCE: Yowell International

At Kennedy Space Center's Shuttle Landing Facility, workers watch as the nose of NASA's Super Guppy aircraft opens to reveal its cargo, a component for the International Space Station (ISS), the P3 truss.

- **Cargo bay door Width x Height: 25'1" x 23'4"**

Aircraft

Since the mid-70's, the space industry has participated in the evolution of public and private cargo aircraft for movement of spaceport-related cargoes. Cargo aircraft dimensions have increased over the years with the A300-600ST (Beluga) being the latest of the large aircraft. NASA has often used these large aircraft (e.g., NASA Super Guppy, USAF C-5, Russian AN-124, and the European Beluga) to move space flight hardware and ground support equipment. The costs associated with use of the aircraft and the costs of support operations (including movement of the cargo from the fabrication facility to a suitable airfield) can be significant, such as the costs of cranes for loading and unloading the Beluga aircraft at a cost of $10,000 at each end. Additionally, only a limited number of these aircraft are available for charter. The NASA

Super Guppy is a NASA aircraft, Belugas are basically dedicated to support European operations, the C-5s are USAF military support assets and have proven difficult to obtain for non-Department of Defense missions, and the AN124s are also limited in number. The foreign air carriers require special FAA permits to fly in U.S. cabotage trade, and for certain commodities deemed Munitions List (ML) articles in 22CFR Parts 120-130. Prior licensing by the State Department is required (taking typically 180 days before the mission). Airlift is a costly alternative to highway movement estimated to be approximately 10 times the highway rate for missions from Huntsville, Houston, or Denver to the Spaceport.

Figure VII-11

C-5 Front Loading – Spacelab Components

- **USAF C-5A/B and C-5SCM**
- **C-5SCM Cargo bay door (rear) Width x Height: 17’7” x 17’7”**
- **C-5A/B Cargo bay door (front) Width x Height: 19’ x 13.5’**

SOURCE: Yowell International

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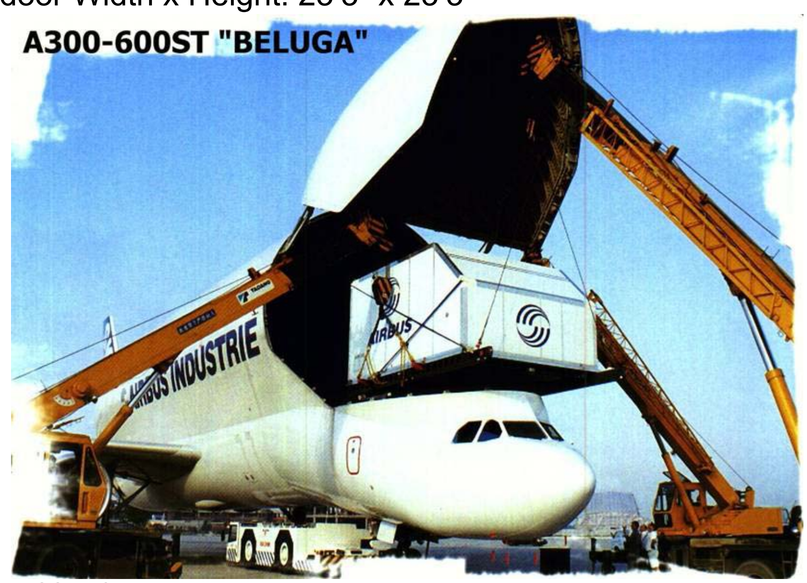
Figure VII-12
Russian AN-124

Cargo bay Width x Height: 20’ x 14.6”

SOURCE: Yowell International

Figure VII-13
A300-600ST Beluga

Cargo bay door Width x Height: 23’3” x 23’3”



SOURCE: Yowell International

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These aircraft photographs illustrate the considerable investment in ground support equipment required to accomplish safe and efficient on-loading and off-loading operations. Many operations require that the equipment needed to off-load the aircraft be shipped to the Spaceport prior to off-loading the aircraft (particularly true of the Guppy and the Beluga).

Highway

The most cost-effective means of transporting many large Spaceport cargoes is by highway. There are, of course, size and weight limitations beyond which highway travel would be impractical or, maybe, impossible. Many large shipments, moved into Florida by water and by air modes, could be shipped by highway at great savings in time and money to the shippers. The purpose of this chapter is to define the practical highway/multi-modal limitations, detail modifications to specific routes (low bridges, tree limbs, utility lines, etc.) to allow transit of large cargoes and suggest changes to local and state regulations and policies to facilitate the process of granting permits for large cargoes to the greatest possible extent consistent with highway safety.

Two examples of over dimensional shipments permitted by other states for highway movement over great distances are illustrated below:

Figure VII-14
Oversized Cargo
Liquid Hydrogen Tank

zoom

SOURCE: Yowell International

This liquid hydrogen tank moved from Decatur, AL,
To Huntington Beach, CA at 18' wide x 20' high

Figure VII-15
Space Station Hardware

SOURCE: Yowell International

This Boeing space station hardware moved from TULSA, OK, TO HUNTSVILLE, AL at 17' WIDE x 18' HIGH. It was subsequently moved from Huntsville to the Kennedy Space Center by the NASA SUPER GUPPY.

A majority of the space-related cargo arriving in Florida originates in either California, Colorado, Alabama or Oklahoma. **Exhibit VI-1** identifies the primary routes used by oversize haulers to transport space-related cargo to Florida and, ultimately, to the Cape Canaveral Spaceport from these destinations. As might be expected, Interstate 10 is a major access route for suppliers and manufacturers located west. U.S. 231 is a major North/South access routing for major suppliers located near Birmingham, Alabama. The Launch Mate Unit (LMU) and Oversized Element Transportation Container (OETC) modules are truck transported utilizing these routes.

Exhibits VI-2 through VI-7 show the intrastate Florida routing most commonly used to haul the LMU and OETC to the Spaceport. A majority of the space-related cargo delivered to the Spaceport is transported along I-10 and arrives in Florida from Alabama, Colorado or California.

Regulatory Considerations

INTERNATIONAL TRAFFIC IN ARMS REGULATIONS (ITAR).
It should be noted that the requirements of 22CFR Parts 120-130 (ITAR) apply to certain aircraft and vessel movements where they cross international borders. Space

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flight hardware and associated ground support equipment typically appear on the U.S. Munitions list, further complicating this mode. Regarding use of a foreign-owned/operated aircraft, State Department regulations, also from the ITAR, require a DSP-73 (Temporary Export License) to move any commodities listed on the Munitions List between two points in the U.S.

Jones Act

This regulation necessitates the use of U.S.-built, flagged and registered vessels for shipments between two U.S. ports by water (cabotage). Foreign vessels are excluded from these trade lanes. This law causes a huge cost penalty due to the requirement that U.S. Vessels and crews (higher cost) must, by law, move intercoastal cargos.

Cost Considerations

The matrix below illustrates the variance in costs and time for the movement of a Launch Mate Unit (launch platform component) from southern California to the Spaceport. The unit measuring 24'Wx24'Lx9'H was moved from California to the Spaceport via an escorted heavy haul truck twice during 2001.

MODE	COST	TRANSIT TIME
Jones Act Vessel – (e.g., Delta Mariner)	$750,000.00	30 days
European A300-600ST Beluga**	$550,000.00	20 days application and flight time
Expedited Escort-Articulated Truck	$55,000.00	14 days

**Excludes DSP-73 State Department license leadtime (up to 180 days prior to need) for Defense Articles deemed temporary exports.

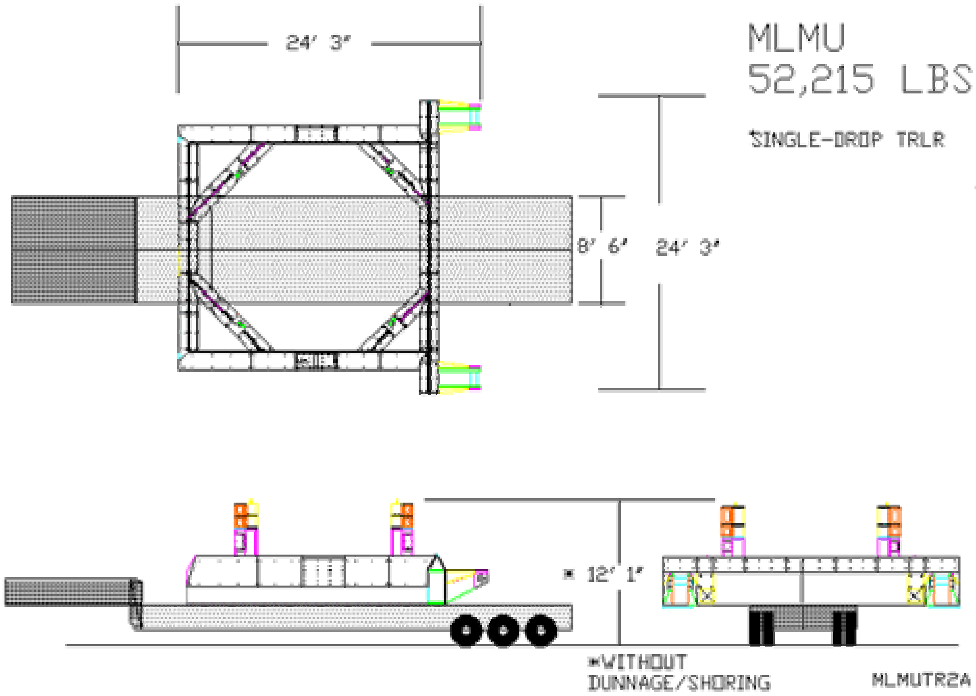
Highway Network

The Florida highway network consisting of federal (Interstate and US Routes), state, county and local roads is basically sound. The roads and highways are, however, at times very congested and under continuous improvement. Florida, as a tourist state, attracts visitors from around the world. Although many travel to Florida by air, the events of September 11 and the current decrease in gasoline prices have resulted in increasing numbers utilizing Florida roadways. Notwithstanding the tourism industry's demands on the system, use of the highways by the spaceflight industry must be accommodated, as well.

Two examples of over-dimensional shipments that have been safely moved over Florida roadways are the Delta LMU and the Space Station OETC. The routings used are detailed elsewhere in this document.

The LMU was permitted to travel at 24'3"W and at legal height from California to the Kennedy Space Center in 2000, a historical first. Obtaining Florida permits for movement of the LMU proved to be extremely difficult. It should be noted that at legal height, a 24’3”W load could safely travel on any number of different routings, including virtually exclusive use of the Interstate System.

Figure VII-16
Dimensions - Launch Mate Unit (LMU)



SOURCE: Yowell International

Figure VII-17
Oversized Element Transportation Container (OETC)

SOURCE: Yowell International

The Oversized Element Transportation Container (OETC) has been moved to and from the Kennedy Space Center on several occasions over the past few years. The unit travels at 17'6" W and 16'5" H. The OETC is a self-contained transport unit and can be hydraulically lowered to further decrease the height whenever necessary. The height of the unit negates exclusive use of the Interstate System, but nonetheless can, and has, utilized several different routings to access the Kennedy Space Center. Obtaining permits to move this unit on Florida roadways continues to be rather difficult.

Current safety limitations and restrictions required by the Florida DOT as conditions applicable to shipments moved under permit would appear to be suitable and appropriate for the permitting of larger Spaceport cargoes. Florida Administrative Rule 14-26 governs such movements. Examples include:

- Private escorts at the front and/or rear of each shipment exceeding certain dimensions
- Under certain conditions, state and local law enforcement escorts accompany the shipment
- Pole cars may be required to precede the shipment of overly high loads
- Special lighting and load markings may be required
- Restrictions on time of travel (e.g., daylight hours only, specific nighttime hours only, curfews during peak traffic in urban areas, weekend/holiday limitations)
- Restrictions on travel during adverse weather conditions

Based on recently accomplished routing surveys conducted in 2000/2001 and past experience moving over-dimensional loads, shipments not exceeding 16'6" in height and 17'6" in width (e.g., OETC) can travel over many routes within Florida. Because of the low bridges in between I-10 Exits 50 and 51, heights in excess of 15'2" preclude travel exclusively via I-10, I-295 and I-95. Use of many secondary routes, such as US331, US98, FL100, et al., in conjunction with the Interstate system, makes movements of this type of load possible at greater risk to the motoring public and to the space hardware. With respect to shipments with heights not exceeding 15' and widths not exceeding 24', use of the Interstate system is entirely practical-presuming FDOT and district approval of permit applications.

Length of shipments that can be safely transported by highway do not pose much of a problem, providing the height and width are within legal limits. Excess lengths could potentially cause problem with load height. Camber calculations and considerations apply in these circumstances and govern transport of excessively long loads.

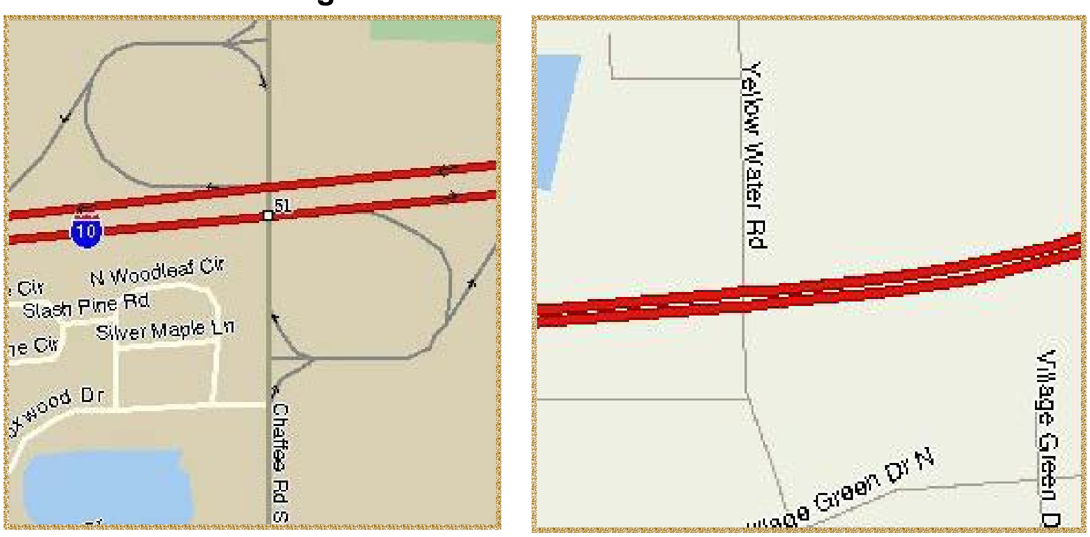
The majority of space-related hardware that can be safely transported by highway easily falls within legal limits, sometimes through utilization of

specialized equipment (i.e., multi-axled trailers for distribution of loads to the roadway), and can satisfy safety regulations and requirements to allow for blanket permitting.
Unlike many other states (e.g., California), Florida does not currently have a codified waiver mechanism to allow private sector shippers, under specific circumstances, to apply for permits for shipments exceeding statutory limits. California has in place a "variance" provision which requires and allows the shipper to provide evidence of the extenuating circumstances under which they are requesting relief from the existing limitations (e.g., width in excess of 17'). The variance, when granted, requires that the shipper and carrier work out specific routing and timeline details with those local highway patrol offices along the established route. Suggested language amending Florida's Administrative Code 14-26 has been previously provided to Florida Space Authority for future legislative consideration.

<u>Recommended Infrastructure Improvements to Current Routings</u>

In the near term, one change to route infrastructures that would improve the I-10 route is to engineer the two low overpasses between I-10 Exits 50 and 51 (Yellow Water Rd. at 15'4"and Chaffee Rd. at 15'2") to accommodate loads of at least 16'3" high. This would allow I-10/I-295/I-95 to become an Interstate corridor to the Spaceport from the Alabama state line.

Figure VII-18
Height Restrictions – Interstate 10



SOURCE: Yowell International

It is also recommended that underpasses at US231/I-10 and US221/I-10 be engineered to allow passage of cargoes of up to 18' clear height. One further improvement would be to create an additional lane on the existing I-95 (exit 78) exit ramp to allow access to SR407 eastbound. The existing exit ramp is designed to allow access only to SR407 westbound.

Figure VII-19
Add Lane – I 95/SR 407

SOURCE: **Yowell International**

Because of the "sunbelt" migration patterns of an aging U.S. population, demographic trends, and an increase in automobile travel (car population), additional lanes should be planned and built on I-10 from the Alabama state line to I-295 and on I-95 from I-295 to the Spaceport area. Most of the space hardware addressed in this report requires the utilization of two lanes of traffic on a highway. Florida should plan for growth in the motoring public's use of the highways and on the needs of the space industry for safe, economical movement on the Interstate corridor.

Conclusions

The foregoing discussion addressed the land, air and sea aspects available to the space industry for delivery of outsized commodities to the Florida Spaceport. The underlying premise for continuing success of the Florida-based Space industry is maintenance of a competitive cost profile to users. Accordingly, highway access to the center is of paramount importance as air and sea modes will typically exceed the transit time and cost of the highway modes for outsized cargo. Transit time for use of foreign-owned airlift providers must include the application lead time for overfly and landing permits from the FAA and, in the case of rocketry or payload appearing on the State Department's list of defense articles, a temporary export license.

Past experience indicates that airlift of space-related hardware from out-of-state origins to a 1000-mile radius from the Spaceport costs in the range of $250,000 for cargo widths exceeding 16' to a maximum of 23'3"'. Such cargo widths are prohibited from highway transport under current FDOT administrative code. A rule of thumb for comparing air to highway is 10 to 1, i.e., an escorted truck superload in the 16' to 23'3" width category will deliver to the Cape for 1/10th the cost of a competing airlift provider.

shardware to perils of the sea, including salt spray and high winds (sometimes, tearing apart weather tarps or shrink-wrap). Again, a rough guideline is to gauge the truck cost at 1/10 the cost of waterborne moves of the same distance.

Consideration should be given by policymakers to the assessment of a "space hardware" corridor by highway from the principal western access route on Interstate 10. NASA, the Department of Defense, Lockheed Martin, Boeing, Alliant Tech System, Hughes Communications and others, including subcontractors, prefer the safety and expediency of the interstate highway system for freight movement. Recent routing surveys of I-10, I-295, I-95 to S.R. 405 corridor revealed several anomalies.

The envelope tested included 16' 3", in overall height. Most bridges passed the pole car setting of 16' 3" except for the bridges near Whitehouse Road, just west of the intersection of I-10 and I-295 in Jacksonville. If these bridges were reconfigured to a clear height of 16' 3", passage by truck at a ground-to-highest-point elevation would be continuous along this corridor. Widths to 24' 3" have been successfully moved by trucks on this pure interstate "corridor" routing. This is an obvious infrastructure change for perfecting a highway corridor to the Spaceport, using the fastest, safest means of over-the-road movement covering outsized space-related hardware provided administrative procedures were applicable in Florida to allow such traffic.

Florida Space Authority should take the lead in fostering mechanisms whereby planners and operatives can count on issuance of highway permits for space super loads moved by truck. The present system through FDOT does not provide for waiver or "variance", (i.e., exception) in writing, to restrictions against load widths in excess of 16'. As a result, the cost of doing business in Florida reflects the increased transport costs identified above for air or maritime movements.

It is recommended, within the next five years, that Florida Space Authority (FSA) pursue a waiver mechanism along with correction to the impasse at the Whitehouse Road bridges on the I-10 Interstate system. In concert, the two changes will help the industry become more efficient and competitive. Under national security conditions, this corridor has successfully been used, albeit not for excess height loads. There must be more than compelling need for defense or national purpose to align Florida with other states in terms of exception permits issuance. Finally, it is recommended that issues raised be reviewed in advance by an ad hoc "Quadra-Modal Council" meeting, at least quarterly, at the Florida Space Authority headquarters office. The council membership could include, in addition to the appropriate FDOT and FSA representation, members of the payload and launch communities, WSA, specialized transport providers and other related public and private interested parties.

