SPACE FLORIDA
SPACEPORT MASTER PLAN

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TABLE OF CONTENTS

Table of Contents 2
List of Figures 7
List of Tables 11
Section A: Executive Summary 12
A.1 Space Transportation in Florida 13
A.2 The "Vision 2020" Connection 13
A.3 Findings 14
A.4 Modernization & Expansion of Space Transportation in Florida 16
A.5 Long Term Initiatives and Implementation 19
Section B: Introduction 20
B.1 Space Transportation in Florida 20
B.1.a History of Space Transportation in Florida 20
B.1.b Impact of Space Transportation in Florida 22
B.1.c The Future of Space Transportation in Florida 23
B.2 Space Florida Vision Statement 24
B.2.a Role of Space Florida in Spaceport Development 25
B.2.b Financial Assistance 26
B.2.c Customer Assistance Service Program for the Eastern Range (CASPER) 27
B.2.d Expansion and Repurposing of Statewide Infrastructure 27
B.2.e Extent of Space Florida Spaceport's Scope, Strengths, Limitations and Constraints 28
Section C: Current Infrastructure Inventory and Assessment 29
C.1 Defining Florida's Spaceports 29
C.1.a Spaceport Territories as Defined in Florida Statutes 31
C.1.b Proposed Commercial Launch Zone 32
C.2 Florida's Existing Spaceports 36
C.3 Kennedy Space Center Facilities Overview 38
C.3.a Discussion of Selected KSC Facilities 40
C.3.b Launch Complexes 39A & 39B 41
C.3.c Launch Control Center (LCC) 43

C.3.d Multi Payload Processing Facility (MPPF) 44
C.3.e Operations & Checkout (O&C) Building 45
C.3.f Orbiter Processing Facilities (OPF) 46
C.3.g Payload Hazardous Servicing Facility (PHSF) 47
C.3.h Reusable Launch Vehicle Hanger at the SLF 48
C.3.i Rotation Processing and Surge Facility (RPSF) 49
C.3.j Shuttle Landing Facility (SLF) 50
C.3.k Space Life Sciences Laboratory (SLSL) 50
C.3.l Space Station Processing Facility (SSPF) 52
C.3.m Vehicle Assembly Building (VAB) 53
C.4 Cape Canaveral Air Force Station Facilities Overview 54
C.4.a Space Launch Complex 17 (SLC-17) 59
C.4.b Space Launch Complex 36 (SLC-36) 59
C.4.c Space Launch Complex 37 (SLC-37) 62
C.4.d Space Launch Complex 40 (SLC-40) 63
C.4.e Space Launch Complex 41 (SLC-41) 64
C.4.f Space Launch Complex 46 (SLC-46) 65
C.4.g Space Launch Complex 47 (SLC-47) 66
C.4.h The Skid Strip 67
C.4.i Space Operations Control Center (SOCC) 67
C.5 Florida's Proposed Spaceports 68
C.5.a Space Florida Spaceport 69
C.5.b Cecil Field Spaceport 70
C.6 Other Space Support Facilities 79
C.6.a Astrotech 80
C.6.b Camp Blanding – Operational Storage Facility (OSF) 81
C.6.c Cape San Blas 82
C.7 Multimodal Connectors to Florida's Spaceports 82
C.7.a Space Florida Spaceport Highway and Multimodal Connector 85
C.7.b Potential future Cecil Field Spaceport Hub 102

Section D: Need, Market Demand, and Space Activity Forecasts 105
D.1 Spaceport Markets in the United States 105
D.1.a Existing Federal Ranges & Spaceports 106
D.1.b Existing Commercial Spaceports 111
D.2 Market Analysis 115
D.2.a Summary of Key Findings 115
D.2.b Global Market Overview 116
D.2.c United States Market Overview 120
D.2.d Florida Market Overview 125
D.2.e Space Tourism Market Forecasts 131
D.2.f NASA Commercial Crew & Cargo Program 136
D.3 Public Workshop 138
Section E: Capacity Analysis of Spaceport Infrastructure 140
E.1 Vehicle Launches / Processing 141
E.1.a Delta II Retirement 145
E.1.b Shuttle Retirement 145
E.1.c Activation of Falcon 9 (SpaceX) 146
E.1.d Licensure of Cecil Field 146
E.2 Payload Processing 147
E.3 Eastern Range 150
E.3.a Eastern Range Overall Launch Capacity 150
E.3.b Eastern Range Launch Azimuths 150
E.3.c Eastern Range Support for New Programs 152
Section F: Plans to Modernize and Expand Facilities 153
F.1 Space Florida Plans for Existing Facilities 153
F.1.a Exploration Park 154
F.1.b Space Florida Spaceport Development 156
F.1.c Space Launch Complex 36 (SLC-36) 157
F.1.d Space Launch Complex 46 (SLC-46) 160
F.1.e Space Launch Complex 47 (SLC-47) 162

F.2 NASA KSC Plans 163
F.2.a Plans for Launch Complex 39A 163
F.2.b Plans for Launch Complex 39B 163
F.2.c Plans for the Vehicle Assembly Building 163
F.2.d Plans for Launch Control Center Firing Room 1 163
F.2.e Plans for the Shuttle Landing Facility (SLF) 163
F.2.f Plans at the SLF RLV Hangar 165
F.3 CCAFS Plans 166
F.4 Jacksonville Aviation Authority Plans 168
F.4.a RLV Hangar & Assembly Facility 168
F.4.b RLV Taxiway & Apron Facility 168
F.4.c RLV Fueling Facility 168
F.5 SpaceX Plans 169
F.5.a Falcon 9 Booster Refurbishment Facility 169
F.5.b Falcon 9 Vehicle Storage Space 169
F.5.c Falcon 9 Ordnance Storage 169
F.5.d Falcon 9 Dragon Capsule Processing Facility 170
F.6 United Launch Alliance Plans 170
F.7 Potential Projects for Space Florida to Advocate for This Year 171
F.7.a Project Listing 171
F.7.b Project Prioritization and Selection 185
Section G: Implementation Plan 188
G.1 Implementation Strategies 188
G.1.a Florida Spaceports and Metropolitan Planning Organizations (MPO) 188
G.1.b Florida Spaceports and the Florida Department of Transportation (FDOT) 188
G.1.c Florida Spaceports and the FDOT Strategic Intermodal System (SIS) 189
G.1.d Florida Spaceports and the FDOT CFASPP 190
G.1.e Florida Spaceports and the FDOT Five Year Work Program 191
G.1.f Funding Limitations and Unsynchronized Statues 193
G.2 Space Transportation and the State Transportation Trust Fund 195

G.2.a Economic Contribution from Space Transportation 197
G.2.b Existing Space Transportation Funding, Contributions and Incentives 198
G.2.c Potential Space Transportation Revenue Sources 199
G.2.d Usage of FAA AIP Funds for Spaceport Infrastructure 200
G.2.e Space Transportation Infrastructure Matching Grants Program 200
G.2.f Next Steps 201
G.3 Spaceport Master Plan Management and Maintenance 202
G.3.a Existing Model Frameworks 202
G.3.b Management and Maintenance of Space Florida Spaceport Master Planning Efforts 205
G.3.c Spaceport Master Planning Schedule 206
G.4 Long Term Initiatives 208
Section H: Appendix – Space Florida Spaceport Evaluation 211
H.1 Spaceport Evaluation Mechanism (SEM) Ratings 211
H.2 Launch Site Viability Evaluation (LSVE) 213
H.2.a Orbital Performance Factors 213
H.2.b Physical and Natural Environmental Factors 213
H.3 Space Florida Spaceport Evaluation 216
H.4 SLC-36 – Site Evaluation 222
H.5 SLC-46 – Site Evaluation 223
H.6 SLC-47 – Site Evaluation 224
H.7 Analysis of Evaluation Results 225
H.8 Areas Requiring Enhancement at Space Florida Spaceport 228
Section I: Appendix – Acronyms 229
Section J: Appendix – References 233

LIST OF FIGURES

Figure 1: Vision 2020 – 10 Market Horizon Constellations 13
Figure 2: Space Florida's "Vision 2020" 14
Figure 3: Current Domestic Space Launch Vehicles 16
Figure 4: Input Process to the FDOT Five Year Work Program 17
Figure 5: Identified Project – Statewide Locations 18
Figure 6: Statewide Spaceport Council Organizational Structure 19
Figure 7: Space Transportation in Florida – Past, Present, Future 20
Figure 8: Friendship 7 (LC-14) 21
Figure 9: Florida's Aviation and Aerospace Cluster Map – (Ref [76] – Enterprise Florida) 22
Figure 10: Spaceport Master Plan Vision 24
Figure 11: Space Florida Goals 25
Figure 12: Spaceport Locations in Florida 30
Figure 13: Spaceport Territories per 2009 Florida Statutes 31
Figure 14: Schematic Illustration of the CLZ 33
Figure 15: KSC and CCAFS Property Administration Areas 36
Figure 16: KSC and CCAFS Property Administration Areas 37
Figure 17: Active Launch Complexes at Kennedy Space Center (Ref [48]) 38
Figure 18: Active Launch Complexes at Kennedy Space Center 39
Figure 19: Assessed Facilities at Kennedy Space Center 41
Figure 20: Ares I-X on Pad 39B with Space Shuttle Atlantis on Pad 39A in the background 42
Figure 21: Launch Control Center at KSC with New Hurricane-Rated Windows 43
Figure 22: Looking Northwest at MPPF 44
Figure 23: Operations & Checkout (O&C) Building at KSC 45
Figure 24: Rendering of Orion Assembly in the O&C 45
Figure 25: Looking West at OPF-1&2 46
Figure 26: Looking Northeast at OPF-3 46
Figure 27: Looking Southwest at the PHSF 47
Figure 28: Reusable Launch Vehicle Hanger at the Shuttle Landing Facility 48
Figure 29: Rotating Processing and Surge Facility at KSC 49
Figure 30: Graphic Rendering of Existing Conditions at the SLF [22] 50
Figure 31: Space Life Sciences Lab (Ref [45]) 51
Figure 32: Looking Southeast at SSPF 52
Figure 33: Processing of Space Station Modules 52
Figure 34: Construction of the Vehicle Assembly Building at KSC in 1965 (Ref [78]) 53
Figure 35: Vehicle Assembly Building at KSC 53
Figure 36: Historical Photo of Cape Canaveral Air Force Station in 1964 (Ref [48]) 54
Figure 37: Eastern Range Customer Set Summary 56
Figure 38: CCAFS Launch Complex Status Map - 2009 57

Figure 39: CCAFS Launch Complex Status Table – 2009 58
Figure 40: Delta II on SLC-17B at CCAFS 59
Figure 41: View of SLC-36 in Present Configuration (Modified Satellite Photo) 60
Figure 42: SLC-36 Blockhouse & Annex Building 60
Figure 43: SLC-36 Support Building (Building #5550) 61
Figure 45: Delta IV HIF at CCAFS 62
Figure 44: Delta IV on SLC-37 at CCAFS 62
Figure 46: Falcon 9 on SLC-40 at CCAFS 63
Figure 47: Looking Southwest at SLC-41 and VIF at CCAFS 64
Figure 48: Aerial View of SLC-46 from July 2008 65
Figure 49: SLC-46 Mobile Access Structure 65
Figure 50: SLC-47 at CCAFS 66
Figure 52: SOCC at Space Florida's CCAFS South Gate Campus 67
Figure 51: Pegasus from Skid Strip (Ref [81]) 67
Figure 53: Florida's Proposed Spaceports 68
Figure 54: Proposed Development of SLC-36 & SLC-46 within the Space Florida Spaceport at CCAFS 69
Figure 56: Proposed Cecil Field Spaceport 70
Figure 55: Cecil Field Airport 70
Figure 57: Preferred Characteristics of Potential Suborbital RLV Sites in Florida 71
Figure 59: Cecil Field Spaceport Licensing Timeline 72
Figure 58: Potential Non-Federal RLV Sites in Florida 72
Figure 60: Example Concept X RLV (Rocketplane XP) 73
Figure 62: Nominal Mission Profile 74
Figure 61: Example Concept Z RLV (SpaceShipOne) 74
Figure 63: Cecil Field Explosive Site Plan and Facilities Layout 76
Figure 64: Liquid Fuel Storage Area and Liquid Fuel Loading Area 77
Figure 65: Primary Temporary Oxidizer Storage Area 77
Figure 66: Auxiliary Temporary Oxidizer Storage Area 78
Figure 67: Oxidizer and Passenger Loading Area 78
Figure 68: Other Spaceport Support Facilities 79
Figure 69: South Side of Payload Processing Facility at Astrotech 80
Figure 70: Operational Storage Facility 81
Figure 71: Launch Site at Cape San Blas 82
Figure 72: Florida Strategic Intermodal System (SIS) January 2009 (Ref [36]) 84
Figure 73: Strategic Intermodal System (SIS) Connectors to SIS Cape Canaveral Spaceport Hub 85
Figure 74: Connectors to Cape Canaveral Spaceport (District 5 SIS Maps) – Ref [44] 86
Figure 75: I-95 @ SR 407 Interchange Modifications (FDOT / HDR Engineering, Inc.) 87
Figure 76: Cape Canaveral Space Hardware Corridor and Choke Points (Ref [37]) 89
Figure 77: Non SIS Highway Connectors to SIS Cape Canaveral Spaceport Hub 90
Figure 78: Non-SIS Highways Connectors and Major Roads in Cape Canaveral Spaceport 92

Figure 79: FASP Airports near the Cape Canaveral Spaceport Hub 93
Figure 80: FASP Airports near the Cape Canaveral Spaceport Hub 94
Figure 81: Spaceport Area Waterways 95
Figure 82: AF Hangar Wharf Cape Canaveral AFS 96
Figure 83: Waterfront Facilities at Port Canaveral Used for Transportation of Spacecraft Components .. 97
Figure 84: Port Canaveral Development Map 97
Figure 85: KSC Locomotive No. 3 Transporting SRB Segments over the Jay Jay Bridge 98
Figure 86: Locations of Railroad Facilities at KSC & CCAFS [7] 99
Figure 87: Railroad & Interstate Highways in Florida 101
Figure 88: Cecil Field-JIA Driving Route 102
Figure 89: Connectors to Cecil Field Airport– Ref [52] 104
Figure 90: 2009 FAA/AST Identification of US Spaceports & Launch Sites (Ref [4]) 105
Figure 91: United States Federal Spaceports (Ref [4]) 106
Figure 92: Vandenberg Air Force Base (SLC-3E - Atlas V) 107
Figure 93: Space Shuttle Landing at Edwards Air Force Base 108
Figure 94: Wallops Flight Facility (Ref [4]) 109
Figure 95: Kwajalein Atoll (Ref [4]) 110
Figure 96: Non-Federal US Spaceports (Existing & Proposed) (Ref [4]) 111
Figure 97: Global Space Activity, 2008 (Ref [15]) 116
Figure 98: US Share of Global Launch Market (1999-2008) (Ref [27]) 116
Figure 99: Global Combined GSO and NGSO Historical Launches and Launch Forecasts (Ref [16]) 117
Figure 100: US Share of Global Commercial Orbital Launches 119
Figure 101: Florida's Shares of Commercial Orbital Launches 120
Figure 102: Florida's Share of US Commercial Orbital Launches 121
Figure 103: Florida's Share of all Successful US Orbital Launches 121
Figure 104: FAA-Licensed Vehicles Launched in 2008 (Ref [17]) 122
Figure 105: FAA-Licensed Commercial Orbital Launches (Ref [17]) 123
Figure 106: FAA-Licensed Commercial Orbital Launch Revenues (Ref [17]) 123
Figure 107: Percentage of US Orbital Launches that are Commercial 124
Figure 108: Patrick AFB and CCAFS Total Annual Economic Impact ($M) in Florida (Ref [19]) 126
Figure 109: NASA/KSC Major Commodity Purchases and Wages in FL FY08 (Ref [20]) 129
Figure 110: Total Economic Impact of All NASA Activities in FL by Geographical Area FY08 (Ref [20]) ... 130
Figure 111: Passenger Demand Forecast for Suborbital Space Tourism (Ref [35]) 132
Figure 112: Gagarin Cosmonaut Training Center, Star City, Russia (Ref [65]) 134
Figure 113: Launch of Genesis I from Russia, and Artist's Rendering of Genesis II (Ref [66]) 135
Figure 114: Spaceport's Core Business Process (Ref [7]) 141
Figure 115: Florida's Active Orbital Launch Complexes and Launch Vehicle Programs 142
Figure 116: Annual Vehicle Launches 143
Figure 117: Maximum Annual Launch Vehicle Throughput Capacity 143
Figure 118: Historical Days between Subsequent Launches of EELVs at CCAFS 144

Figure 119: Payload Processing Options for Eastern Range (Ref [31], [32], and [33]) 148
Figure 120: Astrotech Payloads Processed Annually 149
Figure 121: Eastern Range Launch Azimuths 151
Figure 122: Exploration Park - Building A (Rendering) 154
Figure 123: Exploration Park Concept Master Plan (Pizzuti – Ref [46]) 155
Figure 124: Location of Space Florida Spaceport Launch Complexes 156
Figure 125: SLC-36 Recommended Development Phases 157
Figure 126: SLC-36 – 5-year Plan 158
Figure 127: SLC-46 Recommended Development Phases 160
Figure 128: SLC-46 – 5-year Plan 161
Figure 129: SLC-47 - 5 year Plan 162
Figure 130: Cape Canaveral Air Force Station General Plan (Ref [1]) 166
Figure 131: Project Selection Process 185
Figure 132: General Schedule for Update and Adoption of FDOT Five Year Work Program 192
Figure 133: Unsynchronizes Statutes on Commercial Space 193
Figure 134: Funding Sources and Allocations for the State Transportation Trust Fund (Ref [28]) 196
Figure 135: Space Transportation and the State Transportation Trust Fund – Next Steps 201
Figure 136: Statewide Spaceport Council Organizational Framework 206
Figure 137: Potential Guiding Steps for Successful Spaceport Master Plan Implementation 207
Figure 138: Long Term Initiatives 209

LIST OF TABLES

Table 1: Spaceport Master Plan - Identified Projects 17
Table 2: Assessed Facilities at Kennedy Space Center 40
Table 3: CCAFS Launch Complex and Associated Launch Vehicle Summary 55
Table 4: Comparison of RLV Concepts 73
Table 5: Nominal Launch Phases 75
Table 6: Summary of Other Spaceport Support Facilities 79
Table 7: Chokepoints Along Cape Canaveral Space Hardware Corridor (From 2002 Transportation Master Plan - Ref [37]) 88
Table 8: Rail Spurs within Cape Canaveral Spaceport 100
Table 9: Commercial Spaceport FAA/AST Licensing (Ref [4]) 114
Table 10: Worldwide Satellite Forecast for 2009-2028 – The Teal Group 117
Table 11: FAA/AST Commercial Space Transportation Satellite and Launch Forecast (Ref [16]) 119
Table 12: Annual Launch Rate Potential for Eastern Range 144
Table 13: Maximum Number of Launches for Concept X and Concept Z (Ref [18]) 146
Table 14: Currently Available Expendable Launch Vehicles & Payload Performance (Ref [4]) 147
Table 15: Launch Vehicle Types Supported at Space Florida Spaceport 156
Table 16: Candidate Project Listing 171
Table 17: SEM Critical Path Criteria 211
Table 18: SEM Evaluation of the Proposed Space Florida Spaceport 216
Table 19: SLC-36 Evaluation Matrix 222
Table 20: SLC-46 Evaluation Matrix 223
Table 21: SLC-47 Evaluation Matrix 224
Table 22: Comparison of Space Florida Spaceport to Other Spaceports (Ref [8]) 225
Table 23: Launch Site Viability Evaluation Summary 227

SECTION A: EXECUTIVE SUMMARY

Space Florida was created to strengthen Florida's position as the global leader in aerospace research, investment, exploration and commerce.

Purpose of the Spaceport Master Plan: By Florida Statute 331.360 it is the duty of Space Florida to, *"…develop a spaceport master plan for expansion and modernization of space transportation facilities… shall contain recommended projects to meet current and future commercial, national, and state space transportation requirements… shall submit the spaceport master plan to the Department of Transportation, and such plan may be included within the department's 5-year work program of qualifying aerospace discretionary capacity improvement…"*

Mission Statement

Space Florida drives State economic development across the global aerospace enterprise.

Vision Statement

To be the world leader in developing tomorrow's aerospace enterprise, creating a diversified business environment and robust continued economic growth for Florida.

Space Florida engaged the Spaceport and Aerospace community, and stakeholders in Florida to develop this plan.

This Spaceport Master Plan:

- **DRIVES** the Vision 2020 of Space Florida for Florida.
- **DENOTES** the current infrastructure.
- **CAPTURES** the need of the market.
- **SURVEYS** current capacity.
- **ESTABLISHES** (or positions) plans for modernization and expansion.
- **ILLUMINATES** a path for implementation

This Spaceport Master Plan is a strategic, yet dynamic guide that will facilitate Space Florida in its efforts to **Plan** for the future, **Modernize** its existing capabilities, and **Expand** space infrastructure in Florida to meet current and future markets in space transportation. This master plan also serves as a capacity-building tool that will enable all stakeholders—from government leaders and aerospace businesses to academia and the general public—to have a greater role in assisting Space Florida in both defining and achieving its long-term goals and objectives. **The purpose of this plan is specifically to propose a strategy for expansion and modernization of space transportation facilities and infrastructure in Florida**. It is the intent of this Master Plan to be a living document that is the conduit for stakeholders to establish their Spaceport requirements.

A.1 SPACE TRANSPORTATION IN FLORIDA

No other region of the world has the aerospace infrastructure and talent, related target industries and position on the planet's surface to deliver what Florida can. The space industry in Florida has delivered unrivaled launch systems and operational assets with virtually every aerospace company and defense contractor, along with dozens of federal agencies in the State of Florida. Its benefits economically and socially strengthen the well-being of our state, the nation, and the globe. In 2008 alone, the NASA-related Space industry in Florida generated over $4 billion in economic output and provided nearly 50,000 jobs. Other space industry impacts are even more significant. Florida's role in the space industry will continue to remain significant. Between anticipated Shuttle Program retirement and the development of a replacement program, we will fortify our aerospace hub, leverage opportunities to enhance prospects for growth across the spectrum of Florida's economic sectors and geographic regions and grow new enterprises, investment and job opportunities as we build our global force in aerospace.

A.2 THE "VISION 2020" CONNECTION

In relation to commercial space markets in particular, Space Florida – in conjunction with the development of this Spaceport Master Plan – has developed a revised Vision 2020 and Market Strategy that more accurately reflects today's changing commercial space market. This strategy defines enabling hardware to ensure Florida is facing the market appropriately – not only from a launch services perspective – but also from a payload processing and ground operations perspective. Additionally, several established and emerging, space-related markets are identified within the Vision that have significant commercial impact. The 10 Market Horizon Constellations are shown in the Figure 1.

Over the next decade Florida can capture and grow each of these markets. Space Florida's Vision 2020 also identifies the foundational capabilities that Florida brings to ensure its success in next-generation space industry initiatives, such as R&D, existing and developing infrastructure, workforce, education, partnerships, business environment/incentives and advocacy teams.

Overall, the Vision 2020 components identify the market strategies required to ensure Florida's leadership role in next-generation space programs. The Spaceport Master Plan, focusing primarily on infrastructure expansion and modernization, is a key component to ensuring the success of that Vision.

Figure 1: Vision 2020 – 10 Market Horizon Constellations

Figure 2: Space Florida's "Vision 2020"

A.3 FINDINGS

Contained within this Spaceport Master Plan are the following conclusions regarding the state of the Space Industry and launch infrastructure within Florida:

- In 2008, the total economic contribution to Florida, of NASA alone, was $4.1 billion in output, $2.1 billion in household income and 40,802 jobs. **The economic benefit of space transportation in Florida is undeniable**.
- Currently, space transportation does not have any dedicated funding in the state of Florida, and no State Transportation Trust Fund (STTF) revenue sources are designed to specifically support space transportation.