VIII. NEXT STEPS, FUTURE DIRECTIONS, AND RECOMMENDATIONS

Overview

Aerospace industries comprise an important segment of Florida's economy, and there exists intense nationwide and international competition for future development of these industries. The State has the resources to help these industries meet the challenges and opportunities of competition and to establish itself as a prime location for aerospace, thus creating a key environment for economic development and employment opportunities. However, effective action and the necessary coordination of resources must be based on a reliable assessment of the present climate for such industries in the State. Further, the various options available for legislative action should be carefully considered.

A Blue Ribbon Commission was established by the 1999 Florida Legislature to study and make recommendations regarding ways in which Florida can establish itself as a prime location for aviation and aerospace industries. This group was charged with developing findings and recommendations in the following areas:

(1) Authorize a review of current State and local laws, ordinances, and rules that affect the development and regulation of the aviation and aerospace industries in Florida and recommend ways in which these regulations can be streamlined and revised to operate more efficiently. Governmental oversight functions should be studied to determine the appropriate level and whether centralized or decentralized approaches should be instituted.

(2) Examine the ways in which aviation and aerospace industries, including the component elements of manufacturing, assembly, marketing, servicing, maintenance, logistical support, human resources, and related research and development, can be attracted to locate permanently in the State, and recommend actions that can be taken by State and local governments to accomplish this goal.

(3) Identify the advances that can be expected in the future in aeronautics and aerospace operations, air transport, aeronautical education, and other aeronautical areas, and make recommendations regarding how the State can anticipate, encourage, and accommodate such advances.

(4) Identify aid that is available at the federal level to assist in efforts to improve Florida's aeronautical and aerospace competitive position, and recommend ways in which the State can be most effective in obtaining that aid.

Florida’s aerospace industries include public and private airports, flight and maintenance training programs, aerospace manufacturing and service industries, defense industries, government and commercial aerospace and space industries, and public and private research and development (RandD) programs.

Government and commercial aerospace and space industries are entering a phase of dramatic growth and profound change. Space, at one time a governmental research and development initiative, is now one of the world's fastest growing enterprises, marked by the privatization of federal programs and the commercialization of space-related technologies and services. It is forecast that by 2010, new industrial investment will generate up to $250 billion in sales per year worldwide. Cape Canaveral has served as the center for the aerospace industry's statewide growth and has become the world's busiest and most capable spaceport. The spaceport now supports eight different types of rockets and had over 34 missions in 1999, most of them commercial. A requirement for more than 50 launches per year is anticipated by 2005. However, aerospace and space-related industries are located throughout Florida and the State should foster the growth of these industries, which have the potential to link many Florida communities with an increase in technology-related high pay jobs and substantial economic benefits.

The changes in Florida's aerospace industries are creating both risks and opportunities for Florida. Florida is at risk of losing its current $4.4 billion share of the $77 billion global industry, and opportunities to expand and diversify the industry statewide. The Cape Canaveral Spaceport has limited growth capacity due to outdated spaceport infrastructure and technologies. However, with relatively small investments, Florida can leverage and attract much larger federal and private spending to ensure that Florida becomes the state of choice for future government and commercial aerospace programs. Florida should work with the Air Force, NASA and industry to increase the Cape's launch capacity, preserve its national defense mission, establish facilities for new programs, and provide a business-friendly environment for the commercial aerospace transportation industry. With programs like the International Space Station and other missions on the horizon, NASA is focusing on research and development areas such as life sciences, space transportation, satellite/payload development, and other specialized technologies. Florida Space Authority should continue to support and be involved in efforts with NASA and the Air Force to develop the aerospace transportation industry and the Cape Canaveral Spaceport. The successful transition of the Cape Canaveral Spaceport to a more commercial, manufacturing, and research and development oriented facility will help to diversify Florida's aerospace industry and its economy.

The State has achieved limited success in attracting federal funding for aerospace-related research and development. For example, Florida ranks 30 overall among states that receive NASA funding. One of the ways to increase the success in attracting federal-level funding for the space industry is by investing in initiatives that increase partnering and foster relationships with federal agencies. The State has recognized the benefit of investing in these types of initiatives by creating the Florida Space Research Institute (FSRI). The FSRI serves as an industry-driven center for research, leveraging the State's resources in a collaborative effort to support Florida's space industry and its expansion, diversification, and transition to commercialization. The FSRI operates as a public/private partnership under the direction of a board of representatives of Florida Space Authority, Enterprise Florida, the Florida Aviation Aerospace Alliance, the Florida Space Business Roundtable, private-sector space industry representatives, and representatives from the education community. The Florida Space Authority should continue efforts in the development of publicly funded research, as well as, encourage privately funded efforts.

Florida Aerospace Agencies/Organizations

There are a number of agencies and organizations in the State that are actively involved with programs to address the impediments to a healthier business climate for aerospace. The Governor's Office and Legislature should support those efforts with policy and resources. A partial list and description of those agencies and organizations is provided below.

- **Enterprise Florida, Inc. (EFI)**
    - **Florida Aviation and Aerospace Alliance (FAAA)**
    - **Florida Defense Alliance**
- **Workforce Florida (WFI)**
- **Florida Department of Transportation (FDOT) Aviation Program**
- **Florida Space Authority (FSA)**
- **Florida Space Research Institute (FSRI)**
- **Florida Commercial Space Finance Corporation (FCSFC)**
- **Spaceport Management Council**

Enterprise Florida Inc. is a partnership between Florida's government and business leaders and is the principal economic development organization for the State of Florida. EFI's mission is to increase economic opportunities for all Floridians by supporting the creation of quality jobs and globally competitive businesses. It pursues this mission in cooperation with its statewide network of economic development partners. The contributions to date of EFI to the development of Florida's aerospace industry have been noteworthy; the agency's continuing involvement, as indicated by the list of recommended action items for the agency listed below, is substantial.

- Aerospace industrial and business park marketing
- Marketing for the expansion of aerospace
- Establishment of "electronic" business network
- Support of defense company facility modernization
- Availability of venture capital
- Mentoring (business to business)

It is recommended that the State expand the focus and resources provided to EFI to use aerospace as an economic motivator.

Florida Aviation and Aerospace Alliance is a private, not-for-profit corporation formed by EFI to make Florida the global choice for aviation and aerospace products and services. It brings together Florida's aerospace companies to determine how to expand Florida's aerospace industry and becomes an advocate for these changes. Florida needs to take a more aggressive stance on lobbying for aerospace development and contracts at the federal level. Coordination is needed with the U.S. Department of Defense (DOD) to ensure that the base closure program does not have a negative impact on Florida's aerospace industry.

Workforce Florida Inc. (WFI) is the State's chief workforce policy organization. The public-private partnership supports and promotes economic growth through workforce development. WFI has been given the imposing task of providing the State with a pool of workers adequately trained in technology-based disciplines to meet the need of industry in the State. WFI has identified the aerospace industry as one of the targeted industry sectors having the greatest potential for growth, high-paying job opportunities, and overall economic impact. In particular, the Florida Space Authority should continue avid support for WFI's coordination with the Florida Space Research Institute (FSRI) and EFI in the identification of technological incentives to attract and grow the Florida workforce for aerospace.

The **FDOT Aviation Program** provides coordination and fiscal support to aerospace infrastructure programs in the State. Although the FDOT Aviation Program and Florida Space Authority (FSA) are organizationally separate, there is a significant amount of coordination between the two programs. Legislation passed in 1999 encouraged the state aviation and aerospace programs to work closely together. Florida Space Authority should advocate that the FDOT Aviation Program be staffed and resourced to meet and keep pace with the challenges of Florida's, and the nation's dynamic aviation and aerospace programs.

FSA supported the legislative creation of three "spin-off" organizations: the **Florida Space Research Institute (FSRI),** the **Florida Commercial Space Financing Corporation (FCSFC),** and the **Spaceport Management Council.** These organizations provide specialized statewide services in the areas of space-related academic programs, innovative financing for space-related projects, and coordinated management of policies and programs for space and space related industries. **FSRI** serves as an industry-driven center for research, leveraging the State's resources in a collaborative effort to support Florida's space industry and its expansion, diversification, and transition to commercialization. FSRI operates as a public/private partnership under the direction of a board composed of: representatives of Florida Space Authority, Enterprise Florida, the Florida Aviation Aerospace Alliance, the Florida Space Business Roundtable, and additional private-sector space industry representatives from geographic regions throughout the State. Representatives from the educational community, who are engaged in research or instruction related to the space industry, also serve on the board. The FSRI partners with the State Workforce Development Board and coordinates the workforce-training requirements identified by the space industry, and supports development of workforce-training initiatives to meet such requirements. The **FCSFC** was created as a not for profit corporation on a non-stock basis. The purpose of the corporation is to expand employment and income opportunities for residents of this State by providing businesses domiciled in Florida with information, technical assistance, and financial assistance to support space-related transactions, in order to increase the development within the State of commercial aerospace products, activities, services, and facilities. The **Spaceport Management Council** was created by the Legislature to provide coordination and recommendations on projects and activities that will increase the operability and capabilities of Florida's space launch facilities, increase statewide space-related industry and opportunities, and promote space education and research within the state. The council works to develop integrated facility and programmatic development plans to address commercial, state, and federal requirements and to identify appropriate private, state, and federal resources to implement these plans.

The following recommendations/insights were made by the *Commission on the Future of Aeronautics and Space in Florida* as part of their report to the Governor and Legislature, ***Establishing Florida As a Prime Location for the Aviation and Aerospace Industries***, in January 2001. These suggestions and observations form the basis for next steps, future directions, and recommendations of this first Interim Master Transportation Plan.

Aerospace industry permitting, planning, and development are subject to a pervasive system of local, State, and federal oversight. Improvements can often take 10 years or more from planning to construction. Improvements can and should be made in the State regulation and oversight of aerospace industries and that State regulatory processes are, in some cases, redundant to federal oversight.

Time-consuming and costly permit processes often critically impact aerospace business development, transportation operations, and expansion. Frequently, companies are unable to react to fast-changing market conditions due to permitting delays. With the advanced electronic communications now available, a more efficient permitting process should be possible that reduces time delays and costs without creating a reduction in government oversight.

Because of significant changes at the Cape Canaveral Spaceport, there is a need to promote and clarify the role of the Spaceport Management Council, particularly in terms of the council's working relationship with federal and State agencies. Proposed legislative actions (Section 331.367,F.S.) should include changes to the structure of this organization that will allow State interaction with federal agencies while recognizing that federal statutes and other constraints limit the role of these officials.

The organizational placement of the State's aviation and aerospace programs were previously reviewed by the Commission to determine if they should be centralized. The Commission determined that the programs are appropriately located and that they should not be centralized under one governmental agency. Most importantly, the Commission believes the programs are located to maximize their impact on their respective industries.

Recommendations

Future direction for the Florida Spaceport Authority should include an agenda which, at a minimum, includes the following with respect to transportation infrastructure and access issues.

Support legislation which proposes integration of FSA master plans with local government comprehensive plans consistent with the State Comprehensive Plan, the applicable strategic regional policy plan, and State goals and objectives related to aerospace planning and transportation.

Florida Space Authority should investigate ways to streamline the general permitting processes involving transportation access to the Cape. Expanding and/or streamlining the permitting process would enhance the general economic climate for business development in Florida, as well as aerospace businesses and the transportation of payload components to and from the Cape. An on-line permitting process and information source, agency review time guidelines, and the elimination of duplication in the permitting processes should be investigated and institutionalized. Consideration for establishing an ad hoc "Space Transport Permitting Advisory Council" jointly with the FDOT and key payload delivery operators should be explored

Support proposed revisions to Chapter 331.367, F.S., related to the Spaceport Management Council. The revisions will allow for federal liaison officials to participate in council meetings while recognizing that federal statutes and other constraints limit the role of these officials.

Continue to support and encourage the efforts of the FDOT, Florida Space Authority, Florida Aviation and Aerospace Alliance, and Enterprise Florida to work within existing organizational structures and responsibilities for the promotion of aerospace in Florida and encourage the legislature to provide additional resources for the support of aerospace planning, access and on site infrastructure development.

Transportation and Infrastructure

There has been a recent estimate for over $150 million in aerospace and space infrastructure needs over the next few years at Florida's Cape Canaveral Spaceport. The State, through Florida Space Authority, should continue to support aerospace infrastructure and access investment at the State level and encourage federal, local, and private investment to meet the needs of Florida aerospace, and space in the next decade.

The aerospace and space industry is Florida's premier high technology enterprise with over $4 billion in direct annual spending and billions more in extended economic impacts. Most of the projects planned for Florida's Cape Canaveral Spaceport will use a combination of federal and industry funds, with over 90 percent of total capital investments provided from non-state sources. For projects where insufficient up-front federal funding is available, or where state partnerships will attract matching industrial investment, the State, through Florida Space Authority, should provide transportation funding through the five-year planning process. A dedicated revenue stream provided by a funding mechanism directly related to the space industry would allow Florida to leverage industrial and federal investments to develop launch pads, processing facilities, and manufacturing/assembly facilities for new launch programs. One such revenue stream might be sales tax receipts from the KSC Visitor Center.

There is also a need to ensure that Florida enhances multimodal transportation opportunities for aerospace. Of particular importance is the establishment of multimodal routes and certified corridors for the transport of aerospace payloads and cargo through the State. This document identifies the most economical, efficient, and safe multi-modal routes for the seamless transport of aerospace cargo through Florida to aerospace businesses and facilities in proximity to the Cape. Choke points identified on the interstate and intrastate highway systems as identified elsewhere in this document should be priority objectives for pursuit by Florida Space Authority over the next five-years.

In 1995, the FDOT drafted unofficial guidance for freight facility design that included height, width, and turning radii recommendations for accommodating various size truck/cargo vehicles. That guidance was a first attempt to develop rough benchmarks for evaluating accessibility/connectivity in support of freight movement at major intermodal facilities while structuring a workable “intermodal management system” that would meet then applicable federal requirements. Those requirements were rescinded, and currently, with the exception of interstate highway design criteria, there are no freight, intermodal-related criteria in place. This should be a continuing future priority for Florida Space Authority policymakers.

Florida Space Authority should continue to encourage FDOT to coordinate with Florida airports, other intermodal facility owner/operators, and associated metropolitan planning organizations, to ensure that the enhancement of intermodal connectivity between air cargo and ground freight handlers (rail and truck) is adequately addressed. The FDOT, in concert with the American Association of State Highway and Transportation Officials (AASHTO) and the Transportation Research Board (TRB), develop guidelines for freight access to statewide intermodal facilities.

Florida Space Authority facilities can simultaneously accommodate several competing commercial launch interests. By continuing to enhance and expand the existing infrastructure, the State of Florida can attract more communications satellite and launch vehicle industries to the vicinity. The Legislature should continue to finance and support the development of State facilities at Florida’s Cape Canaveral Spaceport to remain competitive with existing and future spaceports.

NASA’s present research efforts range from general aviation aircraft programs to aerospace and space industry research. The goal of NASA’s Reusable Launch Vehicle (RLV) program is to ensure that the United States remains competitive in the global launch arena by creating an efficient, reusable launch vehicle. NASA’s RLV initiatives include a series of “X-vehicle” prototype development programs. NASA’s Kennedy Space Center is shifting its focus from launch operations support toward an expanded role in space research and technology development, including a responsibility for a range of “spaceport technology” initiatives that will support the future of space transportation and space travel. Florida Space Authority should continue to avidly support this shift in NASA program emphasis as a basis for justifying future transportation infrastructure needs.

It should also pursue the following means to attract aerospace manufacturers to Florida such as: work with NASA, DOD and FAA on their aerospace testing, research and development programs; and develop runway, launch and other take-off/landing facilities for test vehicles.

Advances in space technology and operations could have a negative impact on Florida’s space industry unless the State, through Florida’s Space Authority, prepares and postures itself to take advantage of these advances, including:

- Domestic and foreign competitors are now planning next-generation reusable and expendable launch vehicles. In today's commercially driven space industry, these programs will seek the most cost-effective, internationally competitive launch sites for their operations. Florida, through the Authority, must work with industry and the federal government to make the Cape Canaveral Spaceport more commercially competitive. The advent of new reusable launch vehicles will profoundly change the space transportation industry. Future space planes will blur the lines between aviation and space travel, and probably lead to an integration of air and space traffic control systems. Florida should become the test bed for the new technologies and management approaches that will be required.

- Florida must support near-term evolutionary steps to increasing capacity and decreasing costs at the Eastern Range launch corridor. A Range Development Test Center is proposed to develop and demonstrate approaches to using satellite-based tracking and telemetry, and other currently available technologies, for improving range competitiveness for existing and proposed launch vehicles.

- NASA intends to shift its focus to interplanetary and deep space exploration, leaving near-Earth orbit for commercial development. As part of this vision, NASA plans to privatize or commercialize much of the International Space Station. Florida is perfectly positioned to become the primary ground-based support site for Space Station operations, and should enable projects such as the Space Station Commerce Park to proceed in partnership with NASA; another justification for continuing improved transportation access enhancement to the Cape.

- The continuing trend of consolidation within the space industry is generating opportunities for Florida. With a competitive spaceport, and with increased involvement by Florida's universities, colleges, and the Authority, the State should be able to attract new manufacturing and technology development operations for launch vehicle and satellite systems, and for federally funded research programs. Special attention should be given to attracting these high-value sectors of the industry, because the launch industry alone represents a comparatively low-tech operation in the state.

Florida Space Authority should continue to develop and refine the inventory of readily available runway, launch and other take-off/landing facilities for test vehicles. Through this inventory, supplemental facilities that may be needed can be identified and improvements made. Florida should also promote its existing facilities, such as those at Florida's Cape Canaveral Spaceport and underutilized Georgia airports, to encourage aerospace developers' testing activities (and, by extension, research, development and manufacturing facilities) at these sites.

The State has not in the past actively pursued nor received federal funding for space-related research and development. Specifically, Florida ranks number 30 overall among states that receive NASA funding (Daytona News Journal editorial, February 20, 2000). One of the ways to increase the success in attracting federal level funding for the space industry is by investing in space initiatives that increase partnering and foster relationships with federal agencies. The state has recognized the benefit of investing in space initiatives by creating, through Chapter 331.368, F.S., the Florida Space Research Institute (FSRI).

As the U.S. moves towards the commercialization of its space industry and space launch infrastructure, including launch vehicles, launch sites, and supporting services, states have become more interested in understanding domestic and international developments in space transportation-related businesses and the competitiveness of their own space-related activities. Support of commercial space transportation is already a mainstream activity within the U.S.D.O.T., and the encouragement of space as part of the national transportation system is important to the nation, as well as to the State of Florida. Further investment in space exploration infrastructure will advance the nation's economic growth and domestic and international competitiveness by enhancing the capabilities of the nation's launch infrastructure and related space business activities. Florida Space Authority should continue its role as an advocate for securing federal matching resources for space infrastructure enhancement.

Florida Space Authority through this list of potential roles and activities has much opportunity to achieve. Priorities for which of the previously outlined transportation related initiatives should be undertaken, must be the next level of activity and focus by the Authority. Competitiveness and lost aerospace opportunities are upon the State of Florida. The next update of this Interim Transportation Master Plan should focus on the prioritization of these recommendations and needs for the State to realize its potential in maximizing preserving, enhancing, and growing the space and aerospace industries as contributors to the state's overall economy.

Given the growing levels of international competition in the commercial space transportation industry, it is now vitally important to increase Florida Spaceport's capacity, decrease user costs, and establish a positive, user-friendly environment for both launch service providers and their customers. With its broad state-level powers and innovative approaches to meeting the space industry's requirements, the Authority is prepared to assist the Federal Government and industry to improve Florida Spaceport's long-term competitiveness.

IX. APPENDIX

EXHIBITS

Transportation Infrastructure Analysis - Roadway Inventory

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
I - 95	Indian River County	Valkaria Rd.	9.900	0	0.000	9.900	9.900	70	Div.	64	Lawn	4	32,990	B	1	Y
	Valkaria Rd.	CR 516	6.395	0	9.900	11.065	1.165	70	Div.	64	Lawn	4	32,990	C	1	Y
					11.065	13.306	2.241	70	Div.	64	Lawn	4	32,990	C	11	Y
					13.306	16.217	2.911	70	Div.	64	Lawn	4	44,000	C	11	Y
					16.217	16.295	0.078	70	Div.	64	Lawn	4	44,000	C	1	Y
	CR 516	SR 500	4.404	0	16.295	18.584	2.289	70	Div.	64	Lawn	4	51,500	D	1	Y
					18.584	20.699	2.115	70	Div.	64	Lawn	4	51,500	D	11	Y
	SR 500	SR 520	20.804	0	20.699	22.104	1.405	70	Div.	64	Lawn	4	43,000	D	11	Y
					22.104	23.568	1.464	70	Div.	64	Lawn	4	43,000	D	1	Y
					23.568	24.349	0.781	70	Div.	64	Lawn	4	56,000	D	1	Y
					24.349	24.756	0.407	70	Div.	64	Lawn	4	56,000	D	11	Y
					24.756	27.613	2.857	70	Div.	64	Lawn	4	56,000	D	1	Y
					27.613	28.712	1.099	70	Div.	160	Lawn	4	56,000	D	1	Y
					28.712	31.210	2.498	70	Div.	64	Lawn	4	56,000	D	1	Y
					31.210	35.830	4.620	70	Div.	64	Lawn	4	50,500	D	1	Y
					35.830	41.503	5.673	70	Div.	64	Lawn	4	60,000	D	1	Y
	SR 520	SR 528	3.933	0	0.000	1.154	1.154	70	Div.	64	Lawn	4	44,000	C	1	Y
					1.154	3.933	2.779	70	Div.	64	Lawn	4	46,000	C	1	Y
	SR 528	Fox Lake Rd.	12.535	0	3.933	7.348	3.415	70	Div.	64	Lawn	4	31,500	B	1	Y
					7.348	7.703	0.355	70	Div.	64	Lawn	4	31,500	B	11	Y
					7.703	10.452	2.749	70	Div.	64	Lawn	4	31,500	B	1	Y
					10.452	13.900	3.448	70	Div.	64	Lawn	4	34,000	B	1	Y
					13.900	14.151	0.251	70	Div.	64	Lawn	4	34,000	B	11	Y
					14.151	14.214	0.063	70	Div.	64	Lawn	4	23,000	B	11	Y
					14.214	16.468	2.254	70	Div.	64	Lawn	4	23,000	B	1	Y
	Fox Lake Rd.	SR 46	5.762	0	16.468	18.604	2.136	70	Div.	64	Lawn	4	23,000	B	11	Y
					18.604	22.215	3.611	70	Div.	64	Lawn	4	30,500	B	11	Y
					22.215	22.230	0.015	70	Div.	64	Lawn	4	30,500	B	1	Y
	SR 46	Volusia County Line	8.960	0	22.230	29.807	7.577	70	Div.	64	Lawn	4	27,485	B	1	Y
					29.807	31.190	1.383	70	Div.	64	Lawn	4	20,300	B	1	Y

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 3	SR 520	SR 528	3.386	2	0.000	0.301	0.301	35	Div.	33	Curb > 6" & Lawn	4	28,500	B	16	N
					0.301	0.700	0.399	35	Div.	29	Curb > 6" & Lawn	4	28,500	B	16	N
					0.700	0.947	0.247	35	Div.	29	Curb > 6" & Lawn	4	28,500	B	16	N
					0.947	1.057	0.110	40	Div.	29	Curb > 6" & Lawn	4	28,500	B	16	N
					1.057	1.457	0.400	40	Div.	10	Painted (e.g. continuous left turn)	4	28,500	B	16	N
					1.457	1.688	0.231	40	Div.	10	Painted (e.g. continuous left turn)	4	28,500	B	16	N
					1.688	1.745	0.057	40	Div.	10	Painted (e.g. continuous left turn)	4	28,500	B	16	N
					1.745	2.156	0.411	45	Div.	10	Painted (e.g. continuous left turn)	4	28,500	B	16	N
					2.156	2.992	0.836	45	Div.	10	Painted (e.g. continuous left turn)	4	39,000	B	16	N
					2.992	3.386	0.394	45	Div.	10	Painted (e.g. continuous left turn)	4	39,000	B	16	N
	SR 528	Kennedy Space Center Enterance	6.369	10	3.386	3.400	0.014	45	Div.	22	Curb <=6" & Lawn	4	39,000	B	16	N
					3.400	3.869	0.469	45	Div.	22	Curb <=6" & Lawn	4	39,000	B	16	N
					3.869	5.368	1.499	50	Div.	20	Lawn	4	20,300	B	6	N
					5.368	9.755	4.387	50	Div.	20	Lawn	4	14,900	B	6	N

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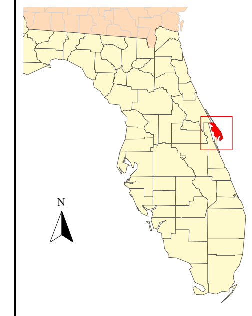
Transportation Infrastructure Analysis - Roadway Inventory



Key Map

Source: FDOT

Exhibit No.

III - 1A

Transportation Infrastructure Analysis - Roadway Inventory

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 50	Orange County Line	I-95	5.133	1	0.000	4.100	4.100	65	Div.	48	Lawn	4	16,100	A	2	N
					4.100	4.850	0.750	55	Div.	48	Lawn	4	16,100	A	2	N
					4.850	4.903	0.053	45	Div.	48	Lawn	4	16,100	A	2	N
					4.903	4.989	0.086	45	Div.	48	Lawn	4	16,100	A	14	N
					4.989	5.133	0.144	45	Div.	40	Curb <=6" & Lawn	4	16,100	A	14	N
	I-95	SR 5 / US 1	3.407	6	5.133	5.489	0.356	45	Div.	40	Curb <=6" & Lawn	4	25,500	B	14	N
					5.489	5.510	0.021	45	Div.	40	Curb <=6" & Lawn	4	19,000	B	14	N
					5.510	5.565	0.055	45	Div.	40	Lawn	4	19,000	B	14	N
					5.565	5.768	0.203	50	Div.	40	Lawn	4	19,000	B	14	N
					5.768	6.850	1.082	50	Div.	28	Lawn	4	19,000	B	14	N
					6.850	7.036	0.186	45	Div.	28	Lawn	4	19,000	B	14	N
					7.036	7.580	0.544	45	Div.	28	Lawn	4	20,000	B	14	N
					7.580	7.730	0.150	40	Div.	28	Lawn	4	20,000	B	14	N
					7.730	8.027	0.297	40	Div.	28	Lawn	4	20,000	B	14	N
					8.027	8.260	0.233	40	Div.	28	Lawn	4	15,000	B	14	N
					8.260	8.300	0.040	35	Div.	28	Lawn	4	15,000	B	14	N
					8.300	8.540	0.240	35	Div.	28	Lawn	4	15,000	B	14	N

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 401	SR 528	Cape Canaveral Air Force Station Limit (Gate 1)	2.200	1	0.000	0.254	0.254	45	Undiv.			4	15,500	B	14	N
					0.254	0.619	0.365	45	Div.	40	Lawn	5	15,500	B	14	N
					0.619	2.200	1.581	55	Div.	10	Painted (e.g. continuous left turn)	4	15,500	B	14	N

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 402	US 1	Beach Road	2.900	0*	0.000	0.400	0.400	30	Undiv.			4	6,800	A	16	N
					0.400	2.900	2.500	30	Undiv.			2	6,710	A	6	N

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 406	I-95 / SR 9	SR 5 / US 1	2.949	4	0.000	0.334	0.334	40	Div.	4	Median Curb < 6"	4	14,400	B	14	N
					0.334	0.995	0.661	40	Div.	16	Curb > 6" & Lawn	4	14,400	B	14	N
					0.995	2.140	1.145	40	Div.	16	Curb > 6" & Lawn	4	17,400	B	14	N
					2.140	2.265	0.125	40	Div.	12	Painted (e.g. continuous left turn)	4	17,400	B	14	N
					2.265	2.585	0.320	40	Div.	12	Painted (e.g. continuous left turn)	4	13,500	B	14	N
					2.585	2.670	0.085	40	Undiv.			4	13,500	B	14	N
					2.670	2.807	0.137	30	Undiv.			4	13,500	B	14	N
					2.807	2.810	0.003	30	Undiv.			4	13,500	B	14	N
					2.810	2.857	0.047	30	Undiv.			4	14,600	B	14	N
					2.857	2.903	0.046	30	Div.	12	Painted (e.g. continuous left turn)	4	14,600	B	14	N
					2.903	2.949	0.046	30	Div.	4	Painted (e.g. continuous left turn)	4	14,600	B	14	N

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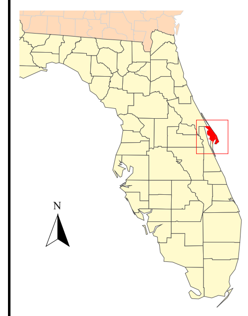

Key Map

Source: FDOT

Exhibit No.

III - 1B

Transportation Infrastructure Analysis - Roadway Inventory

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 405	SR 50	SR 5 / US 1	4.406	4	0.000	0.120	0.120	35	Div.	40	Lawn	4	14,200	B	14	N
					0.120	0.220	0.100	45	Div.	40	Lawn	4	14,200	B	14	N
					0.220	2.394	2.174	55	Div.	40	Lawn	4	14,200	B	14	N
					2.394	2.584	0.190	55	Div.	40	Lawn	4	13,400	B	14	N
					2.584	3.284	0.700	45	Div.	40	Lawn	4	13,400	B	14	N
					3.284	4.209	0.925	55	Div.	40	Lawn	4	13,400	B	14	N
					4.209	4.406	0.197	55	Div.	40	Lawn	4	25,500	B	14	N
	SR 50	Fox Lake Rd.	2.143	1	0.000	0.100	0.100	35	Div.	40	Lawn	4	15,200	D	16	N
					0.100	0.247	0.147	45	Div.	40	Lawn	4	15,200	D	16	N
					0.247	0.250	0.003	45	Undiv.			2	15,200	D	16	N
					0.250	1.134	0.884	55	Undiv.			2	15,200	D	16	N
					1.134	1.531	0.397	55	Div.	12	Paved (e.g. crosshatching)	2	15,200	D	16	N
					1.531	1.996	0.465	55	Undiv.			2	15,200	D	16	N
					1.996	2.039	0.043	45	Undiv.			2	15,200	D	16	N
					2.039	2.143	0.104	45	Div.	12	Painted (e.g. continuous left turn)	2	15,200	D	16	N
	Fox Lake Rd.	W. of Collins Ave.	2.216	1	2.143	2.282	0.139	45	Div.	12	Painted (e.g. continuous left turn)	2	6,800	B	16	N
					2.282	2.316	0.034	45	Undiv.			2	6,800	B	16	N
					2.316	3.301	0.985	55	Undiv.			2	6,800	B	16	N
					3.301	3.601	0.300	55	Div.	12	Paved (e.g. crosshatching)	2	6,800	B	16	N
					3.601	4.285	0.684	55	Undiv.			2	6,800	B	16	N
					4.285	4.359	0.074	40	Undiv.			2	6,800	B	16	N
	W. of Collins Ave	SR 5 / US 1	1.063	3	4.359	4.630	0.271	40	Undiv.			4	6,800	C	16	N
					4.630	4.694	0.064	35	Undiv.			4	6,800	C	16	N
					4.694	4.773	0.079	35	Div.	12	Painted (e.g. continuous left turn)	4	6,800	C	16	N
					4.773	5.213	0.440	35	Div.	12	Painted (e.g. continuous left turn)	4	5,900	C	16	N
					5.213	5.376	0.163	30	Div.	12	Painted (e.g. continuous left turn)	4	5,900	C	16	N
					5.376	5.422	0.046	30	Div.	12	Painted (e.g. continuous left turn)	2	5,900	C	16	N

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 407	SR 528	Brevard Urban Limit	5.037	0	0.000	5.037	5.037	55	Undiv.			2	6,500	C	2	N
	Brevard Urban Limit	SR 528	1.760	0	5.037	6.797	1.760	55	Undiv.			2	6,840	A	12	N

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 524	SR 520	I-95	1.637	0	0.000	1.637	1.637	55	Undiv.			2	4,680	A	2	N
	I-95	SR 528	3.563	2	1.637	1.930	0.293	45	Div.	40	Curb <= 6" & Lawn	4	8,600	D	2	N
					1.930	2.750	0.820	45	Undiv.			2	8,600	D	14	N
					2.750	4.649	1.899	55	Div.	12	Paved(e.g. crosshatching)	2	13,000	D	14	N
					4.649	4.749	0.100	55	Div.	20	Curb>6" & Lawn	4	18,600	D	14	N
					4.749	5.200	0.451	55	1-Way			1	8,300	D	14	N

Source: FDOT

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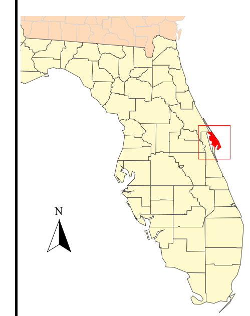

Key Map

Source: FDOT

Exhibit No.

III - 1C

Transportation Infrastructure Analysis - Roadway Inventory

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 520	Orange County Line	SR 524	2.944	0	0.000	0.357	0.357	55	Div.	12	Paved (e.g. crosshatching)	2	8,600	C	2	N
					0.357	0.881	0.524	55	Undiv.			2	8,600	C	2	N
					0.881	1.154	0.273	55	Div.	12	Paved (e.g. crosshatching)	2	8,600	C	2	N
					1.154	1.742	0.588	55	Undiv.			2	8,600	C	2	N
					1.742	2.799	1.057	55	Undiv.			3	8,600	C	2	N
					2.799	2.944	0.145	55	Div.	15	Median Curb < 6"	2	8,600	C	2	N
	SR 524	SR 9 / I - 95	1.938	1	2.944	3.106	0.162	55	Div.	15	Median Curb < 6"	2	12,500	F	2	N
					3.106	4.208	1.102	55	Undiv.			2	12,500	F	2	N
					4.208	4.456	0.248	55	Div.	12	Paved (e.g. crosshatching)	2	12,500	F	2	N
					4.456	4.612	0.156	55	Undiv.			2	12,500	F	2	N
					4.612	4.624	0.012	50	Undiv.			2	12,500	F	2	N
					4.624	4.882	0.258	50	Div.	40	Curb <=6" & Lawn	4	12,500	F	2	N
	SR 9 / I - 95	Willard Street W.	3.962	8	4.882	5.236	0.354	50	Div.	40	Curb <=6" & Lawn	4	23,000	D	2	N
					5.236	5.245	0.009	50	Div.	40	Curb <=6" & Lawn	4	23,000	D	14	N
					5.245	5.369	0.124	50	Div.	32	Curb <=6" & Lawn	4	23,000	D	14	N
					5.369	5.943	0.574	55	Div.	32	Curb <=6" & Lawn	4	23,000	D	14	N
					5.943	7.190	1.247	55	Div.	20	Curb <=6" & Lawn	4	23,000	D	14	N
					7.190	7.298	0.108	45	Div.	20	Curb <=6" & Lawn	4	23,000	D	14	N
					7.298	7.363	0.065	45	Div.	20	Curb <=6" & Lawn	4	23,000	D	14	N
					7.363	7.809	0.446	45	Div.	20	Curb <=6" & Lawn	4	22,000	D	14	N
					7.809	7.868	0.059	45	Div.	24	Curb <=6" & Lawn	4	22,000	D	14	N
					7.868	8.004	0.136	40	Div.	24	Curb <=6" & Lawn	4	22,000	D	14	N
					8.004	8.634	0.630	40	Div.	24	Curb <=6" & Lawn	4	28,000	D	14	N
					8.634	8.727	0.093	35	Div.	24	Curb <=6" & Lawn	4	28,000	D	14	N
					8.727	8.844	0.117	35	Div.	4	Median Curb < 6"	5	31,000	D	14	N
SR 520 EB	Willard Street W.	E of Riveredge	0.456	4	8.844	8.960	0.116	35	1-Way			3	17,000	E	14	N
					8.960	8.984	0.024	35	1-Way			3	17,000	E	14	N
					8.984	9.257	0.273	35	1-Way			3	24,500	E	14	N
					9.257	9.300	0.043	35	1-Way			2	24,500	E	14	N
	E of Riveredge	SR 519	0.723	0	9.300	10.023	0.723	45	1-Way			2	24,500	F	14	N
SR 520	SR 519	North Street	3.100	9	10.023	10.144	0.121	45	Div.	20	Paved, barrier other than guardrail	6	49,636	D	14	N
					10.144	10.586	0.442	45	Div.	12	Painted (e.g. continuous left turn)	6	49,636	D	14	N
					10.586	10.706	0.120	45	Div.	30	Curb <=6" & Lawn	6	49,636	D	14	N
					10.706	10.911	0.205	45	Div.	30	Curb <=6" & Lawn	6	34,000	D	14	N
					10.911	11.462	0.551	45	Div.	22	Median Curb < 6"	6	34,000	D	14	N
					11.462	11.717	0.255	45	Div.	22	Median Curb < 6"	6	32,500	D	14	N
					11.717	11.850	0.133	45	Div.	22	Curb <=6" & Lawn	6	32,500	D	14	N
					11.850	12.516	0.666	45	Div.	22	Curb <=6" & Lawn	6	32,500	D	14	N
					12.516	12.602	0.086	45	Div.	14	Paved (e.g. crosshatching)	6	32,500	D	14	N
					12.602	13.123	0.521	45	Div.	14	Painted (e.g. continuous left turn)	6	32,500	D	14	N
	North Street	SR A1A	3.193	3	13.123	13.142	0.019	45	Div.	12	Painted (e.g. continuous left turn)	4	32,500	C	14	N
					13.142	13.721	0.579	55	Div.	12	Painted (e.g. continuous left turn)	4	32,500	C	14	N
					13.721	14.106	0.385	55	Div.	12	Paved, barrier other than guardrail	4	32,500	C	14	N
					14.106	15.284	1.178	55	Div.	24	Curb <=6" & Lawn	4	32,500	C	14	N
					15.284	15.790	0.506	50	Div.	24	Curb <=6" & Lawn	4	32,500	C	14	N
					15.790	15.903	0.113	35	Div.	24	Curb <=6" & Lawn	4	32,500	C	14	N
					15.903	16.112	0.209	35	Div.	16	Median Curb < 6"	4	32,500	C	14	N
					16.112	16.316	0.204	35	Div.	16	Median Curb < 6"	4	25,000	C	14	N
SR 520 WB	King Street E.	Riveredge Dr.	0.746	0	0.000	0.644	0.644	40	1-Way			2	22,000	C	14	N
					0.644	0.746	0.102	35	1-Way			2	22,000	C	14	N
	Riveredge Dr.	King Street W.	0.447	3	0.746	1.063	0.317	35	1-Way			3	22,000	E	14	N
					1.063	1.193	0.130	35	1-Way			2	22,000	E	14	N

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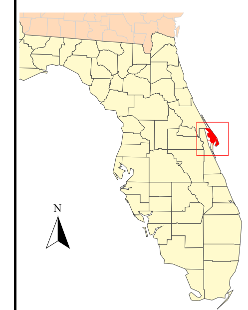

Key Map

Source: FDOT

Exhibit No.