- New funding sources dedicated to funding space transportation will need to be developed; either to augment the existing trust fund or to establish a separate STTF to fund and finance capital projects.
- As provided for in its enabling legislation, Space Florida plans to submit this Spaceport Master Plan to FDOT so that projects identified within the plan can be included within the FDOT Five Year Work Program.
- Over the past ten years about 32% of all successful commercial orbital launches in the world occurred within the US. In the same time only 37% of all successful orbital commercial launches from the US occurred in Florida.
- It is estimated that every dollar earned in the space and aeronautics industry in Florida generates $2.83 in earnings for other sectors of the economy
- Florida has significant opportunities in the aerospace market over the next several years to:
    - Secure the State's dominant role in U.S. vertical launches for military and civil (i.e., NASA) markets, and make significant progress in securing additional commercial launch business
    - Capture a larger share of the supply chain activity for space vehicles and related equipment
    - Position Florida to capture a significant share of the emerging global market for horizontal launches, including sub-orbital personal spaceflight transportation and cargo, and orbital payload delivery
    - Position for global leadership in new space markets and technologies
- Space Florida is currently providing proactive tools, services, and infrastructure to support new customer programs and help those customers navigate the requirements of the Eastern Range that will ultimately reduce their program schedule and cost.
- The Eastern Range currently has the capacity to support anticipated civil, military and commercial launch operations for the foreseeable future.
- Existing payload processing capabilities for commercial and non-commercial missions are adequate for the forecasted market.
- Following the retirement of the Space Shuttle, there will be a gap in U.S. Manned Spaceflight capability, resulting in insufficient capability domestically to support crew access to the ISS. This lack of capability may exist until NASA's Ares I and Orion are operational.
- The Falcon 9 and Taurus II may be able to support the medium-class launch market for commercial, DoD and NASA missions following the retirement of the Delta II program in 2012.
- Florida is currently hosting the Space X Launch Complex, providing additional space launch capability for support of both commercial cargo and potential crew missions in the near future.
- When fully operational, the Space X Falcon 9 will be able to support ISS re-supply and commercial access to space.
- Following the retirement of the Space Shuttle in 2010 and the retirement of Delta II in 2012, the Delta IV, Atlas V and Falcon 9 programs will provide the only active orbital launch capability in Florida until NASA's Ares I is activated in 2015 or later.

- There is market demand and the potential for Florida to be a leader in orbital and suborbital space tourism.
- Based on initial projections for suborbital tourism and competition from other spaceports in the U.S. and globally, Cecil Field Spaceport will have sufficient capacity to independently support a significant portion of the suborbital space tourism market.

A.4 MODERNIZATION & EXPANSION OF SPACE TRANSPORTATION IN FLORIDA

For the State of Florida to remain competitive in the commercial space industry, flexible options and incentives must be made available for potential customers. Investing in launch and facility infrastructure will be one significant strategy to encourage commercial space business development and secure a solid foundation for future Space Florida Spaceport customers. For example, there are several vehicles that are not currently being launched in Florida, due to lack of active infrastructure at Cape Canaveral Air Force Station. These light-to-medium-lift vehicles (represented in Figure 3) could be served by SLC-36 and SLC-46 once those pads are refurbished and activated.

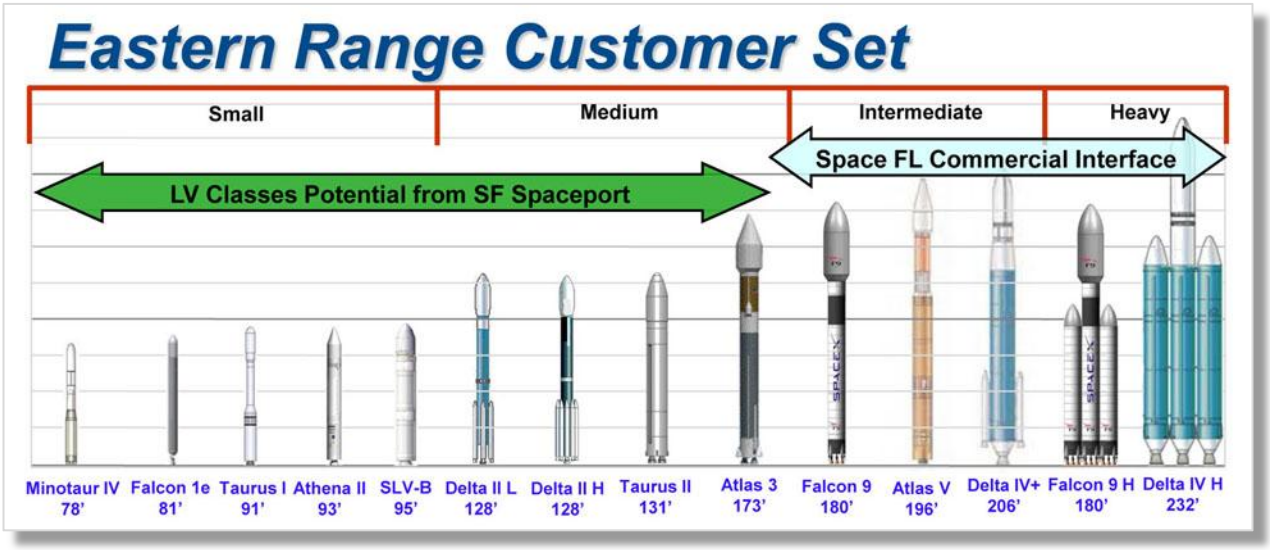


Figure 3: Current Domestic Space Launch Vehicles

State and Federal government policies and regulations will need to be updated to support the need for integrating commercial space transportation launch and payload facilities construction and processes. The planning, design and construction of launch sites and infrastructure will also require Space Florida to seamlessly interface with existing civil and defense components at Kennedy Space Center and Cape Canaveral Air Force Station, as well as compliment the planning goals and objectives of NASA and the 45th Space Wing (45 SW).

To develop a comprehensive list of <u>recommended projects to meet current and future commercial, national and state space transportation requirements</u> for the Spaceport Master Plan, Space Florida solicited inputs from over 25 stakeholders across the state of Florida. Moreover, Space Florida convened a public workshop at Port Canaveral early in October 2009. The participants at the workshop included key FDOT officials, the Jacksonville Aviation Authority representatives, the Canaveral Port Authority, the Space Coast Transportation Planning Organization (TPO), NASA, 45th Space Wing, United Launch Alliance, the Space Foundation, as well as other representatives of the aerospace industry. The current project list is identified in Table 1 with the statewide project locations shown in Figure 5.

Table 1: Spaceport Master Plan - Identified Projects

Project Description (in alphabetical order)	Location
Jacksonville Aviation Authority - RLV Fueling Facility	Cecil Field Spaceport
Jacksonville Aviation Authority - RLV Hanger & Assembly Facility	Cecil Field Spaceport
Jacksonville Aviation Authority - RLV Taxiway & Apron Facility	Cecil Field Spaceport
NASA/KSC - Shuttle Landing Facility Improvements	Kennedy Space Center
Space Florida - Space Launch Complex 36 Phase 0 Design and Construction	Space Florida Spaceport
Space Florida - Space Launch Complex 46 Refurbishment	Space Florida Spaceport
Space Florida - Space Life Sciences Exploration Park Transportation Improvements	Kennedy Space Center
Space Florida - Spaceport Master Planning	Statewide
SpaceX - Falcon 9 Vehicle Storage Space	CCAFS
SpaceX - Falcon 9 Dragon Capsule Processing Facility	CCAFS
SpaceX - Falcon 9 Ordnance Storage	CCAFS
SpaceX - Falcon 9 Booster Refurbishment Facility	CCAFS
United Launch Alliance - Vertical Integration Facility and Mobile Launch Platform	CCAFS – SLC-41

These projects will be provided to FDOT to be **included within the department's 5-year work program of qualifying aerospace discretionary capacity improvement.**

Figure 4: Input Process to the FDOT Five Year Work Program

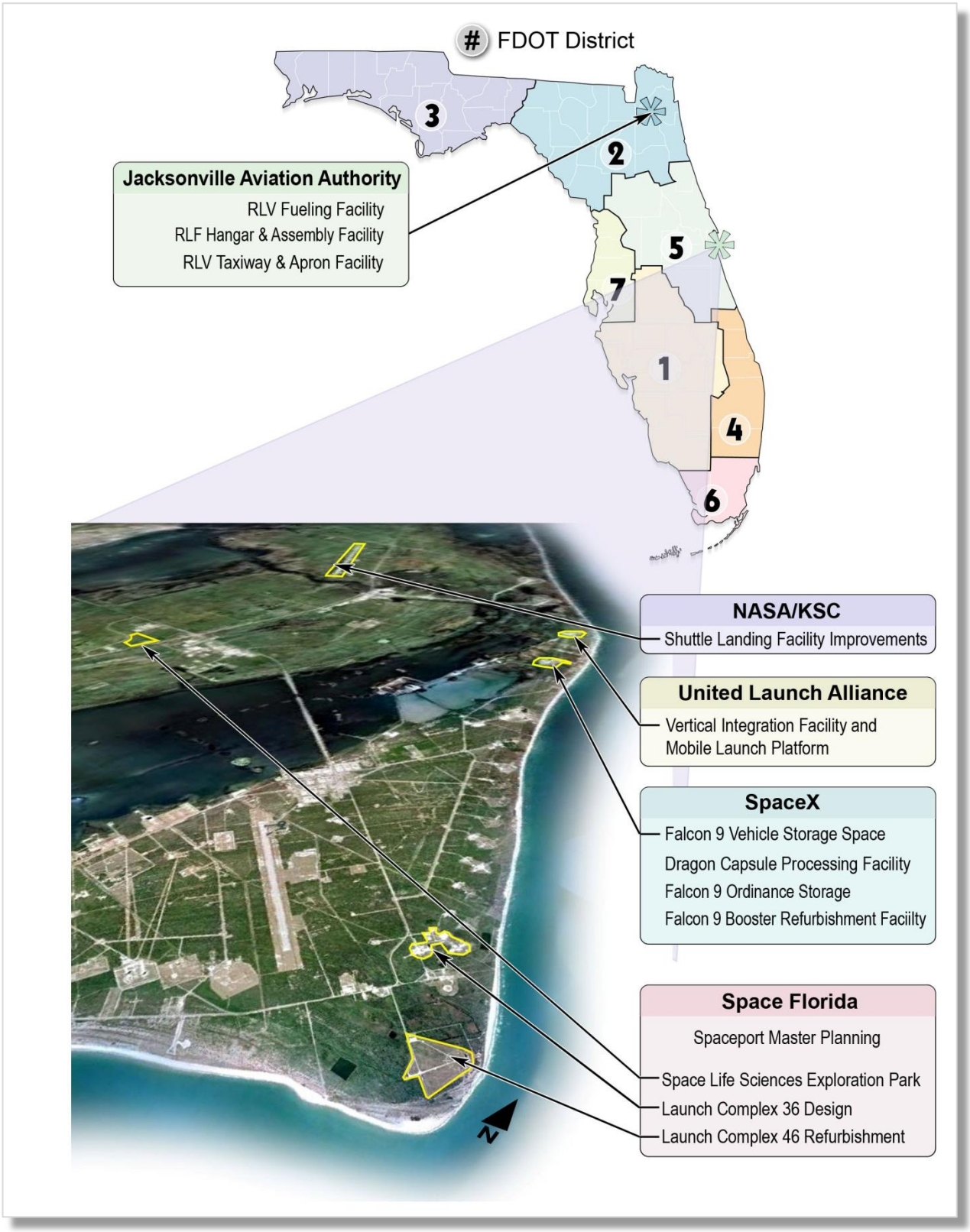


Figure 5: Identified Project – Statewide Locations

A.5 LONG TERM INITIATIVES AND IMPLEMENTATION

Space Florida has been actively working to improve the climate of space transportation in Florida. As the single point of contact for state aerospace-related activities with federal agencies, the military, State agencies, universities, and the private sector, Space Florida has developed a number of innovative programs and technologies including but not limited to the Customer Assistance Service Program for the Eastern Range (CASPER), conduit financing, and proposed Commercial Launch Zone (CLZ) legislation.

To continue in its efforts, Space Florida will lead active partnerships and foster bold economic development activities to expand domestic and international opportunities, support talent development, enhance infrastructure and support governments and organizations in improving the state's competitive business climate. These efforts include sustained close working partnerships with the Federal government, the Florida Department of Transportation (FDOT), Metropolitan Planning Organizations (MPOs) in Florida, as well as the commercial space industry. This will promote a fuller understanding by FDOT of transportation facility requirements for the development and expansion of the space industry in Florida.

It is imperative that Space Florida develop innovative financing solutions and successful marketing strategies that will earn the vital public and political support necessary for securing additional funding. By identifying potential sources of dedicated funding, Space Florida can develop space infrastructure projects and programs which are both cost-feasible and potentially eligible for the FDOT Five Year Work Program.

Another long-term strategy includes governance recommendations to establish a Statewide Spaceport Council to oversee infrastructure recommendations and make determinations on priorities within that list. Additional governance measures will include quarterly public workshops, an aerospace industry advisory council and a regular, on-site presence of a representative from the Florida Secretary of Transportation Office, among others.