III - 1D

Road Name	From	To	Length (miles)	No. of Signals	Segment Begin	Segment End	Segment Length	Posted Speed	Road Type	Median Width	Median Type	Lanes	AADT	LOS	FC	FIHS
SR 528	Orange County Line	Brevard Urban Limit	7.610	0	0.000	1.153	1.153	65	Div.	40	Lawn	4	28,000	B	2	Y
					1.153	4.825	3.672	65	Div.	40	Lawn	4	16,900	B	2	Y
					4.825	5.925	1.100	65	Div.	40	Lawn	4	16,900	B	2	Y
					5.925	7.610	1.685	65	Div.	40	Lawn	4	21,000	B	2	Y
	Brevard Urban Limit	SR 524	2.346	0	7.610	9.400	1.790	65	Div.	40	Lawn	4	21,000	A	12	Y
					9.400	9.484	0.084	55	Div.	40	Lawn	4	21,000	A	12	Y
					9.484	9.956	0.472	55	Div.	40	Lawn	4	32,000	A	12	Y
	SR 524	SR 3	3.092	0	5.200	5.627	0.427	55	Div.	40	Lawn	4	32,000	C	14	Y
					5.627	8.292	2.665	55	Div.	40	Lawn	4	52,500	C	14	Y
	SR 3	SR 401	4.676	0	8.292	11.150	2.858	55	Div.	40	Lawn	4	34,500	C	14	Y
					11.150	11.870	0.720	55	Div.	40	Lawn	4	34,500	C	14	Y
					11.870	12.968	1.098	55	Div.	40	Lawn	4	34,500	C	14	Y

* Draw Bridge

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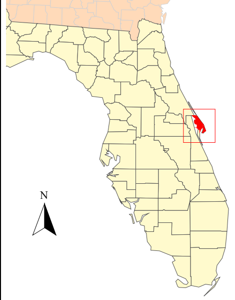
FC - Functional Class. 1 - Rural Interstate, 2 - Rural Principal Arterial, 6 - Rural Minor Arterial, 11 - Urban Interstate, 12 - Urban Freeway or Expressway, 14 - Urban Principal Arterial, 16 - Urban Minor Arterial .

FIHS - Florida Intrastate Highway System

FLORIDA SPACE AUTHORITY

Wilbur Smith Associates

Transportation Infrastructure Analysis - Roadway Inventory

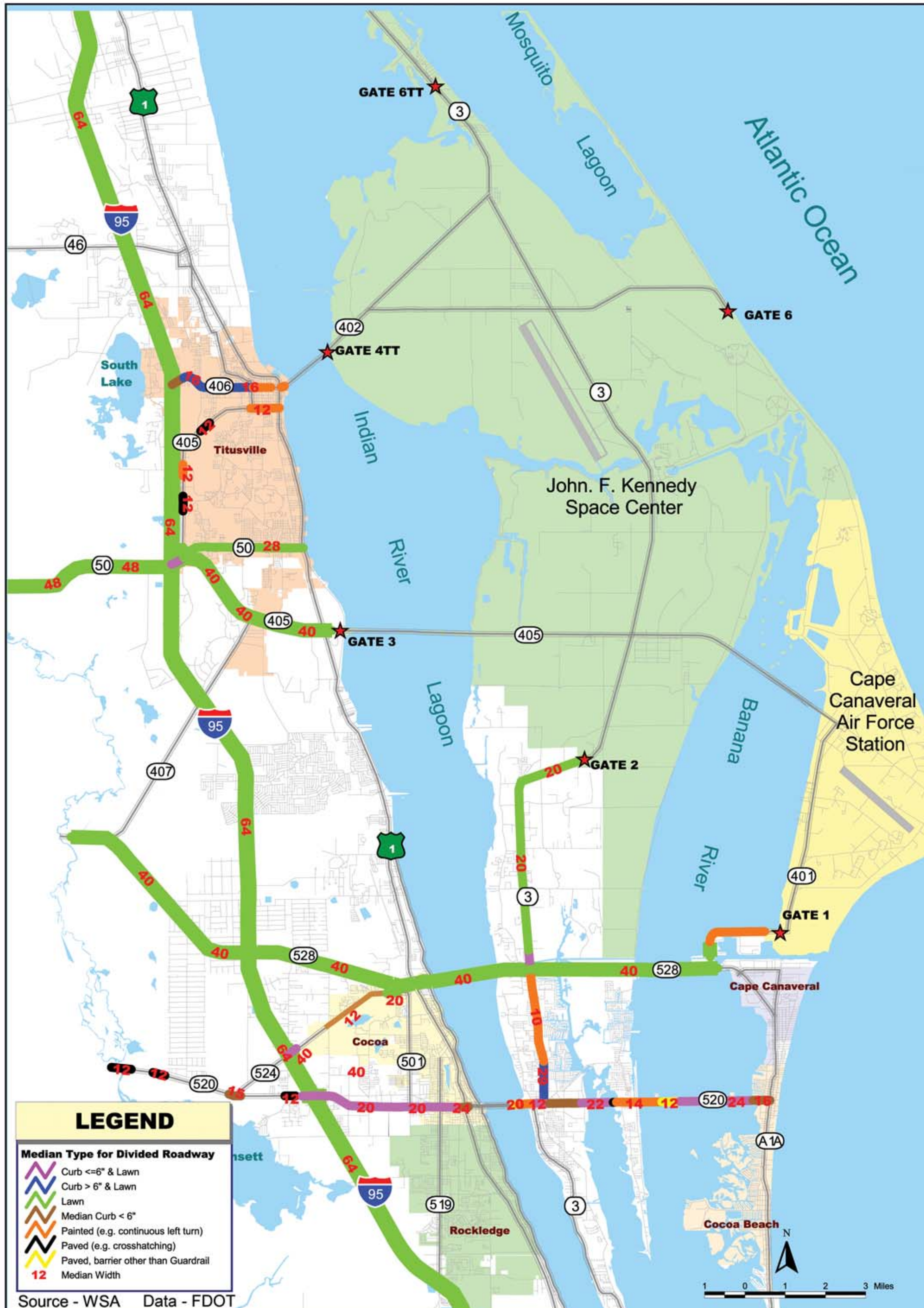


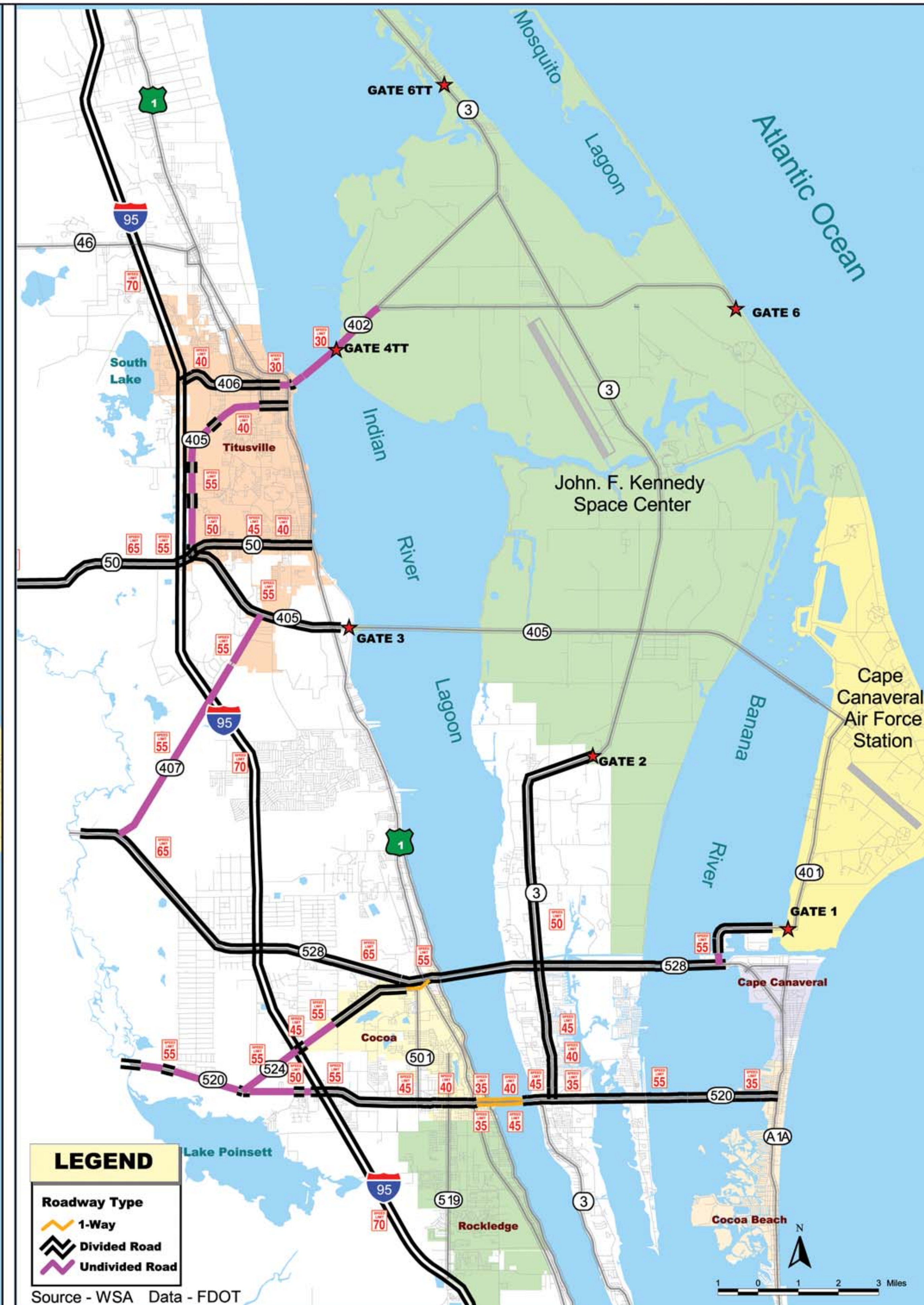
Key Map

Source: FDOT

Exhibit No.

III - 1E





Left:
Median Type & Width for Divided Road

Right:
Roadway Type & Speed Limit

Key Map

Graphic Scale

Exhibit No.
III - 2

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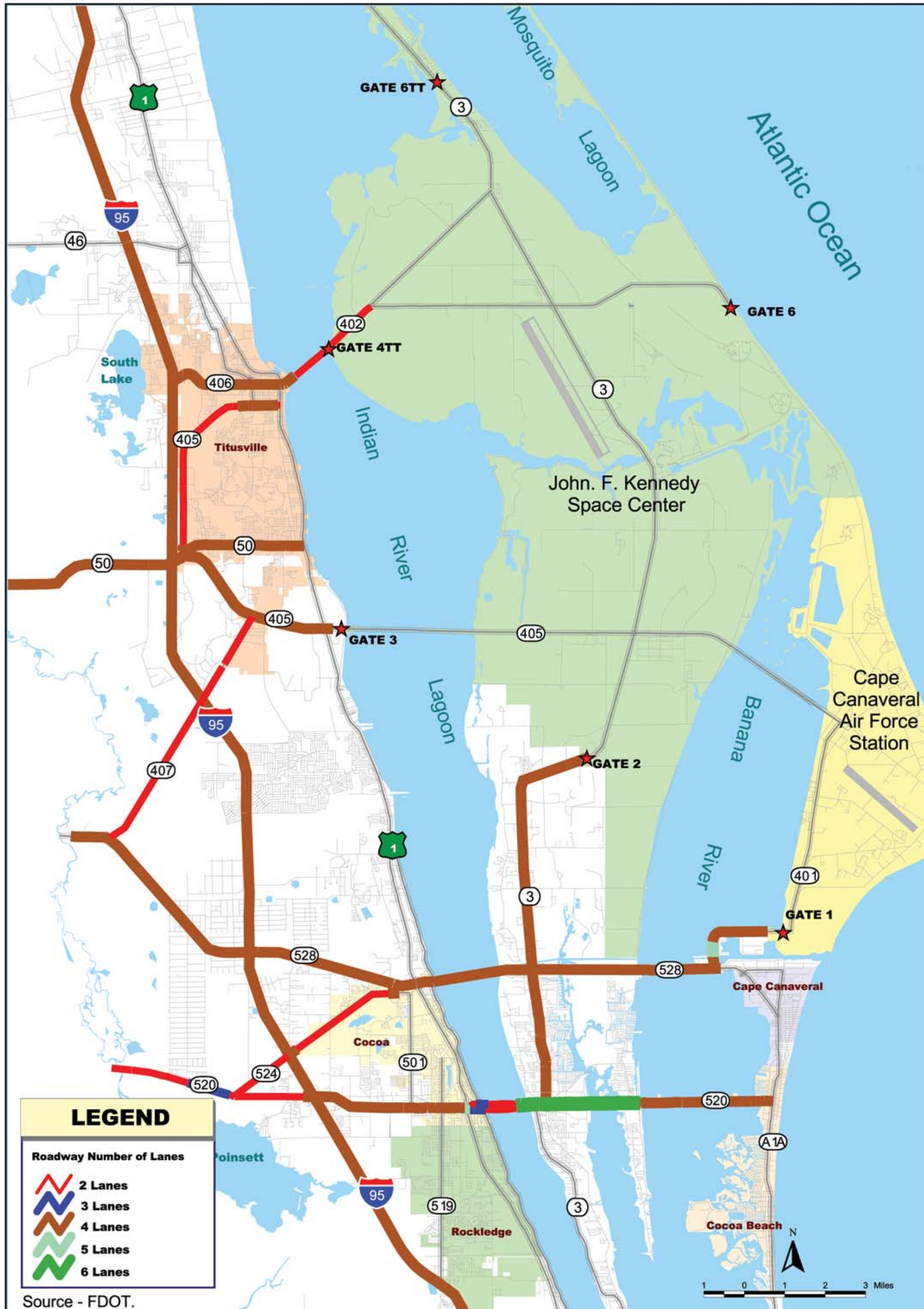

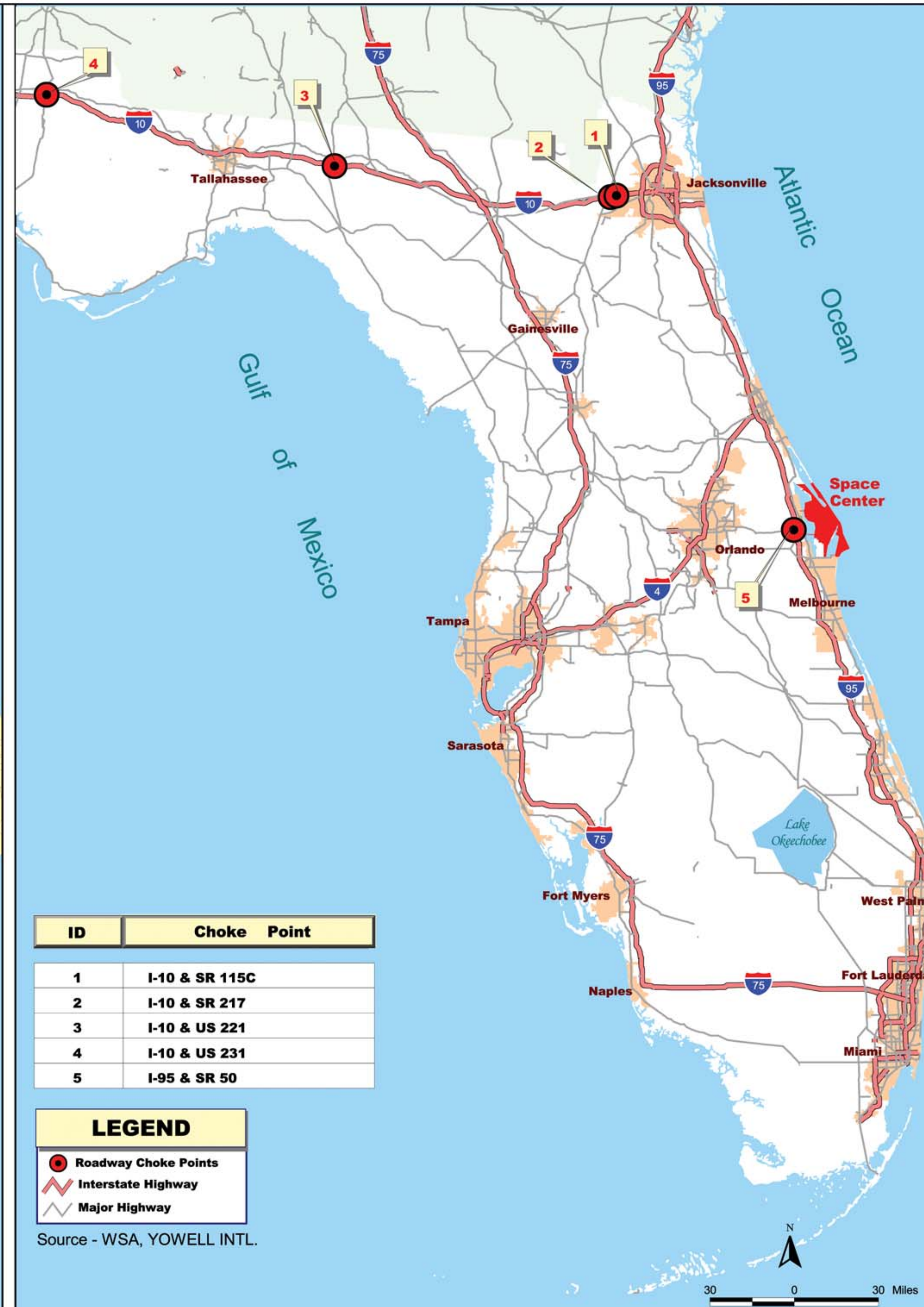

ID	Choke Point
1	I-10 & SR 115C
2	I-10 & SR 217
3	I-10 & US 221
4	I-10 & US 231
5	I-95 & SR 50

FLORIDA SPACE AUTHORITY

Wilbur Smith Associates

Left:
Roadway number of lanes

Right:
Oversized Transport Roadway Choke Points

Exhibit No.
III - 3

Graphic Scale

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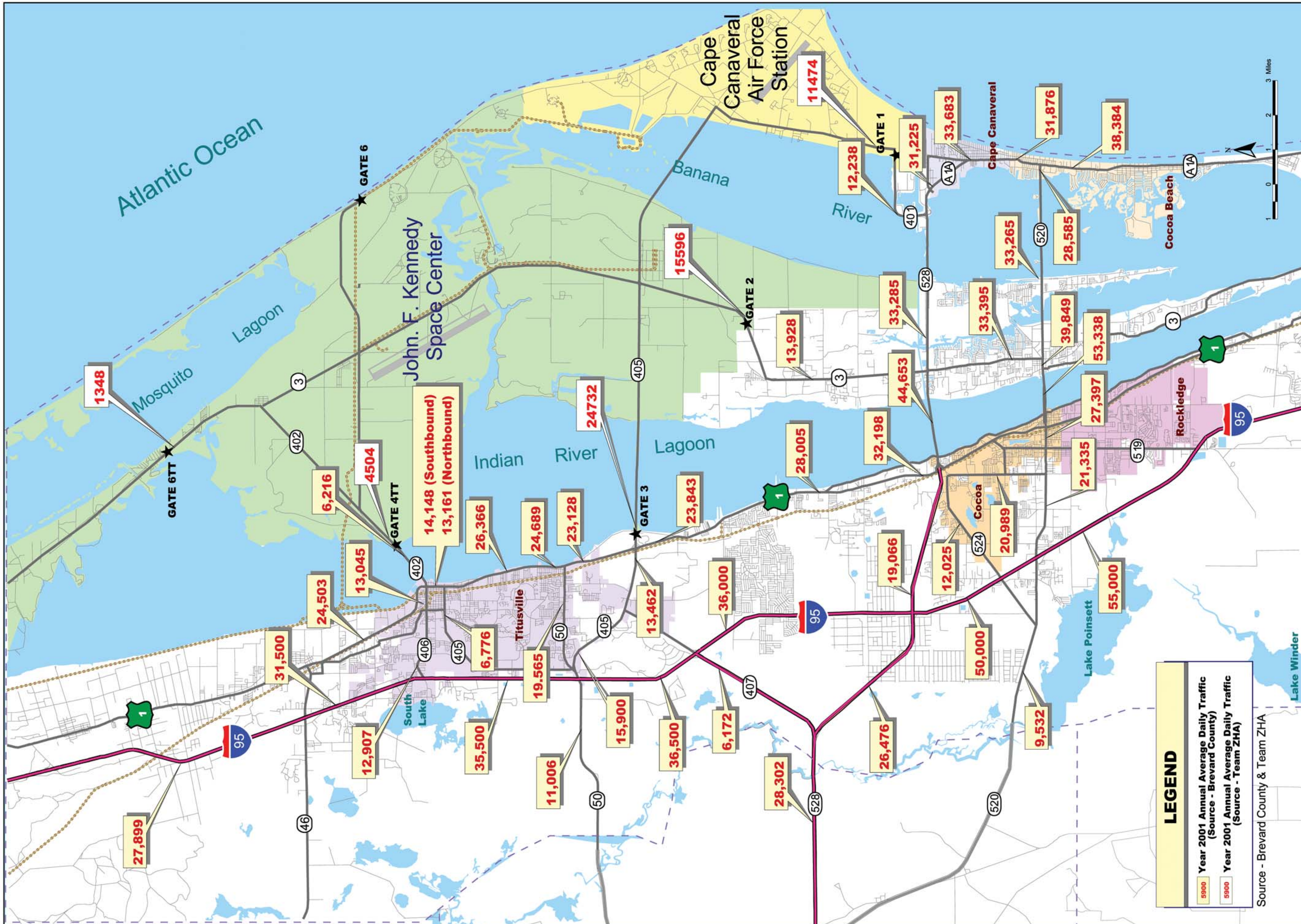


FLORIDA SPACE AUTHORITY

Wilbur Smith Associates

Year 2001
Traffic
Annual
Average
Daily Traffic

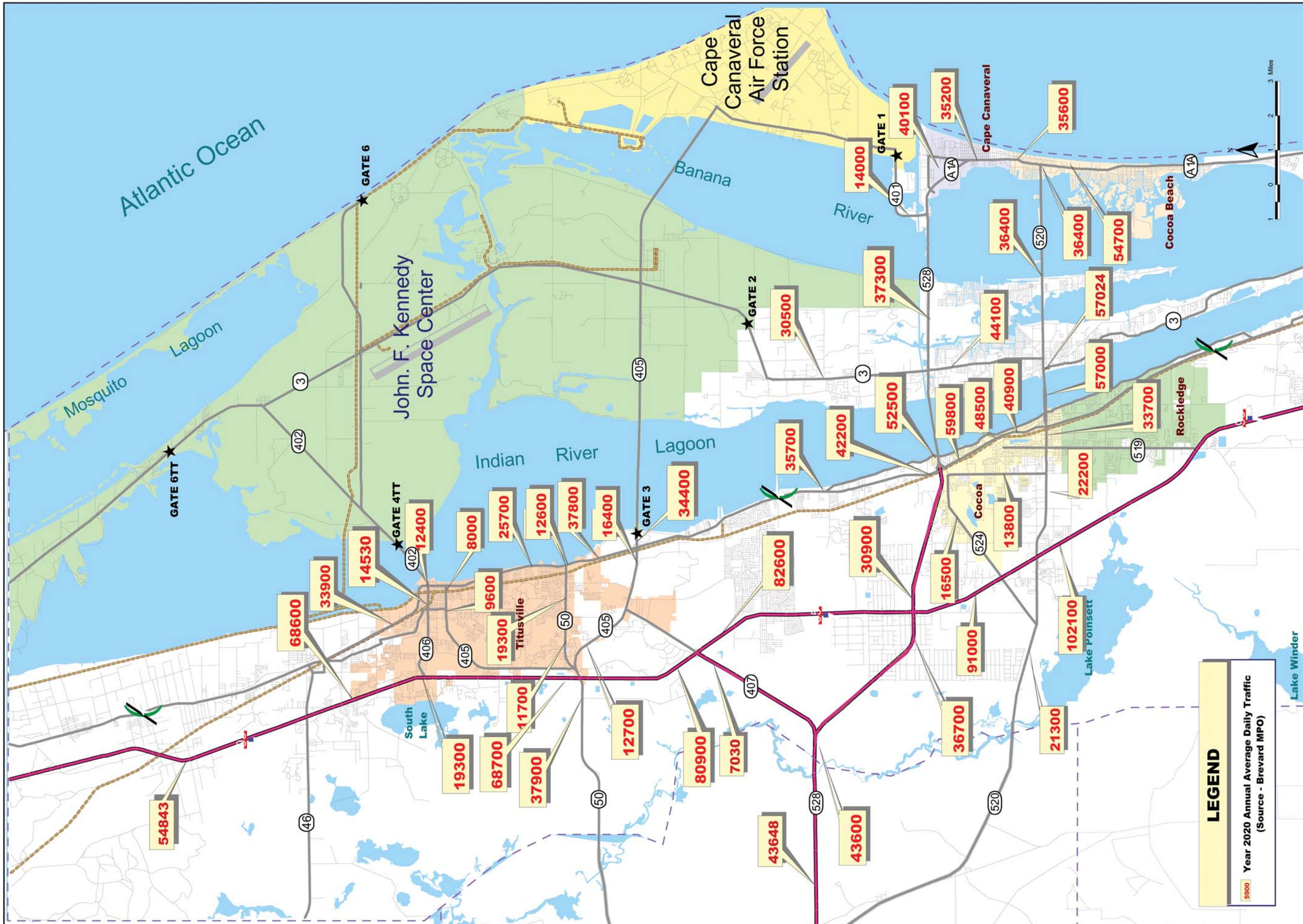
Key Map

Exhibit No.

III - 4

Graphic Scale

Back | Table Of Exhibits | Forward | Go To Page



FLORIDA SPACE AUTHORITY

Wilbur Smith Associates

ENGINEERS PLANNERS ECONOMISTS

Year 2020 Traffic Annual Average Daily Traffic

Key Map

Exhibit No.

III - 5

Graphic Scale

FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Year 1999 Roadway Level of Service

Exhibit No.

III - 6

Graphic Scale

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Year 2000
Traffic
Accidents

#	Street Name	Cross Road
5	SR 407	SR 528
3	SR 407	I-95
1	SR 407	SR 405
1	SR 407	I-95 EXIT RAMP
1	SR 407	Shepherd Dr.
11	SR 524	I-95
9	SR 524	I-95 EXIT RAMP
7	SR 524	Cox Rd
15	SR 524	Industrial Rd
9	SR 524	SR 501
40	SR 528	US 1
27	SR 528	I-95
26	SR 528	N. Banana River Dr.
22	SR 528	SR 401
17	SR 528	SR 3
7	SR 528 EXIT	SR 3
7	SR 528 EXIT	I-95
6	SR 528 ENT	US 1
14	SR 528	Dave Nisbet Dr.
9	SR 406	US1
6	SR 406	I-95
9	SR 406	Singleton Av.
6	SR 406	Fern Av.
6	SR 406	Lemon Av.
11	SR 406	Dixie Av.
13	SR 406	Park Av.
9	SR 405	Park Av.
8	SR 405	SR 407
6	SR 405 (South St	US 1
10	SR 405	Fox Lake Rd
6	SR 405	Rock Pit Rd.
7	SR 405	Sisson Rd
7	SR 405	Windover Trl.
38	SR 50	I-95
15	SR 50	SR 405
7	SR 50	US 1
6	SR 50	Sisson Rd.
18	SR 50	Barna Av.
10	SR 50	Key Largo Dr.

#	Street Name	Cross Road
27	SR 3	Minna Ln
27	SR 3	SR 528
23	SR 3	Crockett Blvd.
21	SR 3	Lucas Rd.
21	SR 3	Richland Av.
20	SR 3	Mustang Way
20	SR 3	SR 520
19	SR 3	Merritt Ave.
14	SR 3	Citrus Blvd.
14	SR 3	Grove St.
13	SR 3	Fortenberry Rd.
11	SR 3	Needle Blvd.
11	SR 3	Tangerine Av.
10	SR 3	Cone Rd.
9	SR 3	Grant Rd.
9	SR 3	Pioneer Rd.
8	SR 3	Magnolia Av.
7	SR 3	Chase Hammock Rd.
7	SR 3	Tropical Trl
6	SR 3	Duval St
6	SR 3	Georgia Av.
6	SR 3	Hall Rd.
6	SR 3	Skyline Blvd.
6	SR 3	Venetian Way
48	SR 520	Plumosa St.
36	SR 520	SR 3
36	SR 520	US 1
34	SR 520	Banana River Dr.
32	SR 520	Newfound Harbor Dr.
31	SR 520	Riveredge Blvd
26	SR 520	Tropical Trl
24	SR 520	I-95
22	SR 520	SR 519
22	SR 520	Sykes Creek Pkwy
11	SR 520	Imperial St.
7	SR 520	Grove St.
20	SR 520	Banana River Blvd.
16	SR 520	SR A1A

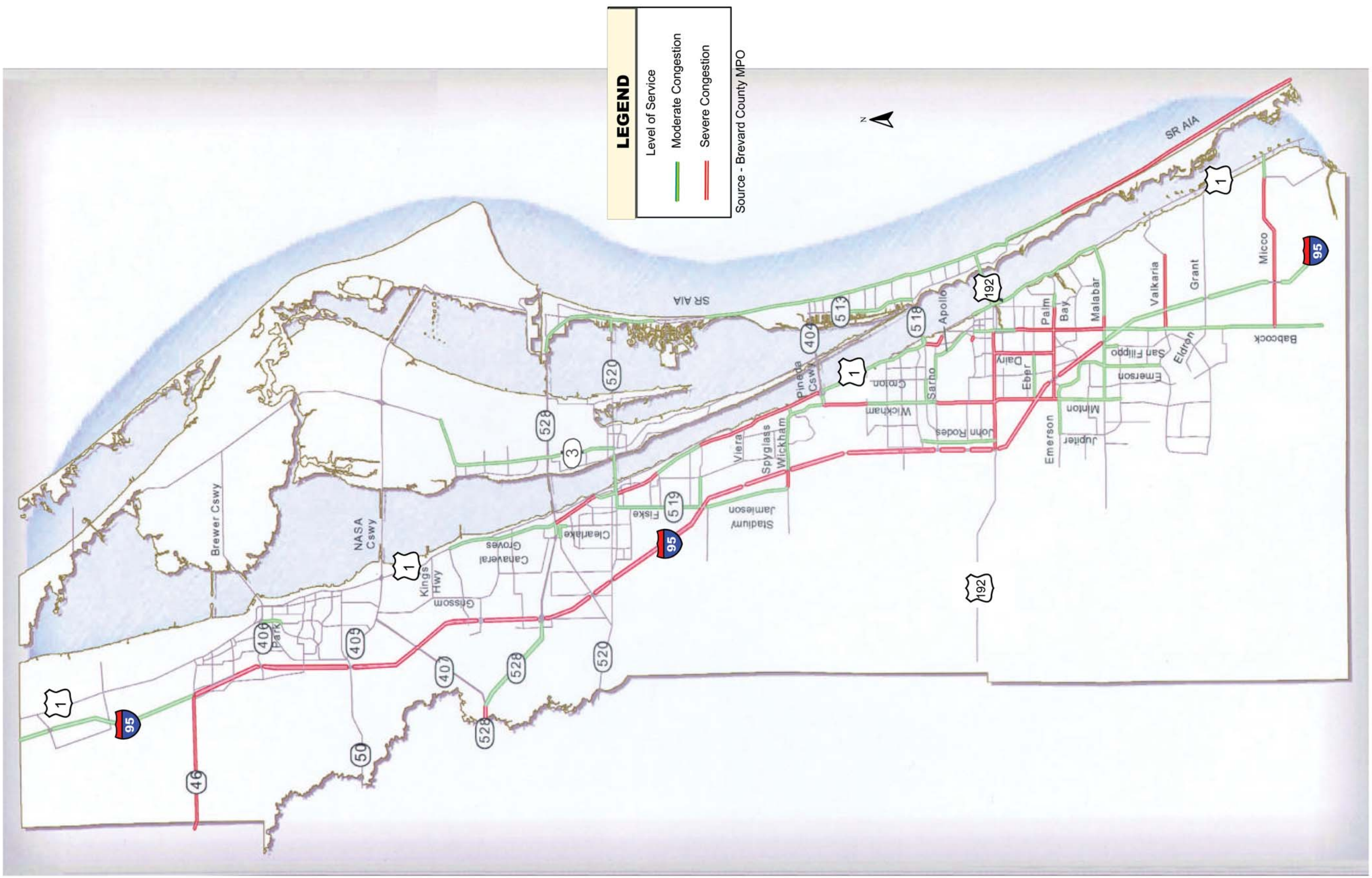
#	Street Name	Cross Road
21	SR 520	Clearlake Rd
11	SR 520	Range Rd
7	SR 520	Blake Av.
6	SR 520	Varr Av.
9	SR 520	Washington Av.
13	SR 520	Frerest Av.
13	SR 520	Florida Av.
15	SR 520	Brevard Av.
7	SR 520	Delannoy Av.
10	SR 520	Magnolia Av.
7	SR 520	Myrtice Av.
7	SR 520	Parnell St.
6	SR 520	Tucker Ln.
6	SR 520	I-95 ENT RAMP
45	I-95	SR 520
34	I-95	SR 50
34	I-95	SR 519
28	I-95	SR 46
20	I-95	SR 528
18	I-95	SR 407
16	I-95	SR 524
7	I-95 EXIT RAMP	SR 519
41	I-95	SR 514
42	I-95	SR 518
46	I-95	SR 500 (US 192)
18	I-95	Micco Rd.
16	I-95	SR 406
29	I-95	SR 516
59	I-95	SR 509
15	I-95 EXIT RAMP	SR 509
6	I-95 ENT RAMP	SR 509
6	I-95	Micco Rd.Overpass
6	il-95 EXIT RAMP	SR 514
13	I-95	Lake Washington Rd.
13	I-95	Valkaria Rd.
11	I-95 EXIT RAMP	SR 518
8	I-95	Minton Rd
6	I-95	Aurantia Rd.
8	I-95	Grant Rd.

Key Map

Exhibit No.

III - 7

Graphic Scale

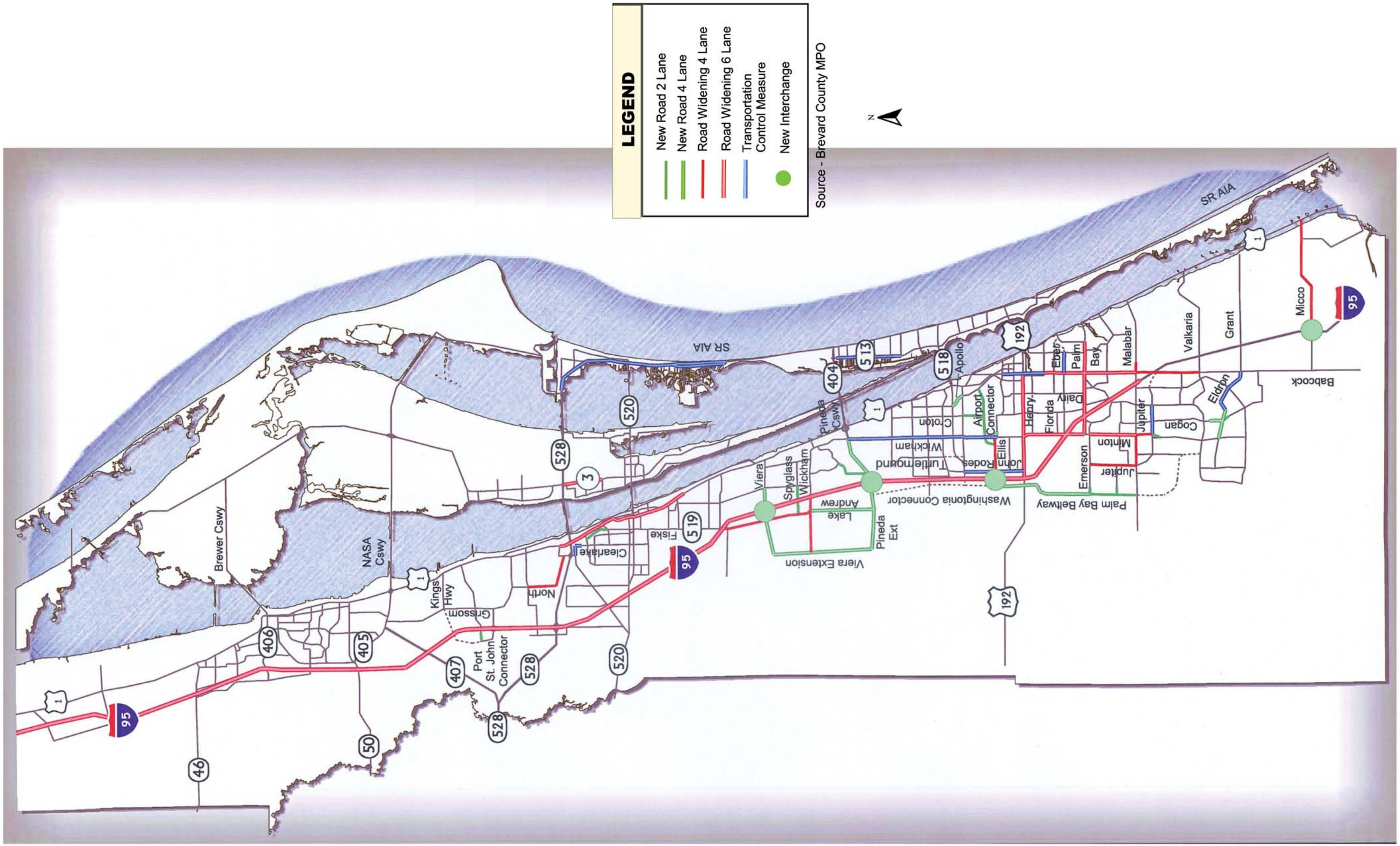


Year 2020
Level of
Congestion
On Existing Plus
Committed
Network

Exhibit No.

III - 8

Graphic Scale



Year 2020
Brevard County
Cost Feasible
Plan

Key Map

Exhibit No.

III - 9

FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Space Coast Area Transit Fixed Routes

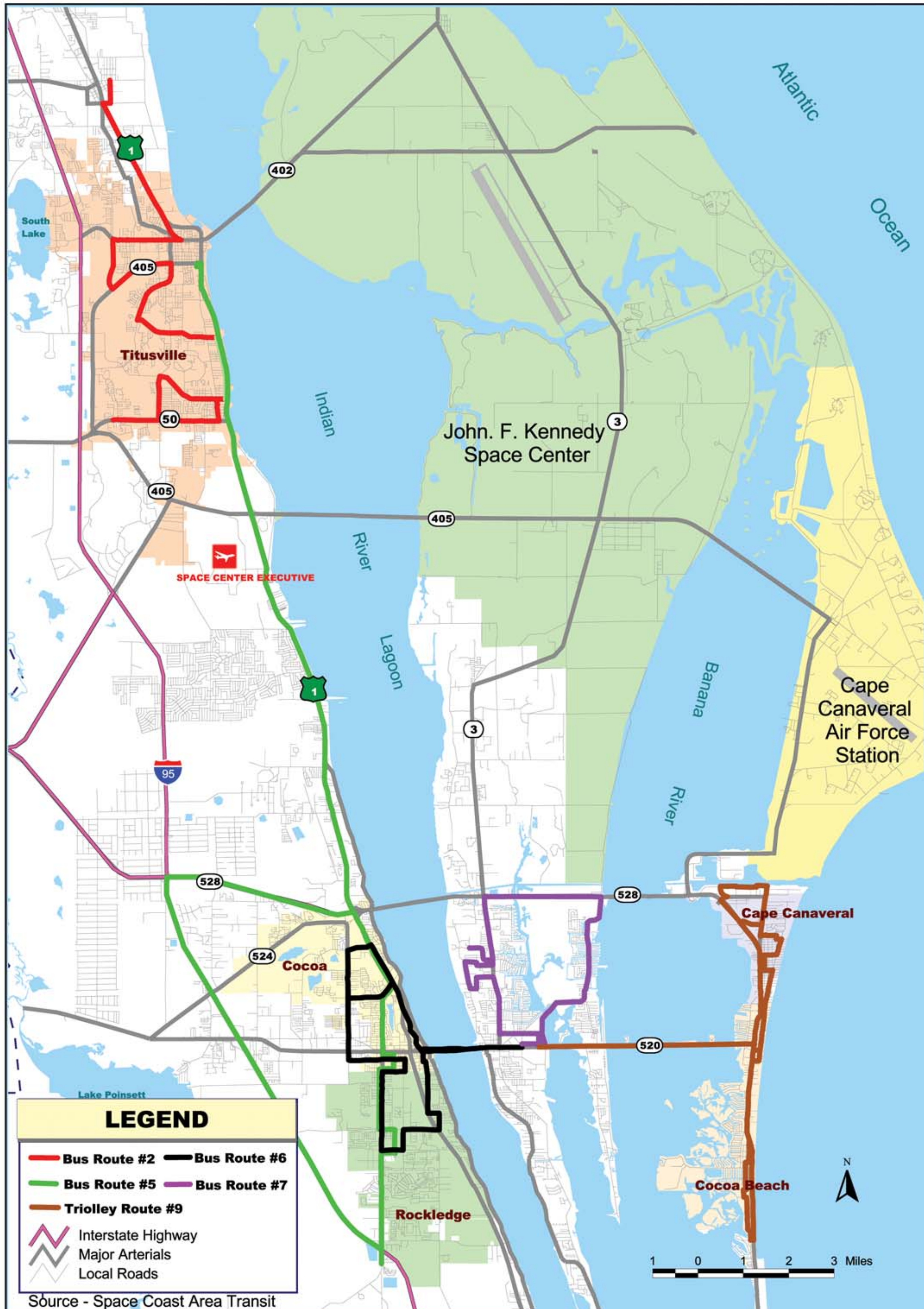
Key Map

Exhibit No.