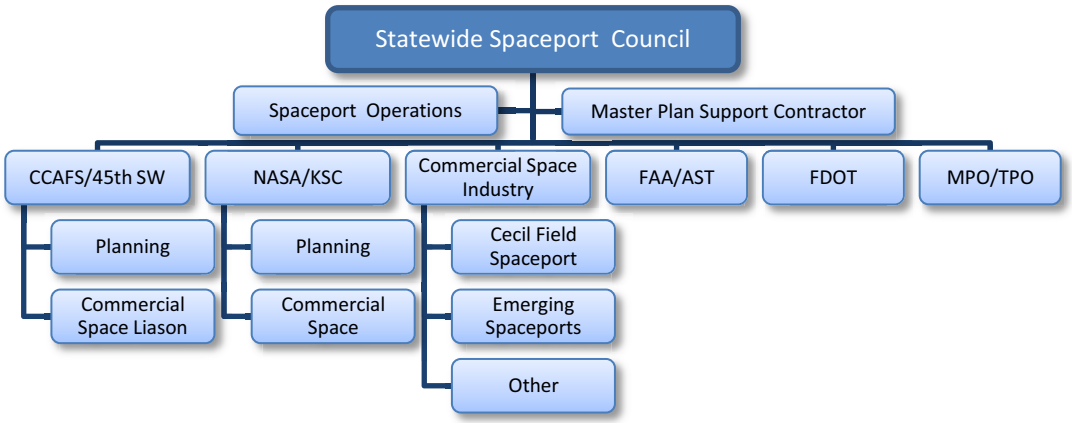


Figure 6: Statewide Spaceport Council Organizational Structure

SECTION B: INTRODUCTION

WHERE WE ARE GOING

For the past 50 years, space transportation has been an important sector of the Florida economy and although it has gone through economic cycles like other industries space transportation has continued to contribute to the overall economic benefit of Florida.

B.1 SPACE TRANSPORTATION IN FLORIDA

Space transportation in Florida has a long and proud history. Current economic benefits are still recognized and Florida will continue to play an important role in Space.

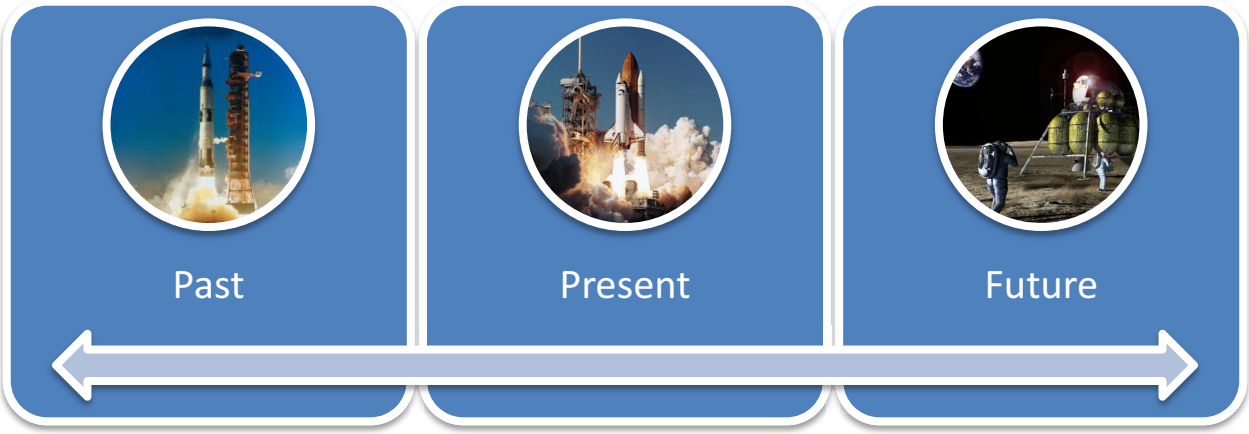


Figure 7: Space Transportation in Florida – Past, Present, Future

B.1.a HISTORY OF SPACE TRANSPORTATION IN FLORIDA

On July 29, 1958, President Dwight D Eisenhower signed Public Law 85-568, creating the National Aeronautics and Space Administration (NASA). In July 1962, the agency established its Launch Operations Center on Florida's east coast. The facility is now known as Kennedy Space Center (KSC), since re-named after the President who set in motion the US quest for the moon.

NASA's John F Kennedy Space Center and USAF's Cape Canaveral Air Force Station have helped set the stage for America's excursions into space for more than forty years. The spaceports have served as the departure gateway for every American manned mission and hundreds of scientific spacecraft. From the early days of Project Mercury and Gemini programs to the Space Shuttle and International Space Station (ISS), and from the Hubble Space Telescope to the Mars Exploration Rovers, Florida's space coast enjoys a rich heritage in its pivotal role as NASA's processing and launch center.

Florida's geographic location is ideal and offers advantages for space flight as it allows for launches out toward the Atlantic Ocean and it is closer to the equator than most other parts of the United States, allowing rockets to get a boost from the Earth's rotation. A launch from Florida will allow for obtaining the equatorial orbits primarily used by many commercial satellites, making it cheaper to launch from Florida for launch companies than more northerly launch points. Furthermore, a launch over the Atlantic provides a safe area for dropping solid rocket boosters or expended components safer. This location also provides an existing low altitude re-entry corridor which the Space Shuttle currently employs every time it lands here on the Space Coast.

On January 31, 1958 Explorer 1 was launched from Cape Canaveral Florida, ushering in the era of space exploration for the United States and establishing The Space Coast of Florida. Explorer 1, a US Army launched scientific satellite was the first US satellite in orbit and lifted off at Cape Canaveral using a modified ABMA-JPL Jupiter-C rocket. It carried the scientific experiment of James A Van Allen, and discovered the Earth's radiation belt.

Other significant space flights originating from Florida include:

- Mercury Freedom 7, launched on May 5 1961 from Launch Complex 5 (LC-5) at Cape Canaveral, Florida, carried Alan Shepard Jr, the first US Astronaut in suborbital space flight.
- Friendship 7, launched on February 20, 1962 from Launch Complex 14 (LC-14) at Cape Canaveral, Florida carried John Glenn, the first US Astronaut to orbit the earth.
- Mariner 2, launched from Cape Canaveral Air Force Station Launch Complex 12 (LC-12) on August 27, 1962, was the first successful inter-planetary spacecraft, flew past Venus, and entered a heliocentric (solar) orbit on December 14, 1962.
- The first lunar landing by Neil Armstrong and Edwin Aldrin, Jr and the first moonwalk on July 20, 1969, using Apollo 11, which was launched from Kennedy Space Center on July 16, 1969.

Figure 8: Friendship 7 (LC-14)

- Pioneer 10, launched on March 3, 1972 from Launch Complex 36A (LC-36A) at Cape Canaveral, Florida, and was the first spacecraft to leave the solar system.
- The first manned mission of the Space Transportation System (STS-1, space shuttle), Columbia, was launched from Kennedy Space Centre on April 12, 1981. The Space Shuttle was the first orbital spacecraft designed for reusability. When the shuttle retires in 2010 it will have achieved over 130 launches.

B.1.b IMPACT OF SPACE TRANSPORTATION IN FLORIDA

The state of Florida has been positively affected by Space Transportation on many levels. According to a 2008 NASA assessment, the Kennedy Space Center and other NASA centers' expenditures in support of space program activities in the state was $1.93 billion. The Kennedy Space Center Visitor Center had approximately 1.6 million visitors, 85 percent of which were out-of-state visitors. Visitors spent about $78 million on goods and services provided by the Visitor Center. In 2008, the total economic contribution of NASA to Florida was estimated at $4.1 billion in output, $2.1 billion of household income and 40,802 jobs. The estimated local economic impact of Patrick Air Force Base and Cape Canaveral Air Force Station (CCAFS) during Fiscal Year 2008 was nearly $1.07 billion. This amount represents wages and salaries for all military and civilian employees, the estimated dollar value of the indirect jobs created, and local contracts and construction. The 45th Space Wing population of military members, military dependents, civilian employees and contractors is approximately 13,000.

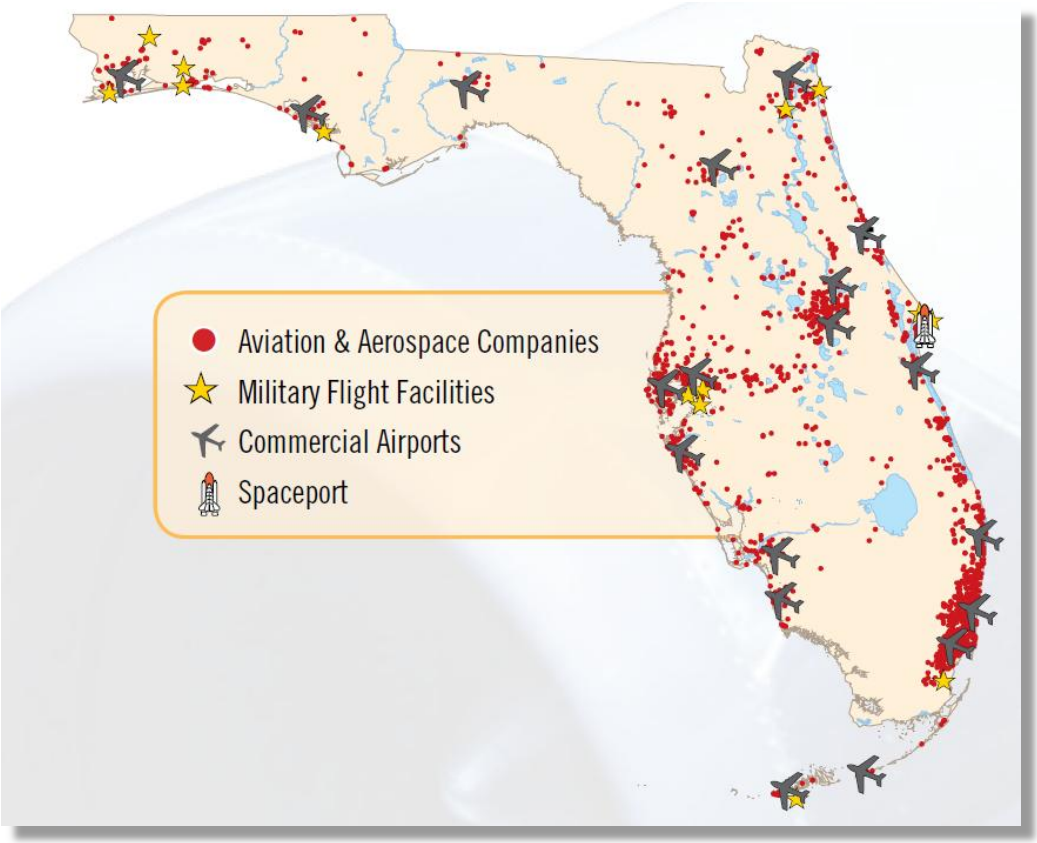


Figure 9: Florida's Aviation and Aerospace Cluster Map – (Ref [76] – Enterprise Florida)

Of the nearly 1,900 Aviation & Aerospace Companies identified by Enterprise Florida in Figure 9, over 200 of them are Space Technology Companies.

B.1.c THE FUTURE OF SPACE TRANSPORTATION IN FLORIDA

The future of US Human Space Flight is uncertain following the release of the Augustine Commission Report in September 2009 and everyone with a vested interest in Space is waiting to hear what the US Policy regarding Space Transportation will be.

At this time the Shuttle Program is scheduled to end in 2010. NASA is still moving forward with the Constellation Program and preparing the facilities at Kennedy Space Center to support the two new launch vehicles (Ares I & Ares V) that are designed to return us to the moon and eventually to Mars. Between the end of the shuttle program and the beginning the new program there will be a multi-year gap in US human spaceflight capability, where the US will not be able to fly astronauts into space domestically and may have to rely on international partners for this task.

Cape Canaveral Air Force Station has been deactivating unused launch complexes and streamlining their operations by ending older launch vehicle programs (such Atlas II/III and Delta II) and supporting the newer Evolved Expendable Launch Vehicles (EELV) developed and operated by Boeing and Lockheed Martin under the joint venture of United Launch Alliance (ULA).

While the government programs remain uncertain, what is certain is that commercial launch providers are attempting to fill potential gaps in space access and are hoping to influence the future direction of space transportation. Jacksonville Aviation Authority has submitted an application to the FAA/AST to obtain a Spaceport License for Cecil Field Airport in Jacksonville and is positioning itself at being the first spaceport in Florida to be able to support suborbital space tourism. SpaceX, one of the two winners of NASA Commercial Orbital Transportation Services (COTS) award, is preparing a launch vehicle (Falcon 9) that will be able to resupply the Space Station and potentially support other market segments left open by the retirement of the Delta II launch vehicle in 2012.

As suborbital Reusable Launch Vehicle technologies mature, Space Florida seeks to support various suborbital RLV launch and landing facilities across the state of Florida to enable transportation of personnel, goods and services state-wide, regionally, and internationally. By providing a network of Aerospaceport in the state capable of supporting suborbital RLV missions, the state can position itself at being a leader in this market.

With new directions in the space launch market, it is important that the state of Florida continue to modernize and expand its Space Transportation facilities to ensure that it can support the direction that the market is headed.

B.2 SPACE FLORIDA VISION STATEMENT

As rail transportation transformed the 19th Century and air transportation transformed the 20th Century, space transportation will transform the 21st Century. Key to this transformation is the concept of assured access to space and the resulting services provided on Earth and enabled from space. To successfully implement this transformation, access to space and space services must become cost effective and assured.

The state of Florida, working with aerospace businesses, academia, local and state government(s), and the federal government, will to be a leader in the 21st Century space transformation as described within the Space Florida Spaceport Master Plan. This master plan includes the development of space transportation infrastructure throughout the state of Florida, including launch sites at SLC-36, SLC-46, and SLC-47, at CCAFS, and Cecil Field Spaceport in Jacksonville. Space Florida is also committed to supporting SpaceX activities at SLC-40 and other commercial space interests across the cape and Florida. These launch complexes are a key part of the launch head point of embarkation for access to space and as a test platform for this transformation.

Success in this transformation depends upon the development of state-of-the-art technologies, retention and development of supporting infrastructure and processes matching launch sites to commercial launch vehicle and payload requirements, while seamlessly interfacing with the policies, statutes, rules and regulations of the DOT, FAA/AST, TSA, NASB, DoD, and other agencies and associations.

The role of this Spaceport Master Plan is to **Plan** for the future, **Modernize** the existing capabilities, and **Expand** the space infrastructure in Florida to capture new markets in space transportation.

Figure 10: Spaceport Master Plan Vision

B.2.a ROLE OF SPACE FLORIDA IN SPACEPORT DEVELOPMENT

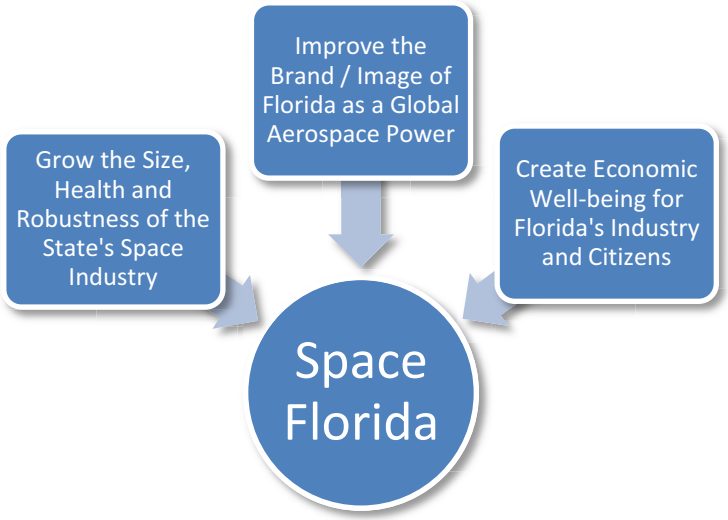


Figure 11: Space Florida Goals

Space Florida was created on May 30, 2006, when then-Florida Governor Jeb Bush approved Florida House Bill 1489. Space Florida consolidates the state's previous space and aerospace entities and coordinates all space-related issues in Florida. Under an arrangement between the federal government and Space Florida, excess CCAFS facilities were licensed to Space Florida for use by commercial launch service providers on a dual-use, non-interference basis.

Space Florida is responsible for implementing the state's aerospace economic development and education policy. Space Florida Spaceport is a proposed FAA/AST licensed Spaceport which coexists in within the existing spaceports at KSC and CCAFS. Among Space Florida's economic development powers is the authority to acquire, own, and operate facilities, launch pads, experimental spaceport facilities, landing areas, ranges, payload assembly and processing buildings, laboratories, aerospace business incubators, launch vehicles, payloads, space flight hardware, and other aerospace-related systems or initiatives, including utilities and educational and cultural initiatives (Ref [24]).

As an independent special district of the state of Florida, Space Florida has unique financing capabilities that can significantly reduce the overall cost of an infrastructure project for aerospace customers. Space Florida's tax exempt status enables the organization to negotiate optimal terms on loans and reduce the overall tax burden associated with the construction of such facilities. Space Florida is working with the state of Florida, NASA, the United States Air Force, the Federal Aviation Administration and other important stakeholders and other agencies to streamline the process of bringing space related businesses to Florida. In supporting this development, Space Florida is providing financial assistance, legislative support, customer assistance, and pre-negotiated access to launch complexes.

B.2.b FINANCIAL ASSISTANCE

Within the past 16 years, the state of Florida has funded and creatively financed a number of unique projects supporting development of spaceport infrastructure and support facilities at Cape Canaveral Air Force Station and elsewhere in the State, including:

- 2009 – On June 24, 2009 a conduit financing package was approved by Space Florida's Board of Directors to reassign the lease for Launch Complex 41 (SLC-41) to United Launch Alliance.
- 2007 to present – SpaceX's development of Launch Complex 40's site engineering, pressure vessel requirements, construction of the Horizontal Integration Facility (HIF), primary use of the Space Operations Control Center, over $2 Million in direct subsidies and in-kind support. Space Florida continues to advocate and secure funding for commercial launch support for SpaceX.
- 2007 – Space Florida provided $40M in conduit financing for the Shuttle Launch Experience at KSC Visitor Complex. The addition of this attraction increased visitors to the visitor complex by 14% in its first year of operation.
- 2006 – The Florida Legislature appropriated $35 million of nonrecurring funds from General Revenue for the 2006-2007 state fiscal budget years to be used for infrastructure needs related to the development of the NASA Crew Exploration Vehicle resulting in the establishment of the Orion Assembly, Test, and Launch Facility within the Operations and Checkout building at Kennedy Space Center.
- 2002 – Conduit financing in the refurbishment of Launch Complex 41 (a former Titan IV launch pad) to accommodate the new generation Atlas V vehicle for United Launch Alliance. The state of Florida made a $235 million commitment to the project, valued at a total of $294,117,000.
- 2001 – state of Florida allocated $35 million for the building of the Space Life Sciences Laboratory.
- 1999 – $24 million in conduit financing to construct the 88,960 sq. ft. Horizontal Integration Facility (HIF), built to support the unique assembly and integration needs of the Delta IV
- 1995 – $16 million in conduit financing to construct the Solid Rocket Motor Upgrade Operational Storage Facility at Camp Blanding.
- 1994 – Space Florida (Spaceport Florida Authority) entered into an agreement to assist in financing related to the construction of a museum and tourism facility housing the Saturn V Rocket and the purchase of a new bus fleet. The original value of the assisted financing on this project was approximately $35 million.
- 1993 – Over $8 million in a launch tower, launch stand, and other associated commercial support infrastructure at Launch Complex 46.

Launch Facilities and Services

Space Florida has agreements in place for access to several launch facilities and launch complexes at CCAFS and KSC and is working with JAA and NASA to develop new commercial launch capabilities. Space Florida continues to explore ways to work with new customers by providing initial capital required to modernize and expand those facilities to support individual customer requirements.

Under a unique public private partnership, Space Florida has teamed with Astrotech Corporation, a leading provider of commercial space services, to offer "end-to-end" solutions for potential commercial space customers that will streamline the process for these companies to prepare and launch their important payloads into space. The partnership between Astrotech and Space Florida is designed to fully leverage and support commercial space business. This innovative partnership is intended to provide a competitive advantage for Florida and the U.S. in the global marketplace for commercial space businesses. For more information on Astrotech visit www.spacehab.com or call (321) 268-3830.

B.2.c CUSTOMER ASSISTANCE SERVICE PROGRAM FOR THE EASTERN RANGE (CASPER)

In 2007 Space Florida developed the Customer Assistance Service Program for the Eastern Range (CASPER) to help refine range policies and regulatory processes that will blend the needs of military and civilian users. New commercial customers bringing their launch vehicle or payload to the Eastern Range can use this free service to work through the requirements and flight safety approval process. This can speed up the process and lower costs for customer access to the Eastern Range.

CASPER provides help with the preparation and review of all program, mission, and test requirement documents through the Universal Documentation System (UDS), including Program Introduction (PI), Program Requirement Documents (PRD), and Operations Requirements. This program also provides assistance with FAA licensing, environmental impact measures, explosive site plans, ground operations plans, system safety program plans, and flight termination system reports.

Space Florida will continue to refine customer service requirements and implement innovative solutions to bring new aerospace business to Florida. Through this program, the 45th Space Wing prefers that any commercial launch provider wishing to launch from the Eastern Range utilize Space Florida in their initial coordination efforts with the 45th Space Wing. For more information about CASPER visit www.spaceflorida.gov or contact Pat McCarthy at (321) 730-5301.

B.2.d EXPANSION AND REPURPOSING OF STATEWIDE INFRASTRUCTURE

The benefits which Florida offers to a commercial aerospace industry includes the local talented and experienced experts eager to develop new emerging technologies, industries knowledgeable with the ever changing aerospace requirements, and infrastructure easily adaptable for commercial use. Florida

has excellent transportation capabilities with sea, rail, air, and highway in close proximity to desirable launch locations. Space Florida has been working with JAA to develop Cecil Field as a new Spaceport for Reusable Launch Vehicles. The existing infrastructure and location was evaluated and found a suitable launch and landing site for Reusable Launch Vehicles with minimal modifications. Camp Blanding was found an ideal location to store Solid Rocket Motors. Space Florida enabled these facilities to be built in Florida and continues to find tenants. A launch site on a remote Florida Cape (Cape San Blas) has been used for educational launches and now Space Florida is investigating additional uses for the site. Space Florida has teamed with commercial launch partners to secure and finance upgrades to existing Launch Complexes and support facilities at CCAFS.

B.2.e EXTENT OF SPACE FLORIDA SPACEPORT'S SCOPE, STRENGTHS, LIMITATIONS AND CONSTRAINTS

The Proposed Development of the Space Florida Spaceport, consisting of SLC-36, SLC-46, and SLC-47 at Cape Canaveral Air Force Station (CCAFS) is one of many proposed Space Transportation projects addressed in this Master Plan. To help ensure the success of this master plan, Space Florida and RS&H have met with both NASA and the 45th Space Wing to discuss their respective General Development Plans. The information shared in these meetings has been used to verify asset availability, enhance overall coordination, ensure that common goals are being met and ensure that this plan is consistent with the KSC and 45th Space Wing Plans.

Some of the fundamental strengths of the Space Florida Spaceport include:

- Launch Complexes have a previous history of space launch activity and have been previously used by DoD or licensed by the FAA.
- Most potential launch complexes consist of previously disturbed land that would minimize overall environmental impact.
- Significant support infrastructure is in place, including roads, rail access, barge facilities, runway access, power, data/comm., range safety, weather services, and launch control.
- Launch Complexes are located within secure perimeter of CCAFS.
- An experienced workforce may be immediately accessed.
- Proximity to space related companies.
- Flight safety approach has been approved for a wide variety of launch vehicles.
- Eastern Range size is over 15 Million Square Miles

Some of the fundamental limitations and constraints of the Space Florida Spaceport include:

- Launch azimuths preclude the option of launching into a polar orbit.
- A large concentration of endangered species and surrounded by wetlands, limits the ability to expand outside previously disturbed areas.

SECTION C: CURRENT INFRASTRUCTURE INVENTORY AND ASSESSMENT

WHAT WE ARE STARTING WITH

Before we plan for where we are going, it is important to review where we are and what we are starting with. This is best accomplished by examining the current space transportation infrastructure that Florida has in place. This infrastructure assessment is organized as follows:

1) Defining Florida's Spaceports
2) Florida's Existing Spaceports
3) Kennedy Space Center Facilities Overview
4) Cape Canaveral Air Force Station Facilities Overview
5) Florida's Proposed Spaceports
6) Other Space Support Facilities
7) Multimodal Connectors to Florida's Spaceports

C.1 DEFINING FLORIDA'S SPACEPORTS

As the United States' gateway into space, Cape Canaveral has a rich heritage of Space exploration. Cape Canaveral Air Force Station has been launching rockets for almost 60 years, including America's first manned mission in 1961. The U.S. Air Force's 45th Space Wing, operates military and commercial launches from CCAFS. Kennedy Space Center is NASA's premier launch and payload processing center for crewed launches. As the aerospace industry evolves, the private sector requires unique technology, infrastructure, and accessibility into Space. Non-Federal Spaceports are emerging to serve these needs; Space Florida is working to create two new Spaceports in the state of Florida, Cecil Field Spaceport in District 2 and Space Florida Spaceport which coexists with KSC and CCAFS in District 5.