III - 10

Graphic Scale

Page 113



FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Left:
Space Coast Area Transit Subroutes Routes #2, #5, #6, #7 & #9

Right:
Routes #10, #11, & #12

Key Map

Exhibit No.
III - 11

Graphic Scale

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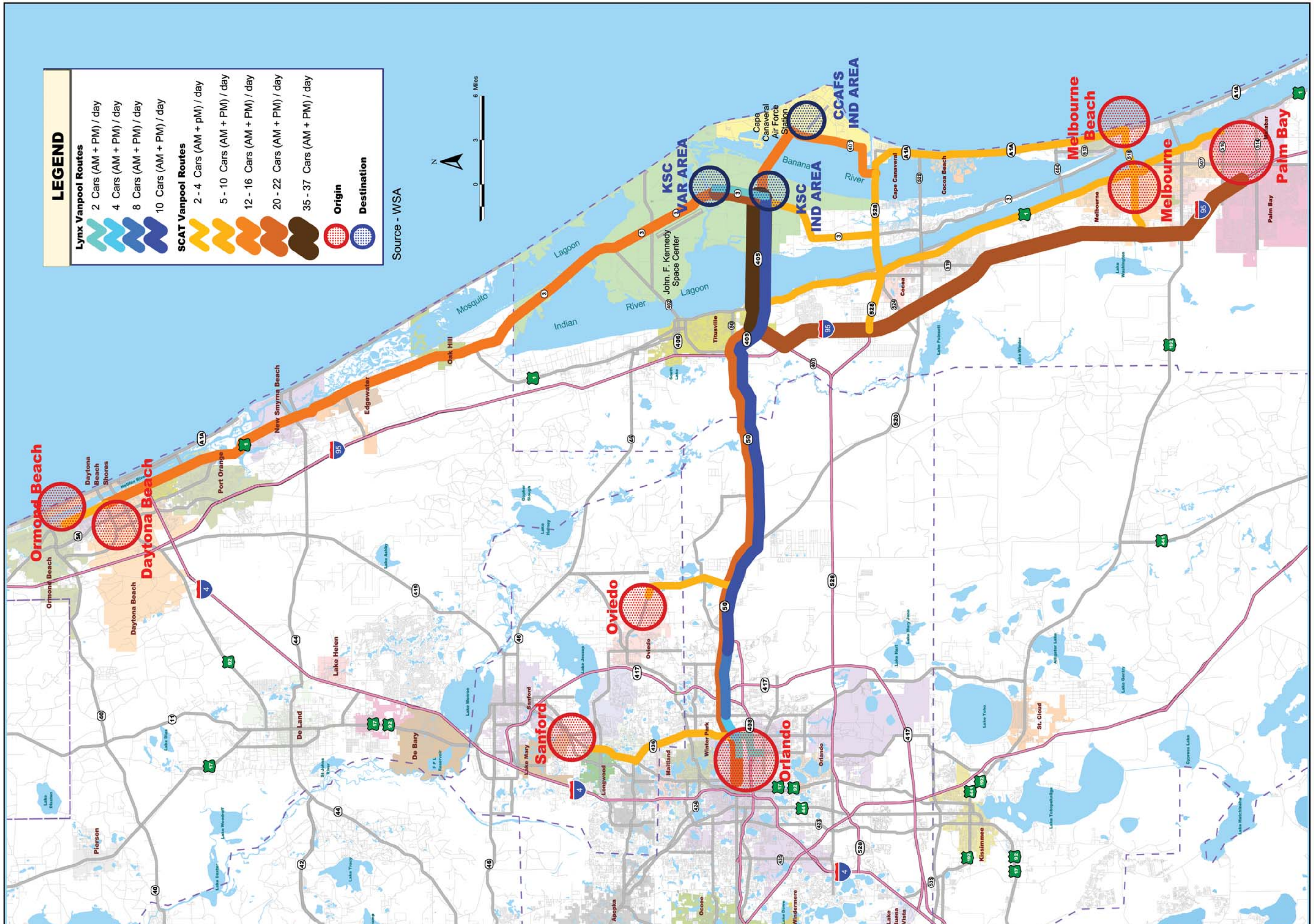
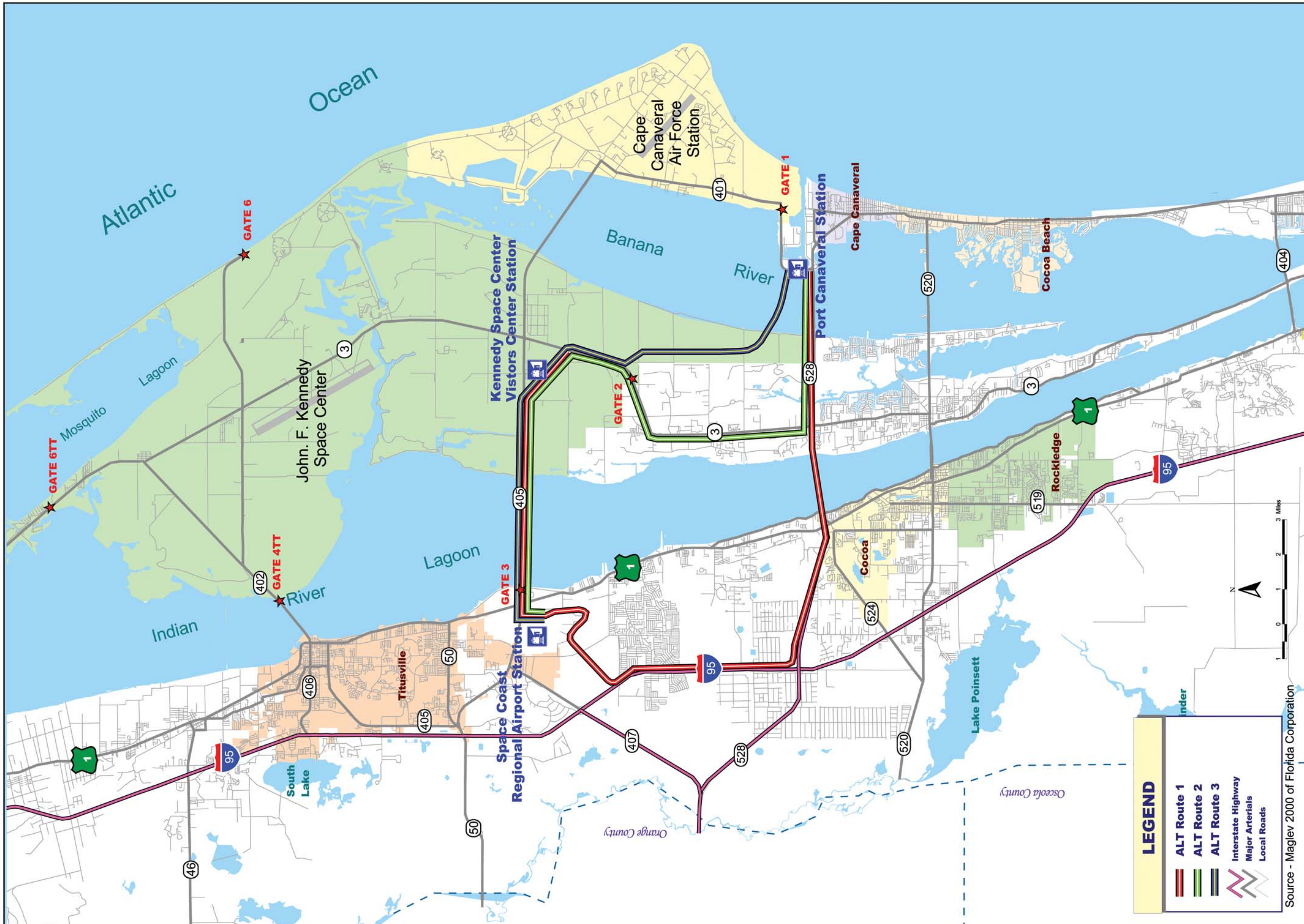


Van Pool Routes

Exhibit No.

III - 12

Graphic Scale



Wilbur Smith Associates

Maglev 2000 of Florida Corporation Proposed Routes

Key Map

Exhibit No.

III - 13

Graphic Scale

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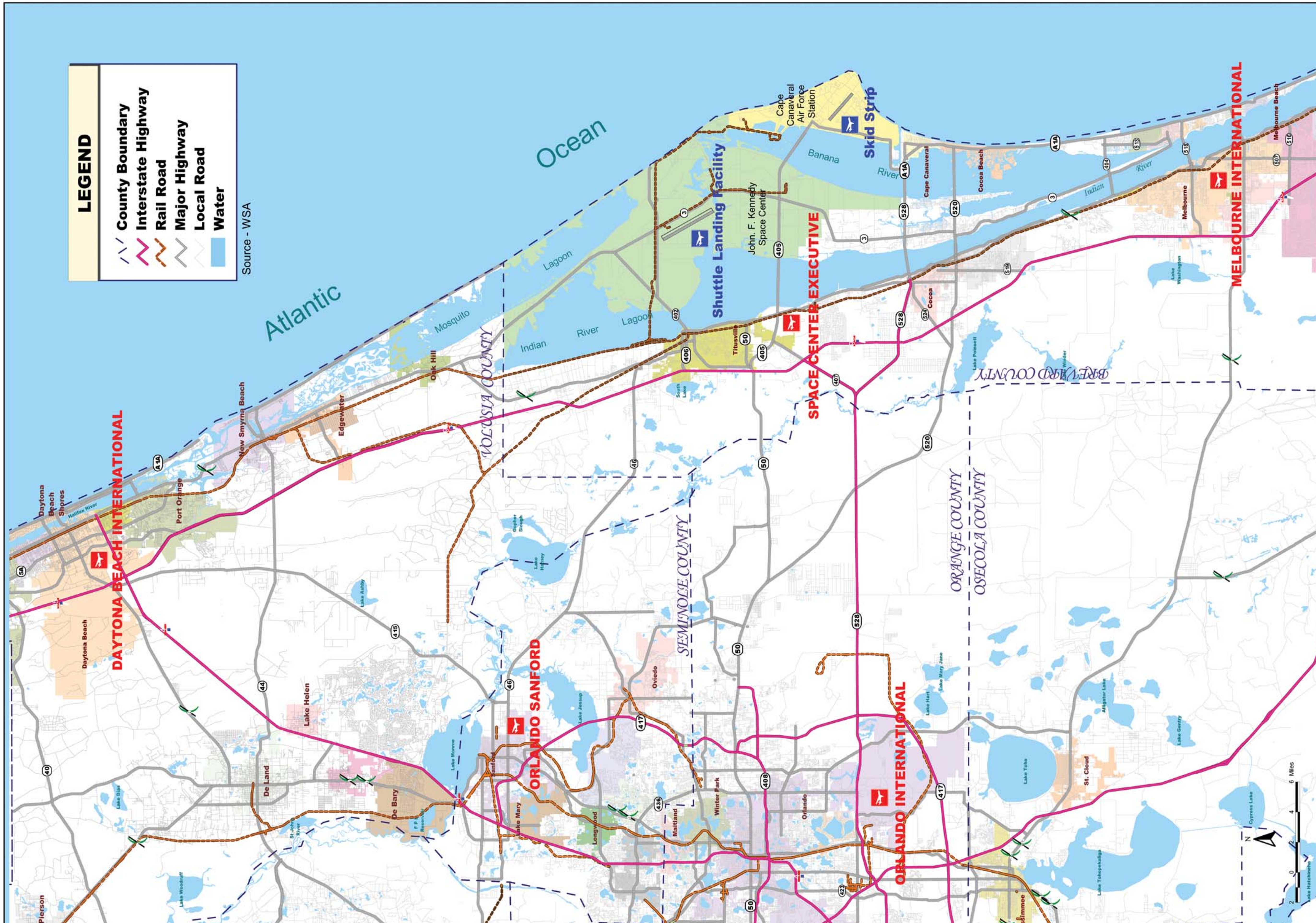


FLORIDA SPACE AUTHORITY
Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

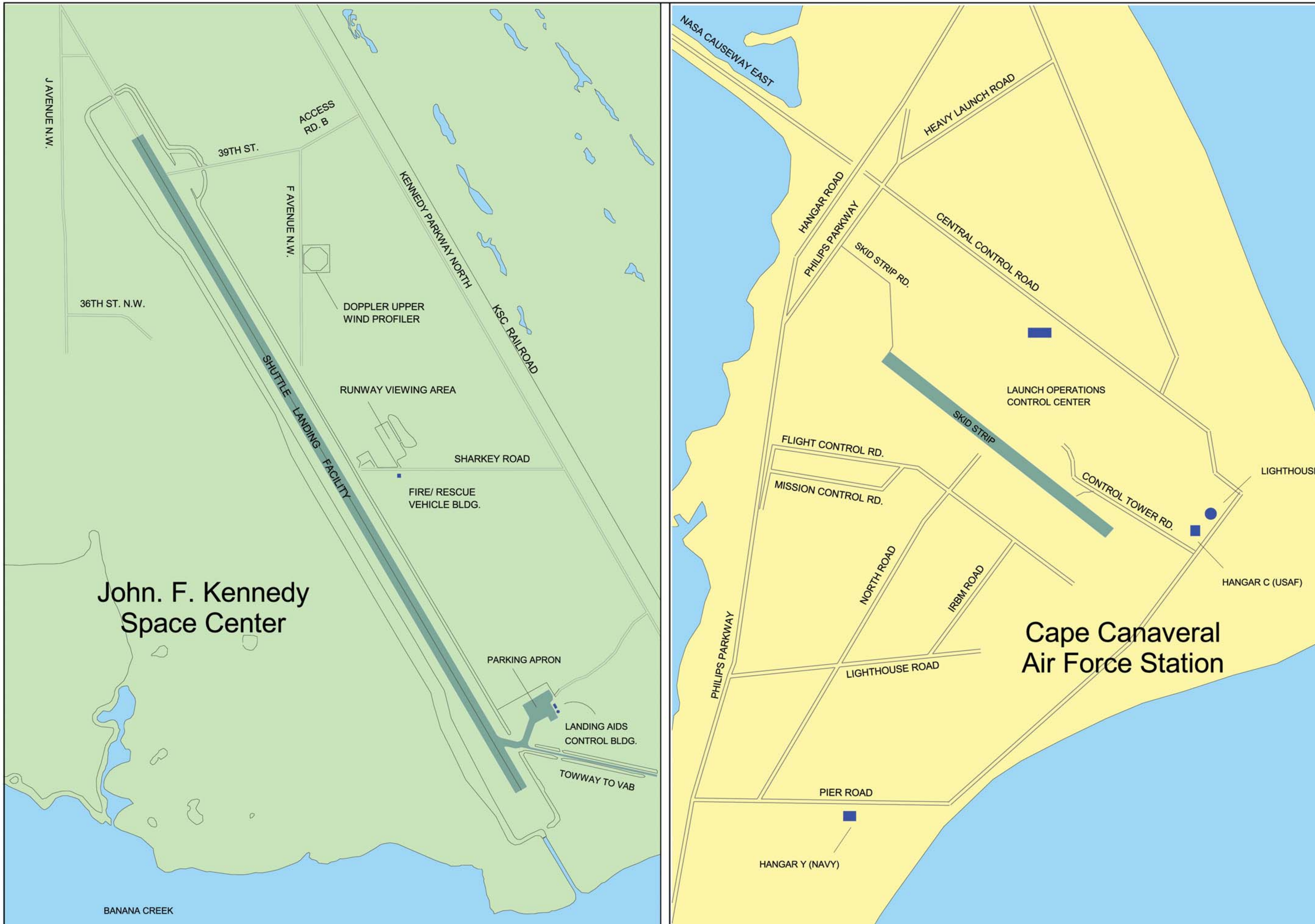
Spaceport Area Airport Facilities

Key Map

Exhibit No.