The Florida DOT designation criterion for spaceports includes operating spaceports handling commercial or military freight payloads on Florida's Strategic Intermodal System (SIS). Although Florida Statutes define a number of areas in the State as "Spaceport Territory," currently only the property located in Brevard County in District 5 is on the SIS and meets the FDOT Spaceport criterion. This area is collectively called Cape Canaveral Spaceport by the FDOT.

While the FDOT designation of the Cape Canaveral Spaceport Hub includes all space related activity that occurs in the Merritt Island and Cape Canaveral area, the Federal Aviation Authority/ Office of Commercial Space Transportation (FAA/AST) recognizes three spaceports in this same area (Kennedy Space Center, Cape Canaveral Air Force Station, and Space Florida Spaceport).

To operate a launch or reentry site in the U.S. or U.S. territories for non-federal use, it is necessary to obtain a license through the FAA/AST. Per FAA there are two federal Spaceports in District 5; the

Kennedy Space Center and Cape Canaveral Air Force Station, and one proposed non-federal spaceport Space Florida Spaceport. Space Florida Spaceport has assets within the both the KSC and CCAFS areas and is uniquely positioned to develop more commercial launch capacity as more existing launch infrastructure becomes available. FAA also acknowledges North Florida's Proposed Spaceport in District 2, Cecil Field Spaceport.

The existing spaceport infrastructure in Florida may be separated into the following categories:

1. Existing Spaceports
2. Proposed Spaceports
3. Statewide Spaceport Infrastructure

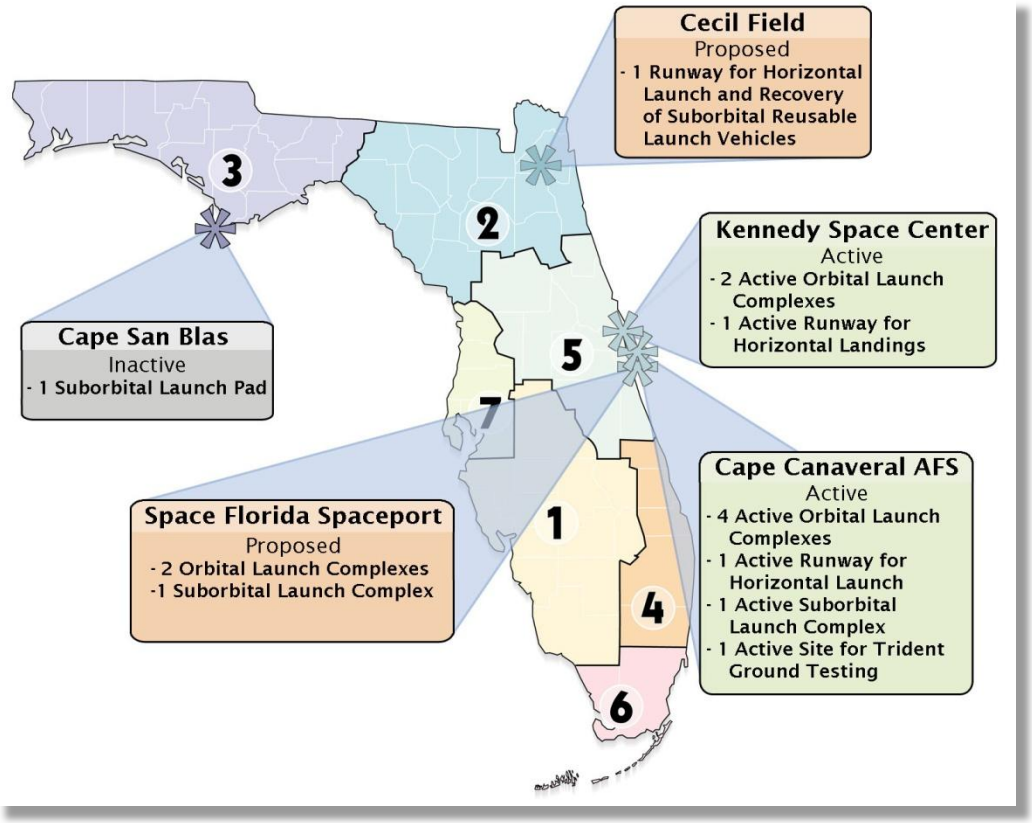


Figure 12: Spaceport Locations in Florida

C.1.a SPACEPORT TERRITORIES AS DEFINED IN FLORIDA STATUTES

Florida Statutes Chapter 331, Part II is "The Space Florida Act" and contains the following definitions and capabilities relevant to the state legislative definition of "Spaceport Territories" in the state of Florida:

> ***FS 331.303 (10)*** *"Launch pad" means any launch pad, runway, airstrip, or similar facility used for launching space vehicles.*
> ***FS 331.303 (18)*** *"Spaceport territory" means the geographical area designated in s. 331.304 and as amended or changed in accordance with s. 331.329.*
>
> ***FS 331.304 Spaceport territory****.--The following property shall constitute spaceport territory:*
>
> > *(1) Certain real property located in Brevard County that is included within the 1998 boundaries of Patrick Air Force Base, Cape Canaveral Air Force Station, or John F. Kennedy Space Center. The territory consisting of areas within the John F. Kennedy Space Center and the Cape Canaveral Air Force Station may be referred to as the "Cape Canaveral Spaceport."*
> >
> > *(2) Certain real property located in Santa Rosa, Okaloosa, Gulf, and Walton Counties which is included within the 1997 boundaries of Eglin Air Force Base.*

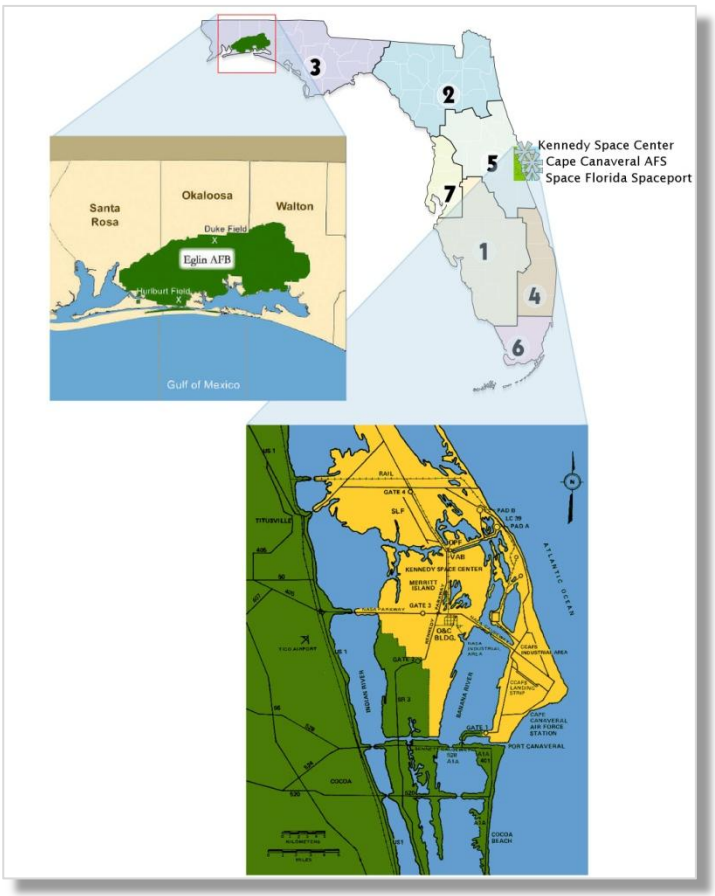


Figure 13: Spaceport Territories per 2009 Florida Statutes

FS 331.329 (1) *The board of directors may at any time strike out or correct the description of any land within or claimed to be within the boundary lines of any spaceport territory upon the written consent of the owners of all the land that would be included or excluded from the boundary lines of any spaceport territory or otherwise affected by the taking of such action, and of the owners of not less than the majority in acreage of all lands within any spaceport territory.*

(a) The board may enlarge the geographical limits of any spaceport territory to include any lands not then within any spaceport territory:

1. Upon the written consent of the owners of all the land to be included in any spaceport territory and of the owners of not less than a majority in acreage of all the land then within any spaceport territory; or

2. By resolution of the board approved at a special election called for such purpose, by vote of a majority of freeholders residing within the area to be annexed and a majority of freeholders residing within any spaceport territory.

FS 331.329 (4) *Space Florida shall designate new launch pads outside the present designated spaceport territories by statutory amendment of s. 331.304.*

Space Florida is currently determining the appropriate course of action to include Cecil Field and future Spaceports in Florida as Designated Spaceport Territories under the Florida Statutes.

C.1.b PROPOSED COMMERCIAL LAUNCH ZONE

One method proposed to encourage businesses to bring space related enterprises to Florida is the concept of the Commercial Launch Zone (CLZ). Space Florida is advocating for passage of new legislation to create a Commercial Launch Zone during the 2010 Florida Legislative Session. The CLZ for Florida will provide incentives for new commercial spaceflight businesses to locate within the State of Florida, and at the same time, to maintain or enhance commercial spaceflight opportunities for existing Florida businesses. As shown in Figure 14, the CLZ includes a hub and various spokes. The hub of the CLZ is located at KSC/CCAFS and consists of launch complexes SLC-36, SLC-46, SLC-40, SLC-41 and SLC-47, as well as a variety of support facilities, including but not limited to the Space Life Sciences Laboratory, the Reusable Launch Vehicle (RLV) hanger, Exploration Park, and Astrotech, Titusville, facilities. The various spokes depict typical links to existing and potential locations for commercial space related businesses within the State of Florida. The hub and spoke configuration of the CLZ illustrates how commercial space related business incentives will be available on a statewide basis.

Vision, Goals, Characteristics

The establishment of the CLZ will launch Florida as the national leader in legislatively promoting and attracting the emerging aerospace industry. Further, it is the goal of the CLZ is to make Florida aggressively competitive in the global marketplace. Overall, the CLZ is structured to give relief to the cost of establishing or expanding into new aerospace-related business arenas. The CLZ bill includes a robust compilation of "close the deal" incentives that are intended to lower the tax burden for new Florida based commercial spaceflight businesses over a defined period of time. Specific incentives include:

- Non-Transferable Corporate Income Tax Credits
- Transferable Net Operating Loss/Carry Forward Tax Credits
- Jobs Tax Credits
- Machinery and Equipment Credits

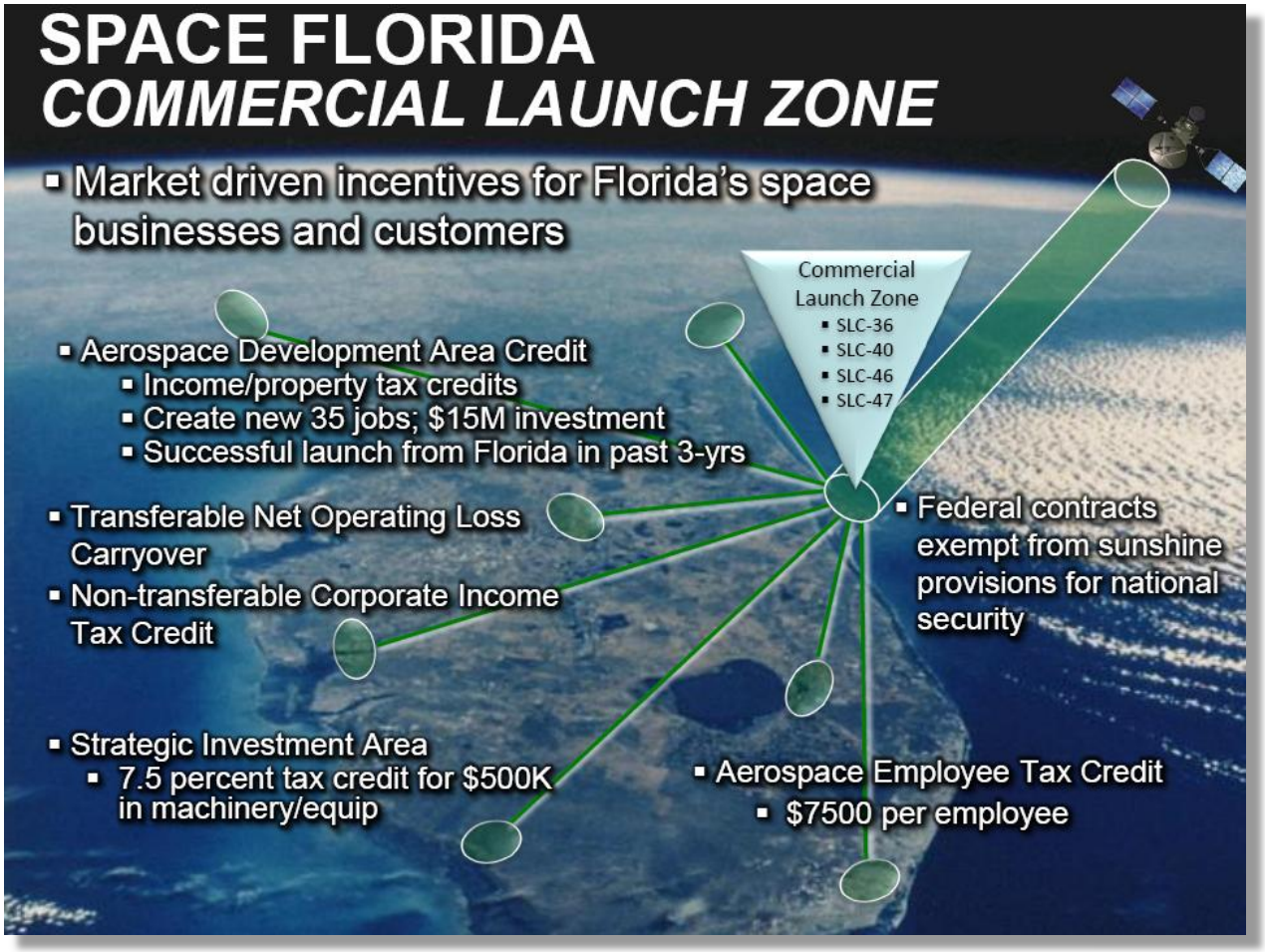


Figure 14: Schematic Illustration of the CLZ

The CLZ is configured to provide these incentives to new aerospace businesses in Florida that are engaged in any of the following non-governmental activities:

- Engineering, design and/or manufacturing of a launch vehicle, reentry vehicle, or components thereof;
- Providing a launch service or reentry service; or
- Providing a payload for a launch vehicle or reentry vehicle.