III - 14

Graphic Scale



FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
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Shuttle Landing Facility and Skid Strip

Left:
John F. Kennedy Space Center

Right:
Cape Canaveral Air Force Station

Key Map

Exhibit No.
III - 15

Not To Scale

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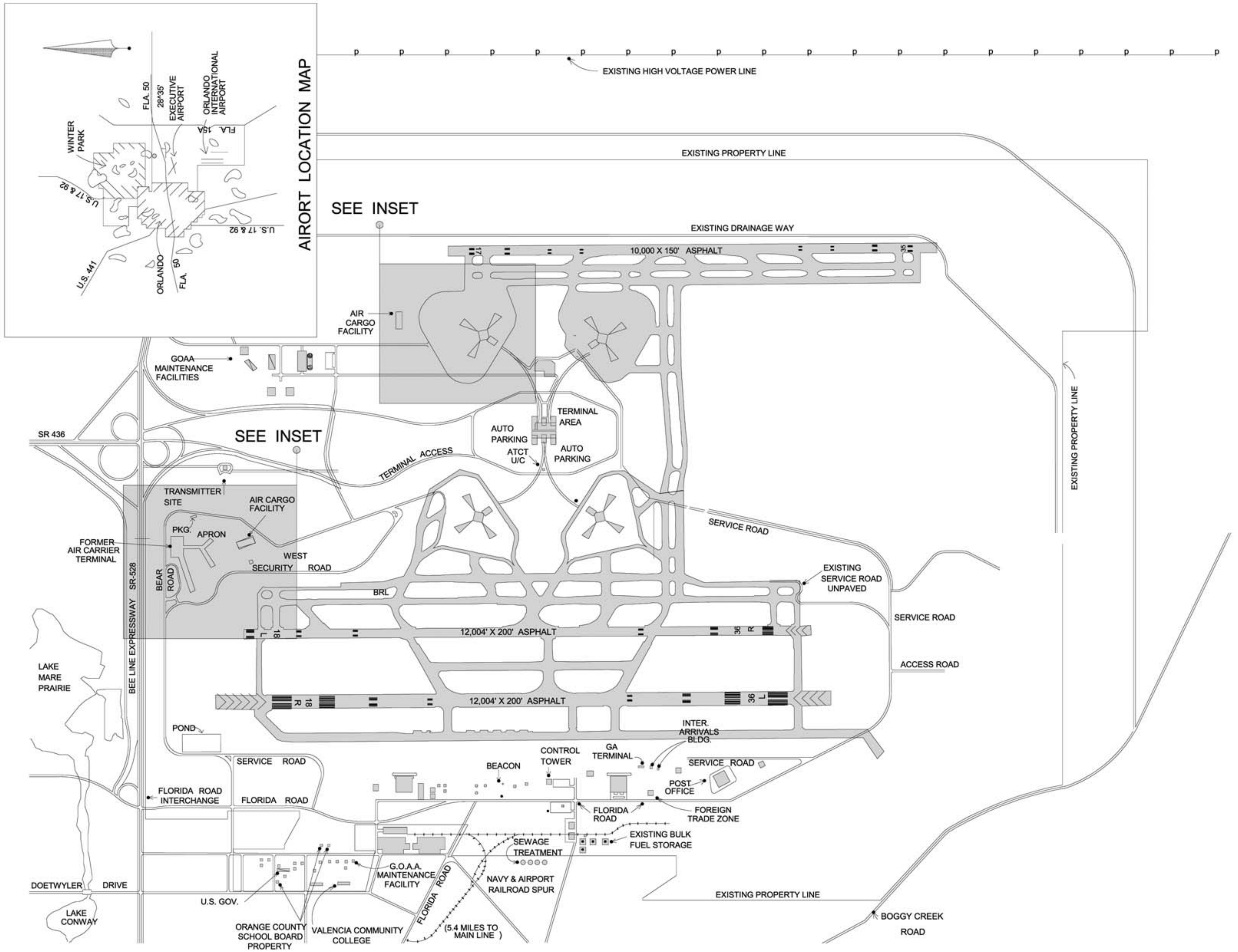
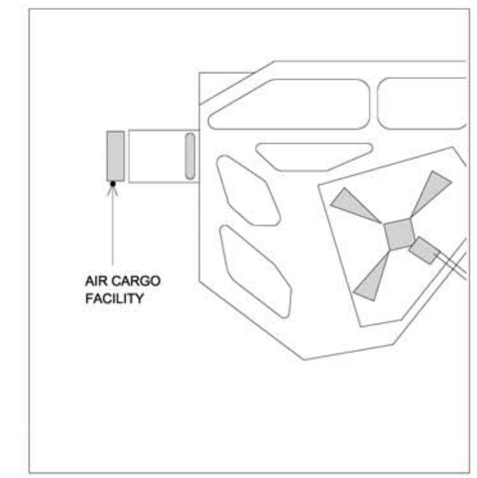




AIR CARGO FACILITIES A

AIR CARGO FACILITIES B

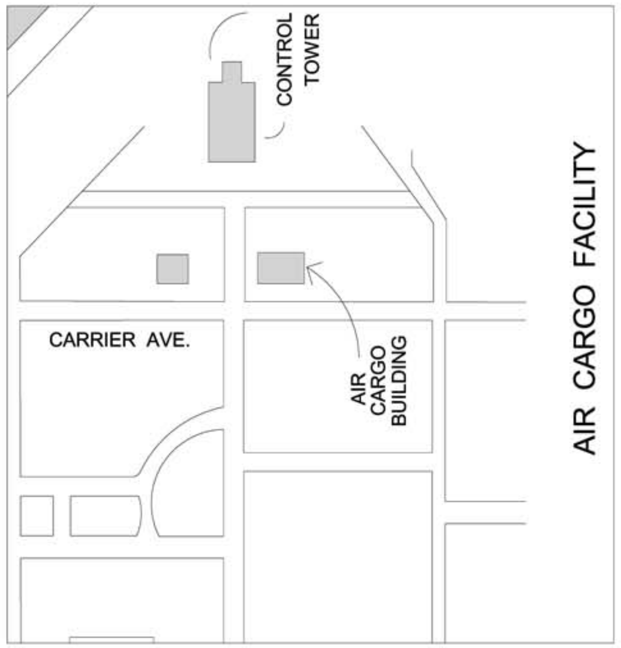
Orlando International Airport

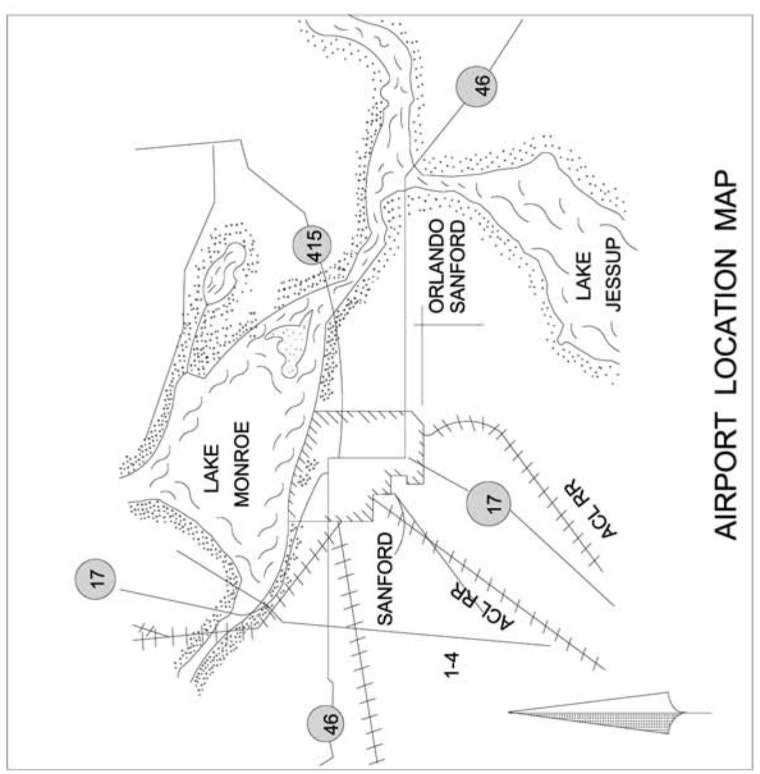
Key Map

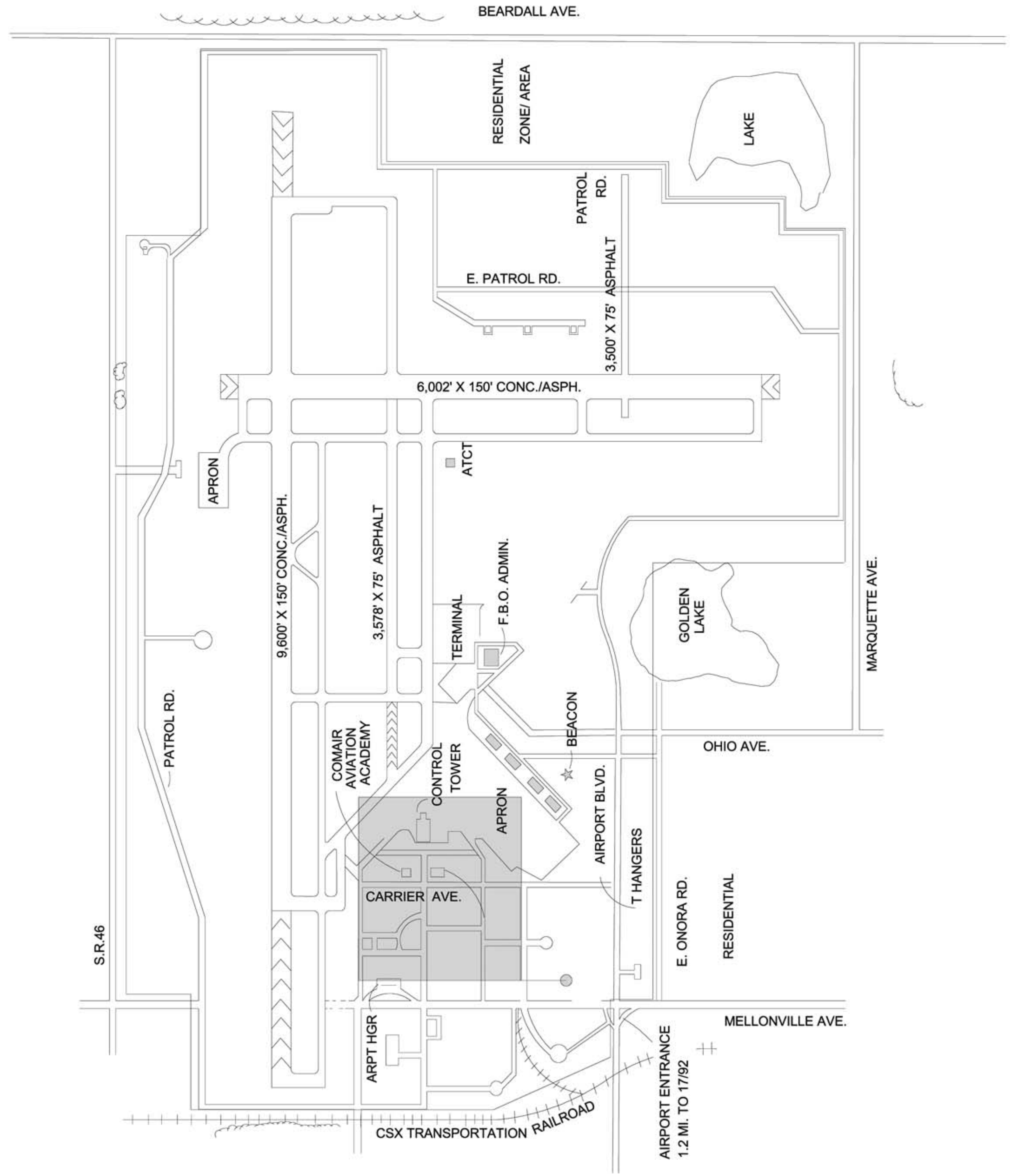
Exhibit No.

III - 16

Not To Scale







FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Orlando - Sanford Airport

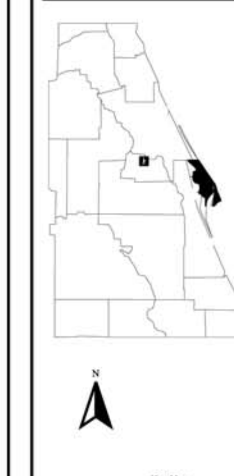
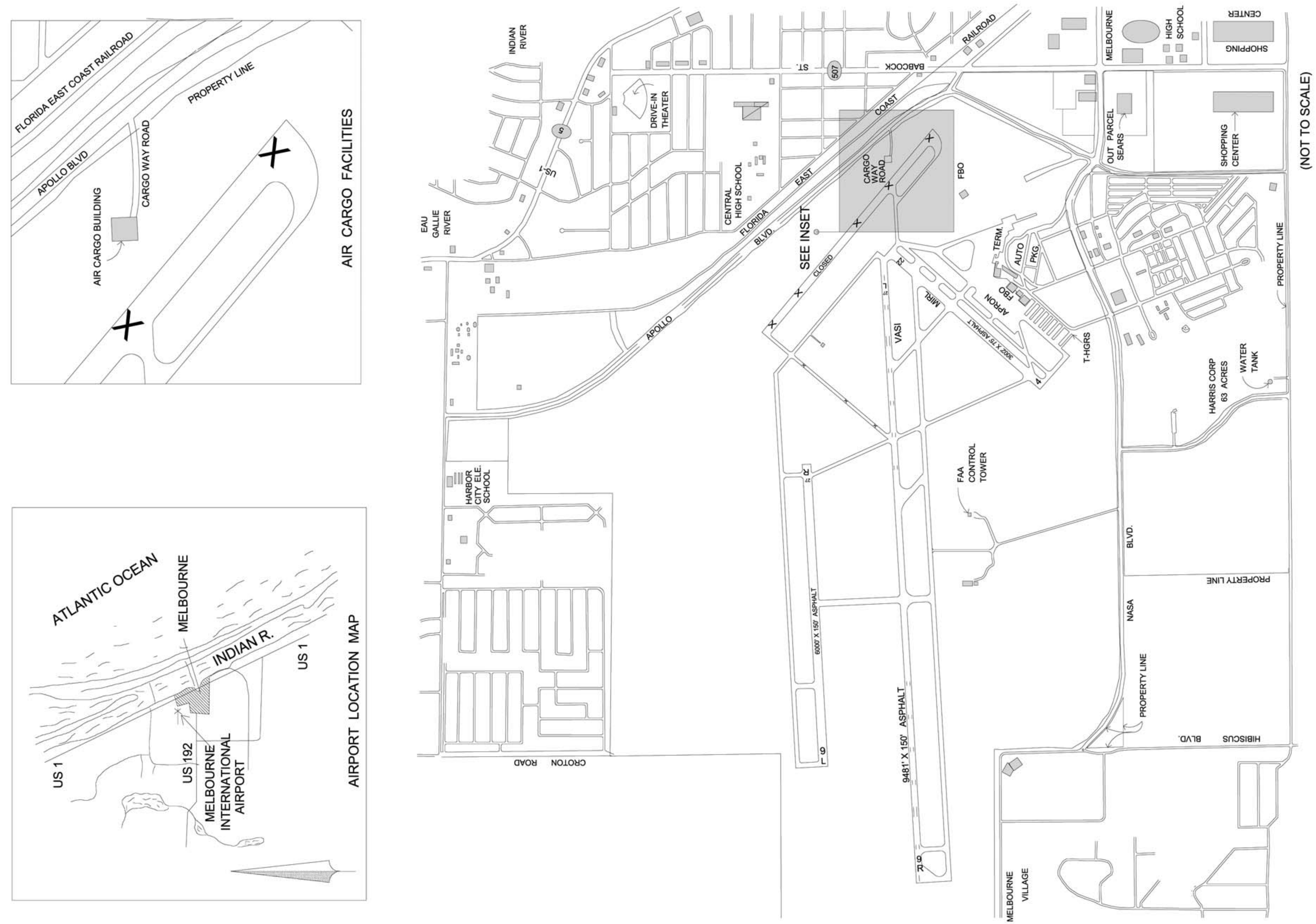


Exhibit No.

III - 17

Not To Scale



FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Melbourne International Airport

Exhibit No.

III - 18

Not To Scale

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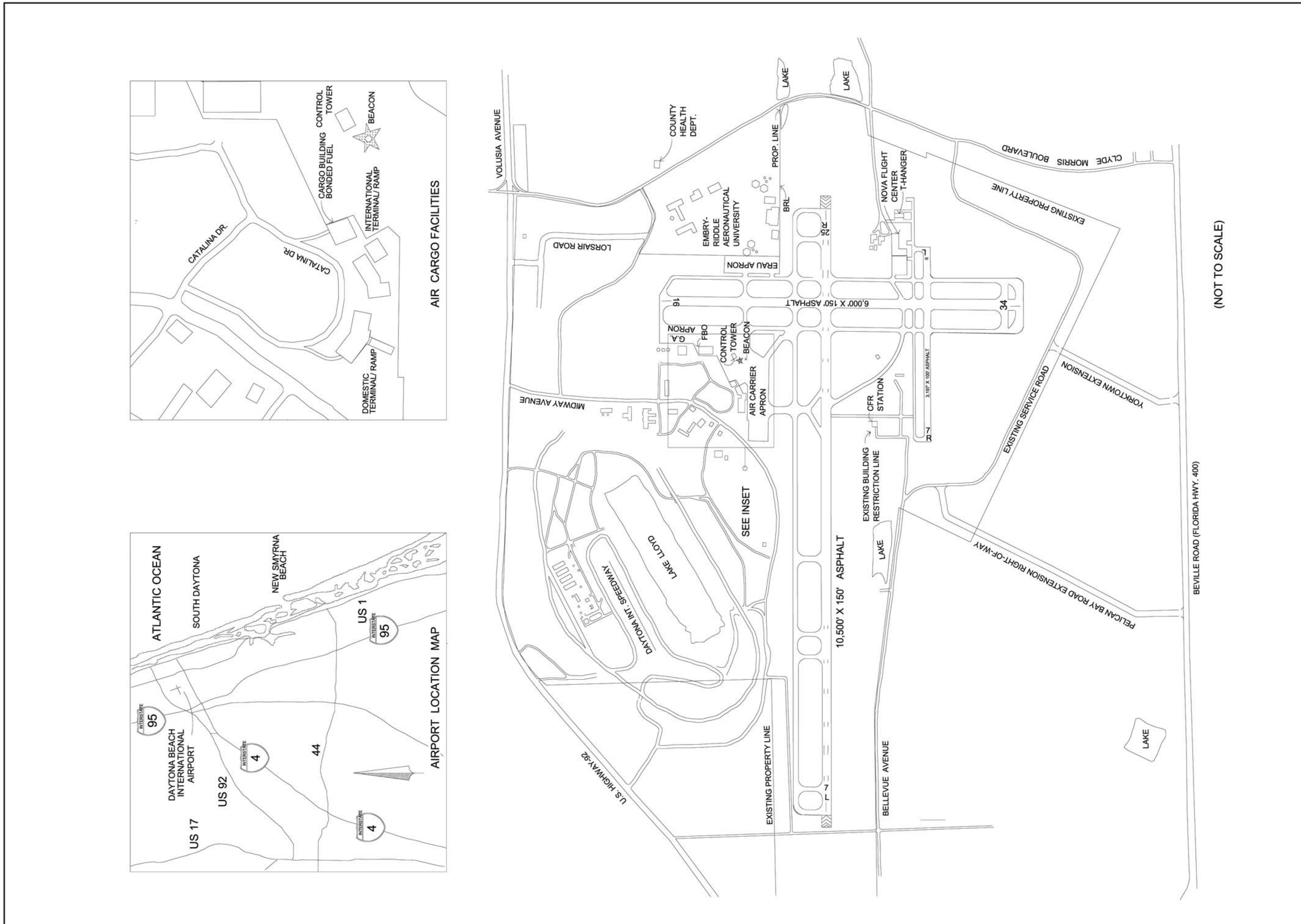

FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Daytona Beach International Airport

Key Map

Exhibit No.

III - 19

Not To Scale

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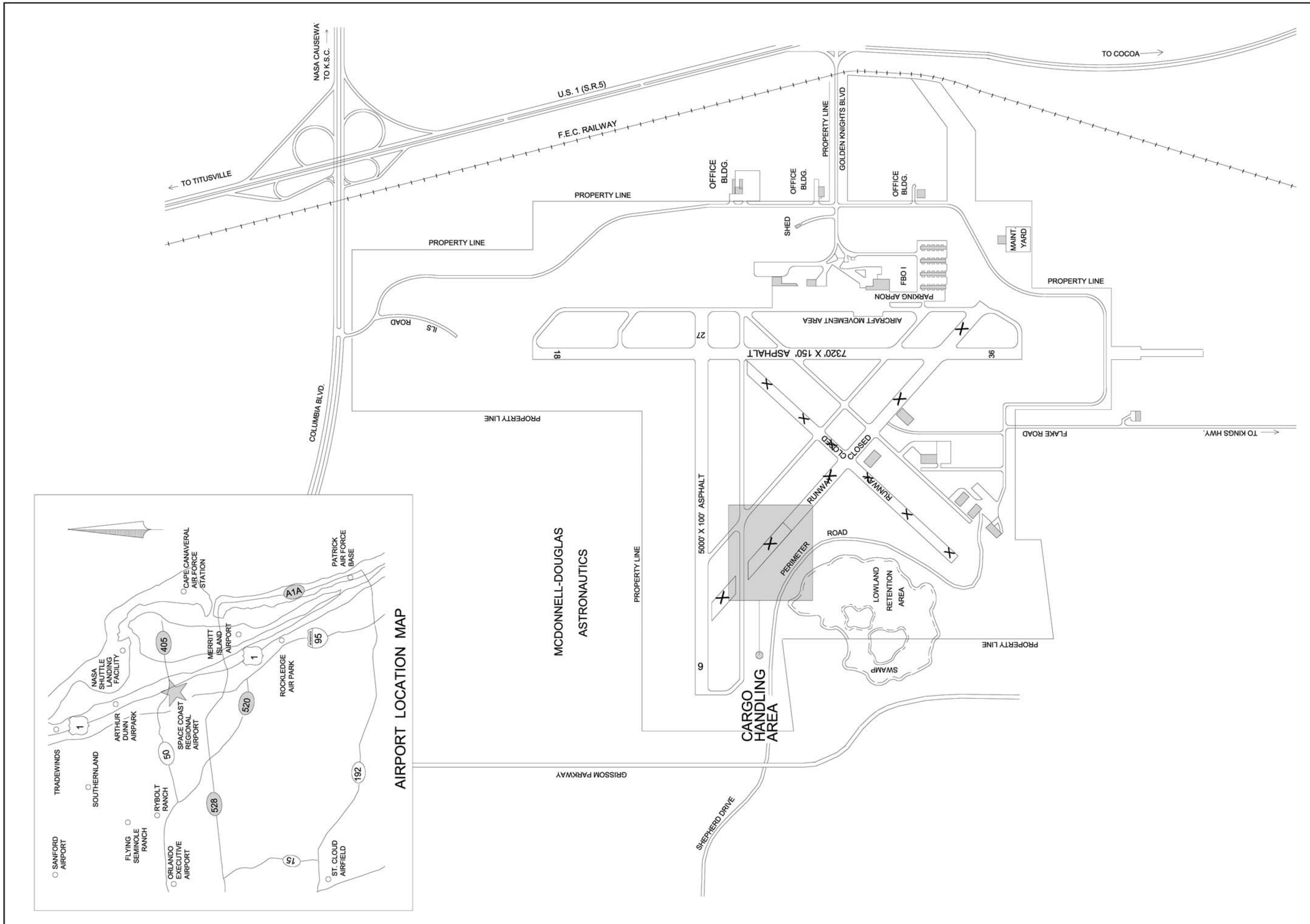

FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Space Coast Regional Airport

Key Map

Exhibit No.