Similarities & Differences to a Free Trade Zone

The Commercial Launch Zone for Florida is very similar to a Free Trade Zone or Foreign Trade Zone (FTZ) concept. A FTZ is defined as an area near a port of entry, such as an airport or a seaport, where foreign and domestic merchandise is considered to be outside the country, or at least, outside the U.S. Customs territory.

In Florida, businesses currently have access to around 20 FTZs, giving Florida the second largest FTZ network in the nation. The majority of these zones are located in or around the state's international airports and seaports; however some FTZs also function in inland areas. Certain types of merchandise may be imported into a FTZ without going through formal Customs entry procedures or paying import duties. Customs duties are due only at the time of transfer from the FTZ for U.S. consumption. If the merchandise never enters the U.S. commerce, then no duties or taxes are paid on those items (Ref [3]).

The purpose of a FTZ is to strengthen the local economy by helping companies in trade related industries to remain competitive and to attract and retain jobs. For the CLZ, the purpose is to strengthen the State's economy and the targeted aerospace businesses that support activities within the CLZ. While the hub of a FTZ is an international port of entry, the hub of the CLZ consists of commercial launch facilities that constitute a port of entry into suborbital, orbital, and space trajectories and re-entry to Earth.

Typically, the geographic scope of a FTZ is not limited to land contiguous to the port of entry itself. The FTZ may also include industrial parks or other locations where aerospace trade-related activities are conducted. For example, FTZ 136, which is located within Brevard County, encompasses Port Canaveral, Melbourne International Airport, Space Coast Regional Airport, Spaceport Commerce Park and Tate Industrial Park (Ref [11]). Similarly, commercial aerospace businesses in the CLZ are not required to be located within the immediate vicinity of commercial launch facilities at CCAFS or at future launch sites. In fact, the CLZ is configured so that these businesses can be located anywhere within the State of Florida.

Geography, Implementation

As shown in Figure 14, the proposed CLZ is configured like a hub and spokes. The CLZ hub is the area surrounding the commercial spaceport launch facilities at CCAFS, including SLC-36, SLC-40, and SLC-47. As shown in Figure 14, the various spokes depict links to existing and potential locations for commercial aerospace businesses within the State of Florida. The hub and spoke configuration of the CLZ means that commercial aerospace business incentives will be available on a statewide basis.

A bill (HB 133/SB Pending) has been introduced in order to create a new section of the Florida Statutes (FS 220.194) that would enact Commercial Launch Zone tax incentives. This Space Florida led effort includes the drafting and filing of this Bill within the 2010 Session of the Florida Legislature. If enacted, this legislation will make Florida a national leader in promoting and attracting new commercial aerospace businesses. Space Florida's intention is to ensure that every company considering relocation will be attracted by Florida's geography, existing infrastructure, highly skilled workforce, deep supply chain, and solid safety record. Furthermore, potential new businesses will determine that, with the incentives included in the CLZ, there is nowhere else in the nation or world that is better suited for aerospace activity success.

C.2 FLORIDA'S EXISTING SPACEPORTS

Florida's existing spaceports are located entirely within the bounds of FDOT District 5 (See Figure 16) and are currently limited to Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS). CCAFS is operated by the US Air Force 45th Space Wing and conducts launch Operations and provides range support for military, civil, and commercial launches. KSC serves as NASA's only launch site for human spaceflight.

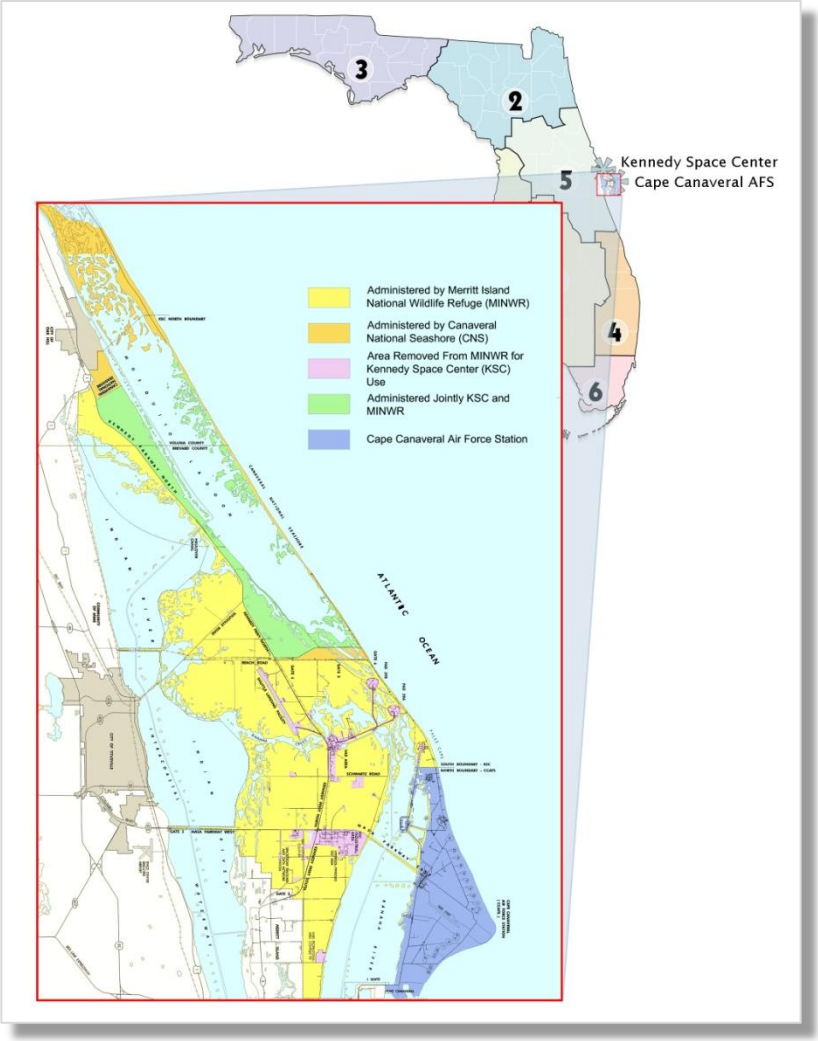


Figure 15: KSC and CCAFS Property Administration Areas

Presently in Florida there are two existing Spaceport; Kennedy Space Center and Cape Canaveral Air Force Station.

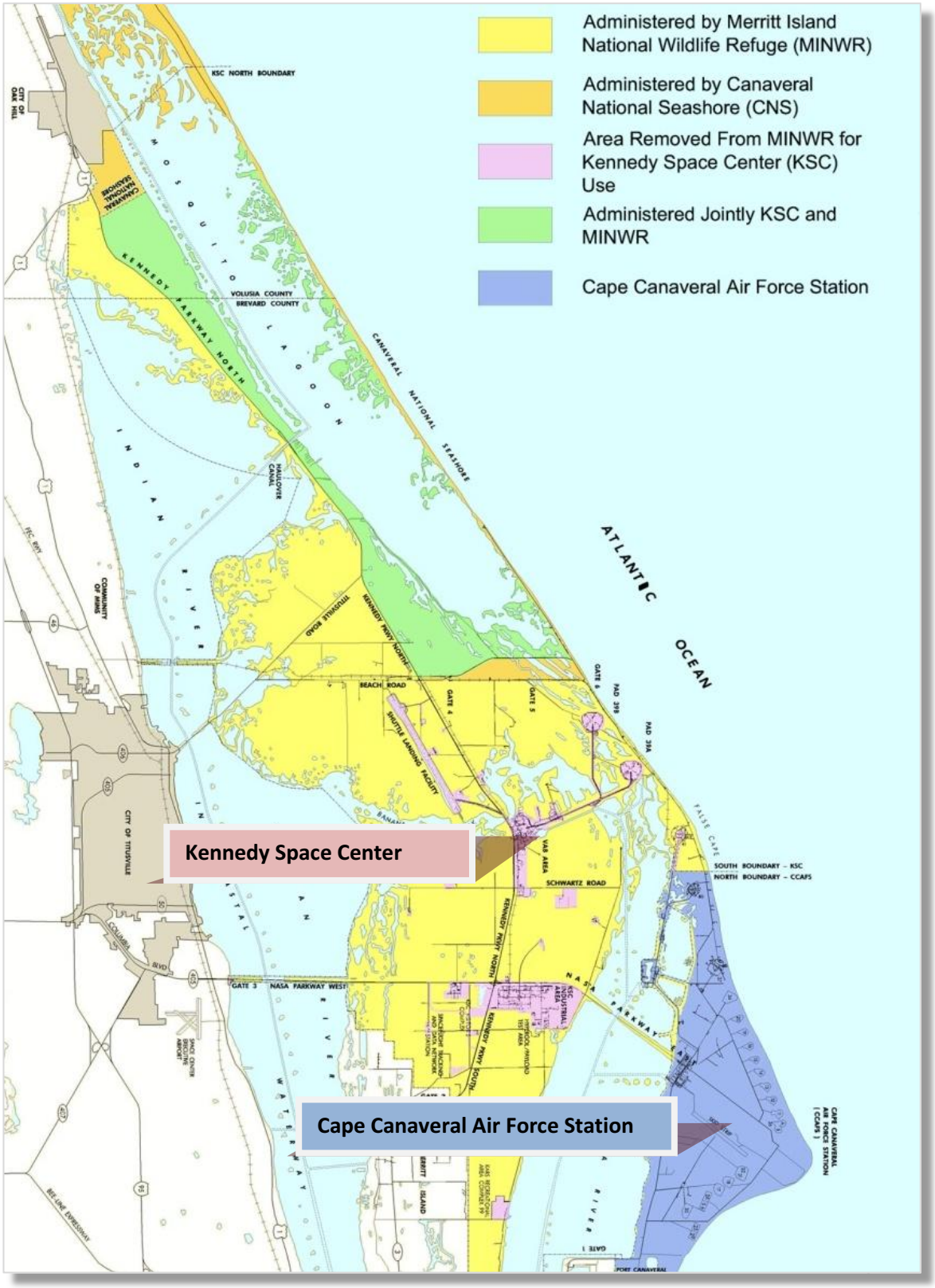


Figure 16: KSC and CCAFS Property Administration Areas

C.3 KENNEDY SPACE CENTER FACILITIES OVERVIEW

Figure 17: Active Launch Complexes at Kennedy Space Center (Ref [48])

For more than 40 years the John F. Kennedy Space Center (KSC), in Florida, has been the home to NASA's launch Complexes in support of their primary mission. Located on Merritt Island, between the Banana and Indian Rivers, the area is approximately 34 miles long and 6 miles at its widest point, covering 219 square miles. Because much of KSC is a restricted area and only nine percent of the land is developed, the site also serves as an important wildlife sanctuary. KSC stretches over 139,490 acres of land and coexists with the Merritt Island National Wildlife Refuge. This environmentally unique Federal property includes: 41,000 acres of Canaveral National Seashore managed by the National Park Service; 1,800 acres of active producing orange groves; and 70,000 acres of estuary designated as a system of national importance by the U.S. Environmental Protection Agency, including 35,000 acres of protected wetlands and 35,000 acres of uplands. KSC is a major tourist destination for visitors to Florida.