III - 20

Not To Scale

FLORIDA SPACE AUTHORITY

Wilbur Smith Associates

Railroad Condition

Exhibit No.
III - 21

Graphic Scale

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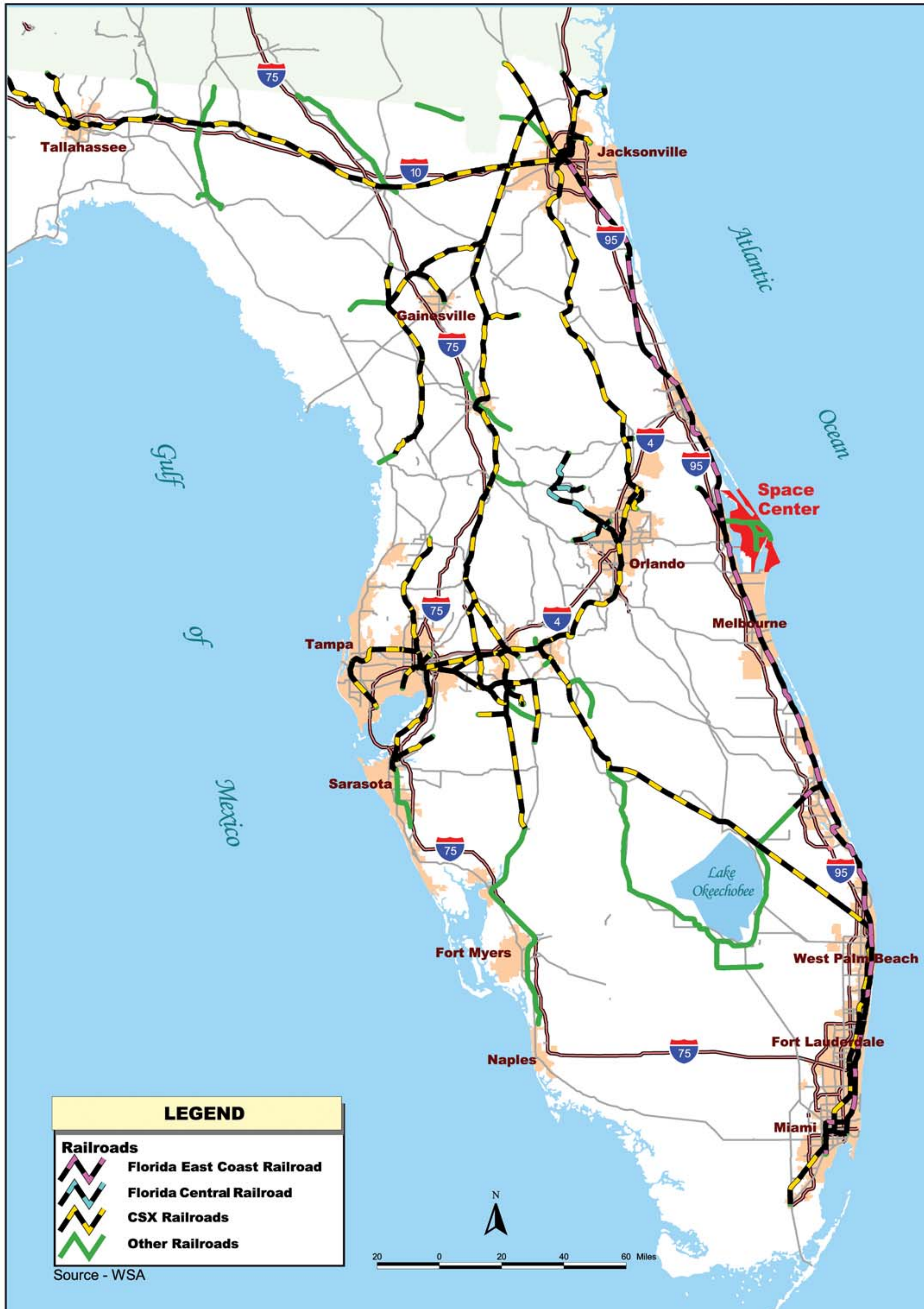

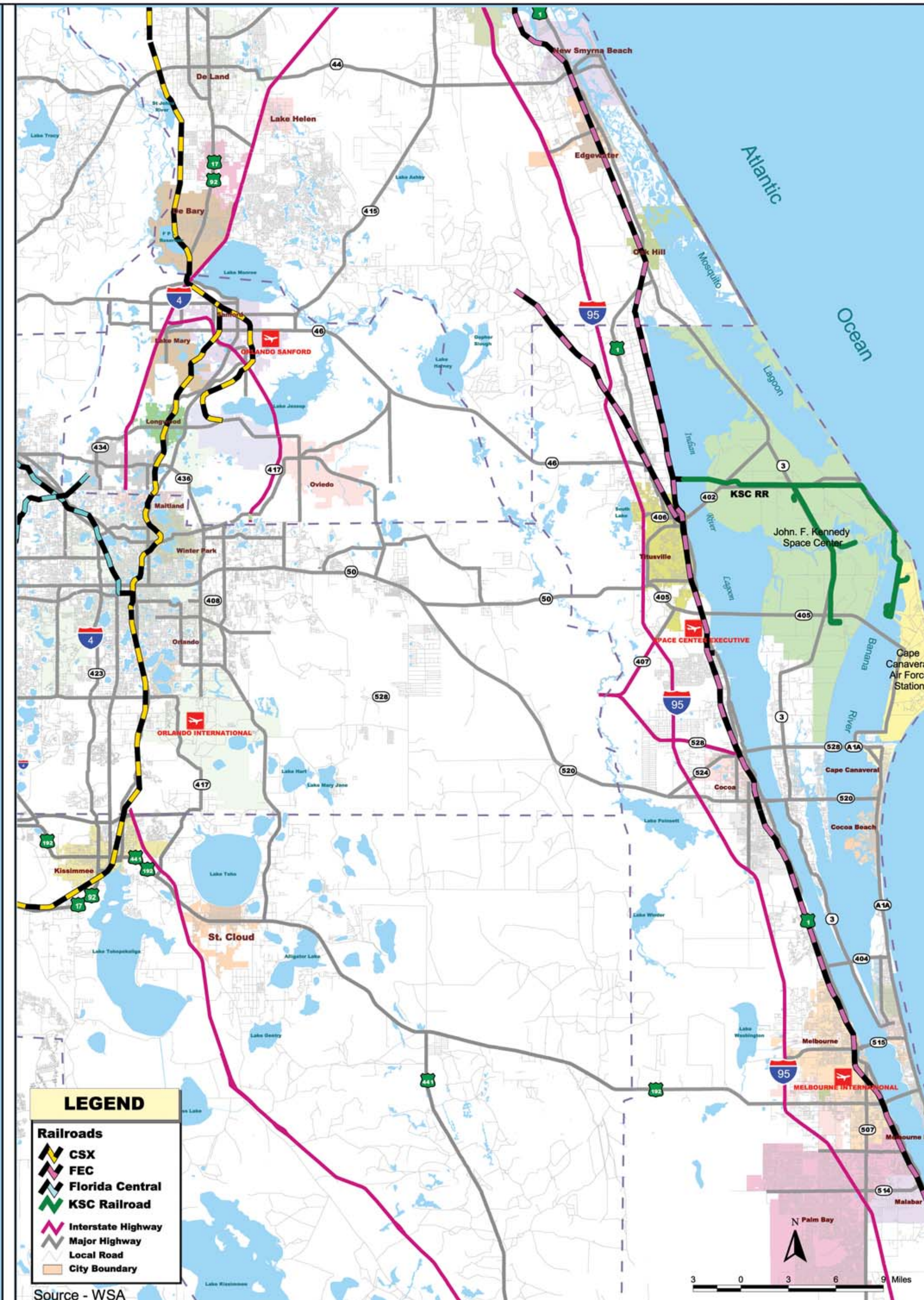

FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Left:
Florida Railroad System

Right:
Railroad in Space Center Area

Key Map

Exhibit No.
III - 22

Graphic Scale

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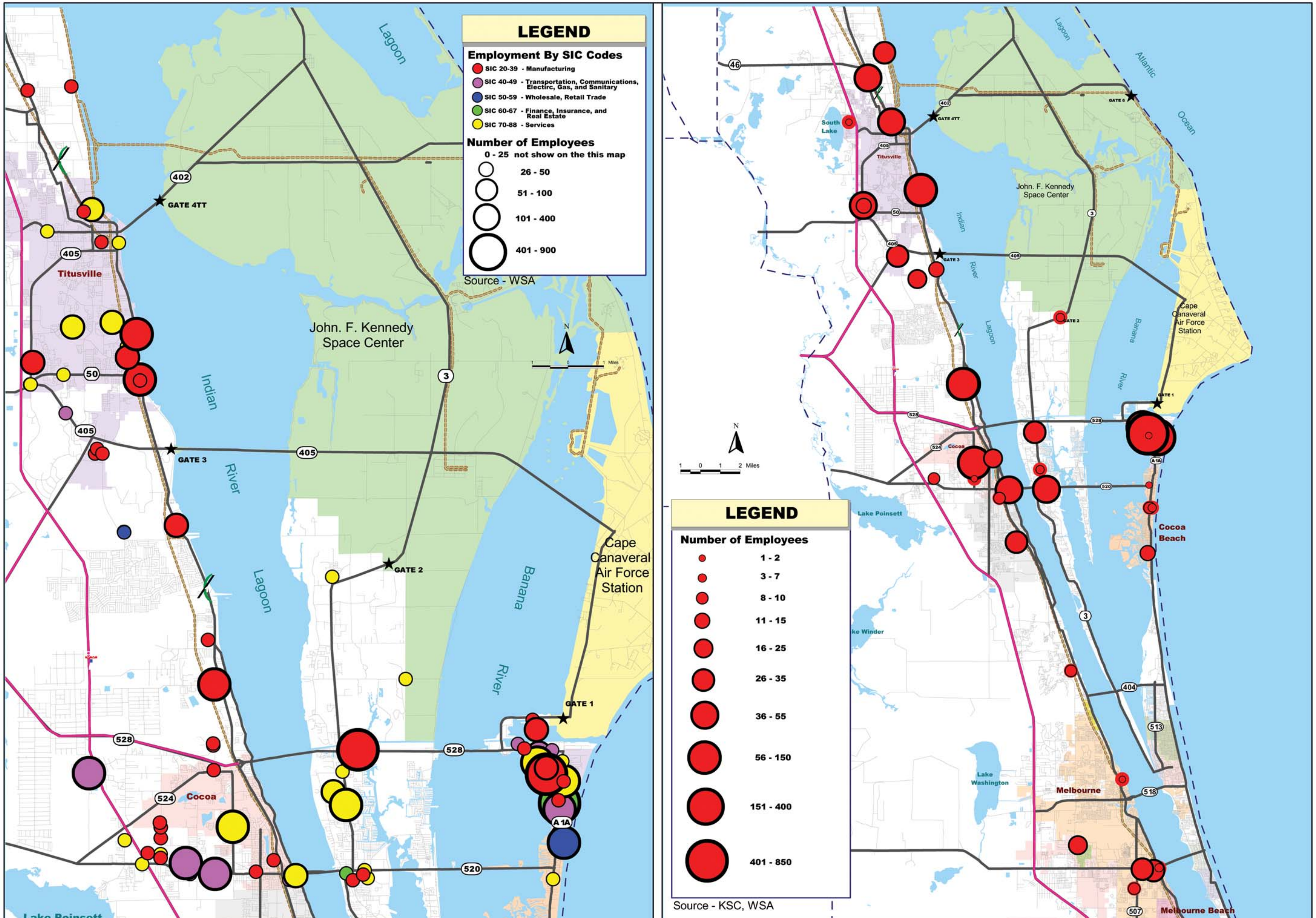

FLORIDA SPACE AUTHORITY

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

Left:
Total Employees Off-Site, 2000

Right:
Space Related Employees Off-Site, 1997-2001

Key Map

Exhibit No.
IV - 1

Graphic Scale

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KSC LAND USE CATEGORIES	ITE LAND USE CATEGORIES	LAND USE CODE	ITE DESCRIPTION	CALCULATED BASED ON	WEEKDAY TRIP GENERATION RATE (TRIP/DAY)
Spaceport Management	Military Base	501	A complex that serves one of the armed forces of the United States. It typically contains offices, training facilities, housing facilities, and recreational facilities.	Trips/Employees	1.78 Trips/Employees
Research and Development	Research and Development Center	760	Facilities or groups of facilities devoted almost exclusively to research and development activities.	Trips/Employees Trips/1,000 Sq. Feet Gross Fl Area	2.77 Trips/Employees 8.11 Trips/1,000 Sq. Feet Gross Floor Area
Public Outreach	Amusement Park	480	An amusement park contains rides, entertainment,	Trips/Employees Trips/Acres	22.08 Trips/Employees (On a Saturday) 180.20 Trips/Acres (On a Saturday)
Launch	No Equivalent ITE Land Uses				
Launch Support	Government Office Buildings	733	A related group of buildings where a varity of functions of a city, county, state, federal government, other governmental unit, or multiple governmental units are carried out. This complex differs from government office building in that it is a group of buildings that are interconnected by pedestrians	Trips/Employees Trips/1,000 Sq. Feet Gross Floor Area (GFA)	3.50 Trips/Employees 11.42 Trips/1,000 Sq. Feet Gross Floor Area
Airfield Operations	General Aviation Airport	022	Designed primarily for the use of small private and corporate aircraft, not for commercial passenger service.	Trips/Employees Trips/Average Flights Perday	14.22 Trips/Employees 1.97 Trips/Average Flights Per-Day
Seaport	Water/Marine Terminal	010	Areas for the transfer of materials between land and sea and possibly for the storage of these materials.	Trip/Berths Trip/Acres	171.52 Trip/Berths 11.93 Trip/Acres
Recreation	City Park	411	City parks are owned and operated by a city. The city parks surveyed varied widely as to location, type, and number of facilities, including boating or swimming facilities, ball fields, camp sites, and picnic sites.	Trip/Acres Trips/Picnic Sites	1.59 Trip/Acres 5.87 Trips/Picnic Sites
Conservation	State Park	413	State parks are owned and operated by a state. The state parks surveyed varied widely as to location, type, and number of facilities, including beaches, hiking trails, boating or swimming facilities, ball fields, camp sites, picnic facilities, and general open space.	Trips/Employees Trips/Picnic Sites	0.65 Trips/Employees 9.95 Trips/Picnic Sites

Ref: ITE Trip Generation, 6th Ed.

FLORIDA SPACE AUTHORITY

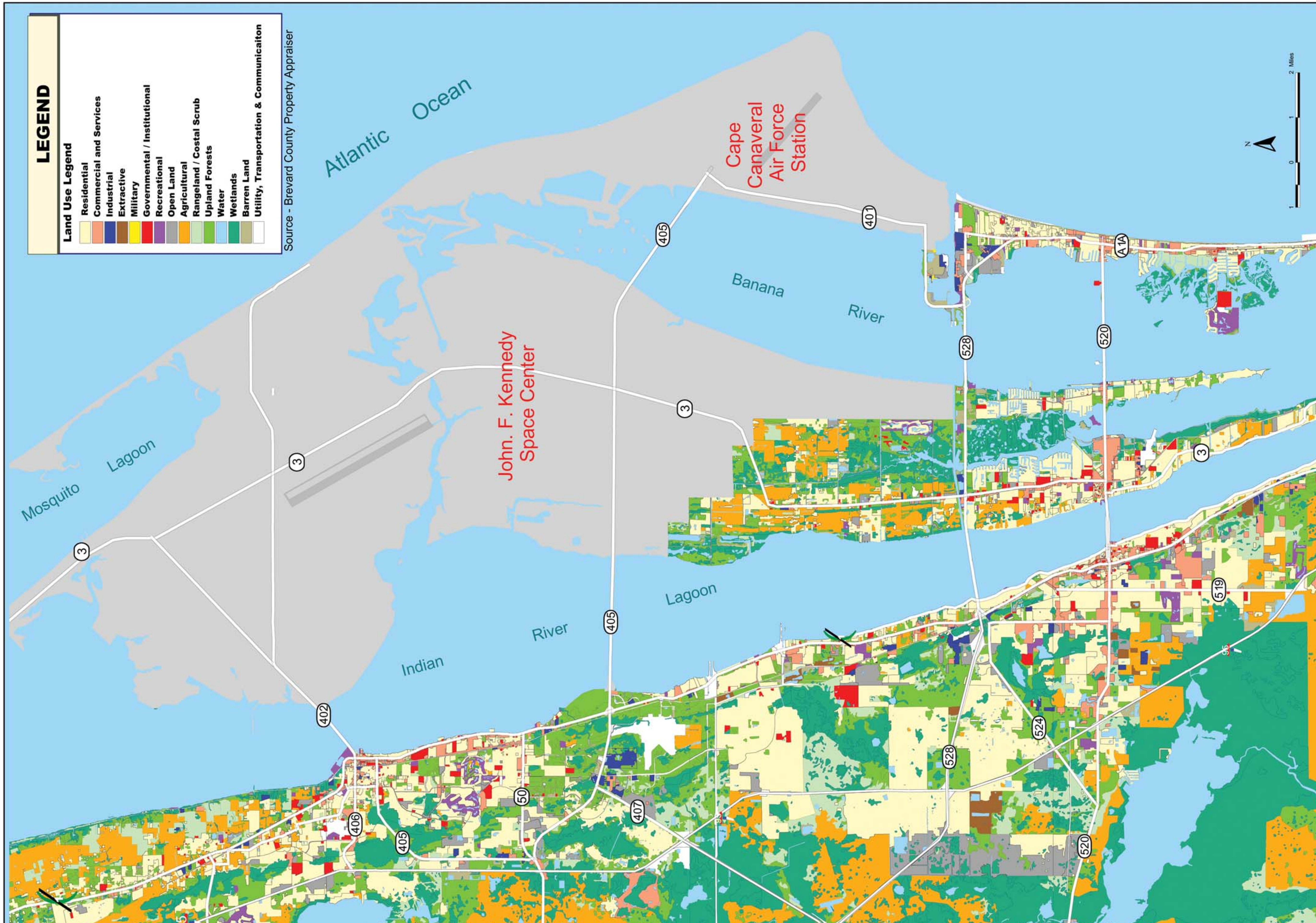
Wilbur Smith Associates

Proposed Trip Generation Rates for Spaceport Land Use

Key Map

Exhibit No.

V - 1



FLORIDA SPACE AUTHORITY

Wilbur Smith Associates

Current Land Use - Off-Site

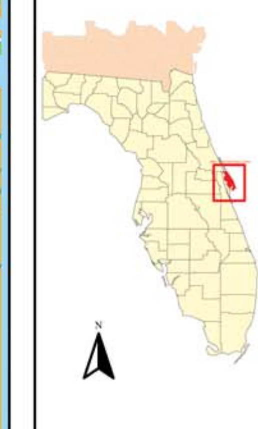


Exhibit No.

V - 2

Graphic Scale