On July 29, 1958, President Dwight D. Eisenhower signed Public Law 85-568, creating the National Aeronautics and Space Administration (NASA). In July 1962, the agency established its Launch Operations Center on Florida's east coast [currently CCAFS], The NASA Florida launch operations site was renamed, the John F. Kennedy Space Center (KSC) in late 1963 to honor the president who put America on the path to the moon. CCAFS and KSC have served as the departure gate for every American

manned mission and hundreds of advanced scientific spacecraft. From the early days of Project Mercury (CCAFS), Gemini (CCAFS), Apollo(CCAFS & KSC), Skylab to the space shuttle and International Space Station, from the Hubble Space Telescope to the Mars Exploration Rovers, the launch center enjoys a rich heritage in its vital role as NASA's processing and launch center (Ref [38]).

NASA is operating the Shuttle Program and sections of the Constellation Program in parallel at KSC. LC-39B is in the process of being redesigned for the Ares I rocket. LC-39A will continue to support Shuttle launches through 2011 and is being renovated to support the Ares V rocket. All KSC's vertical launch operations are at Launch Complex (LC) 39, Pads A & B (See Figure 18). All other launch operations currently take place at Cape Canaveral Air Force Station (CCAFS).

Today, there are a total of **823** facilities at the Kennedy Space Center. Of those, 442 facilities are currently involved in the shuttle program. Only a small portion of these facilities are assessed here.

Some of the NASA/KSC supporting infrastructure includes the Vehicle Assembly Building (VAB), three Orbiter Processing Facilities (OPFs), the Orion Processing Facility (located in the Operations & Checkout Building), the Launch Control Center (LCC) and a host of ancillary support facilities. At this time, the VAB and launch pads are reserved for other uses and are not available (Ref [9]). Space Florida holds land use agreements with NASA/KSC and also owns and manages the Space Life Science Lab (SLSL) and the Reusable Launch Vehicle (RLV) Hanger at KSC.

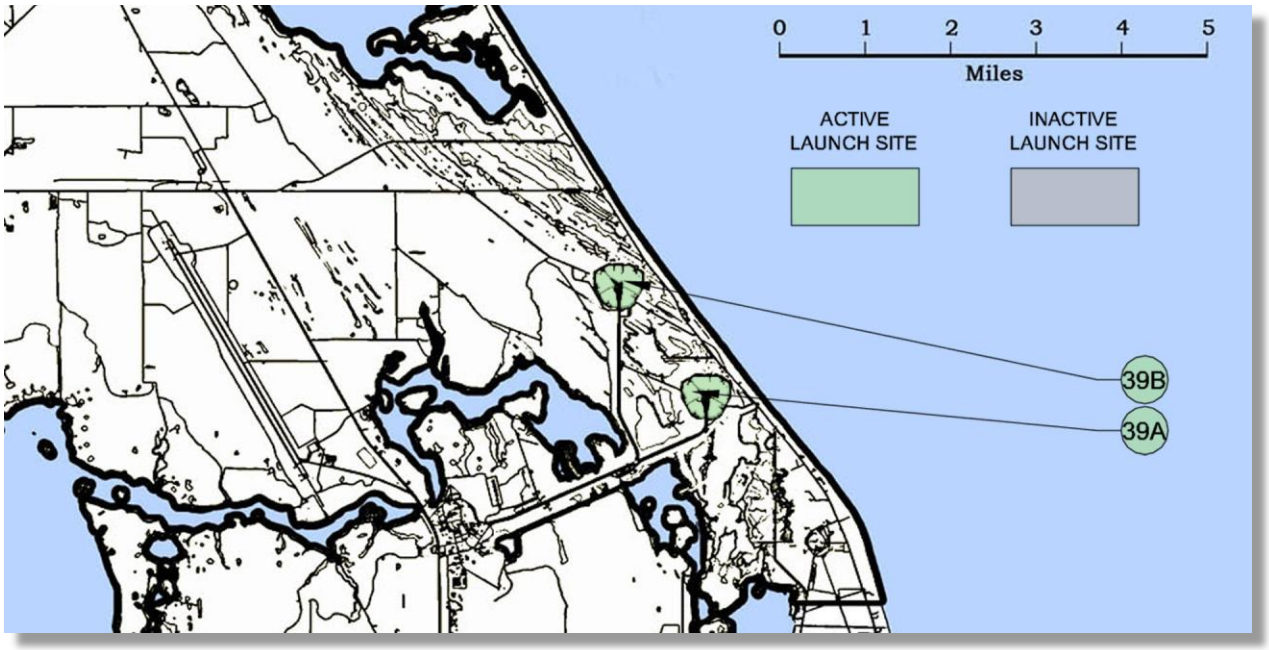


Figure 18: Active Launch Complexes at Kennedy Space Center

The KSC industrial area is where both the Kennedy Space Center's administrative headquarters building is located along with a variety of other facilities, including the Operations and Checkout (O&C) building for processing horizontal payloads and the Space Station Processing Facility (SSPF) for International Space Station (ISS) modules. Numerous payload processing, storage, testing, assembly, and other support facilities are located here and around Merritt Island.

To help promote space education Space Florida conducts student balloon releases annually from the Space Education Center, at the KSC Visitor Center campus. Space Florida will continue to coordinate with NASA/KSC to determine if any excess facilities may become available for commercial use.

C.3.a DISCUSSION OF SELECTED KSC FACILITIES

The following inventory and facilities assessments are a small snapshot of the over 800 facilities located at Kennedy Space Center. The facilities selected here for assessment are based on their significance and impact on space transportation in Florida.

Table 2: Assessed Facilities at Kennedy Space Center

	Spaceport Related Infrastructure (Assessed)
1	Launch Complexes 39 A & B
2	Launch Control Center (LCC)
3	Multi Payload Processing Facility (MPPF)
4	Operations and Checkout (O&C) Facility
5	Orbiter Processing Facility (OPF)
6	Payload Hazardous Servicing Facility (PHSF)
7	Reusable Launch Vehicle (RLV) Hanger at the SLF
8	Rotation Processing and Surge Facility (RPSF)
9	Shuttle Landing Facility (SLF)
10	Space Life Sciences Lab (SLSL)
11	Space Station Processing Facility (SSPF)
12	Vehicle Assembly Building (VAB)

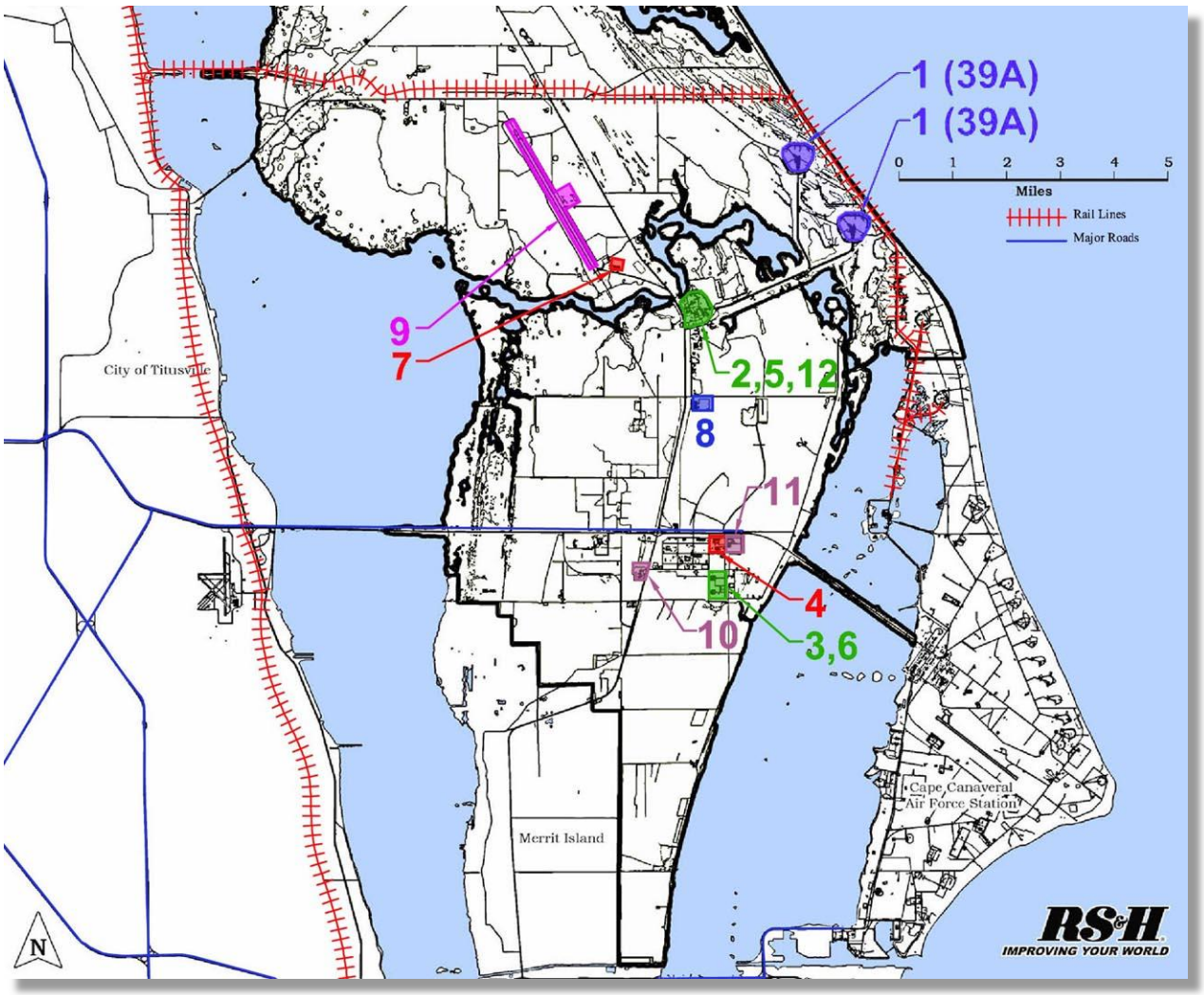


Figure 19: Assessed Facilities at Kennedy Space Center

C.3.b LAUNCH COMPLEXES 39A & 39B

Launch Complex 39 (LC-39) has served America's most significant manned Space flight endeavors, Apollo, Skylab, and the Space Shuttle Program. Modification of pads 39A & 39B began in July 1975 to support Space Shuttle program. The pads were designed for mobile launch operations where the space vehicle is checked and assembled in the protected environment of the Orbiter Processing Facilities (OPFs) and the Vehicle Assembly Building (VAB) and then transported by large track crawlers to the launch pad for final processing and launch.

NASA is currently operating the Space Shuttle Program from Pad-39A. The shuttle is assembled in the VAB and brought to the Pad atop a Mobile Launcher Platform (MLP) and crawler-transporter. Several MLP systems interface with Pad systems including water, propellants, helium, nitrogen, electrical,

communications, and vehicle data. A fixed and a rotating service structure, with an orbiter access arm, emergency egress system, a large flame trench-deflector, and associated tanks and equipment surround the pad. LC-39A will remain in service for the remaining of the Space Shuttle missions; the 134th and final shuttle flight launch target date is currently scheduled for September 16, 2010. LC-39B is currently being redesigned to support the Ares I launch vehicle that will carry the Orion Crew Exploration Vehicle that sits on top. Following the end of the Space Shuttle Program, LC-39A will be modified to support the Ares V, which is a heavy lift cargo launch vehicle required to take astronauts back to the moon.

Launch Complex 39B has three new 600ft tall lightning protection towers and several other modifications to support the Ares I-X test flight. It will undergo additional modifications in support of the Constellation Program.

Figure 20: Ares I-X on Pad 39B with Space Shuttle Atlantis on Pad 39A in the background

The Ares I-X was successfully launched on October 28, 2009 from LC-39B.

C.3.c LAUNCH CONTROL CENTER (LCC)

The Launch Control Center (LCC) is a four-story building that is the electronic "brain" of Launch Complex 39. The LCC is attached to the southeast corner of the Vehicle Assembly Building and is about 3.5 miles from Pad 39A.

Figure 21: Launch Control Center at KSC with New Hurricane-Rated Windows

The first floor contains offices and computer operations. The second floor houses telemetry, RF and tracking, instrumentation, and data reduction and evaluation equipment. The Central Data Subsystem (CDS) computers, one of the two major components of the Launch Processing System (LPS) that automatically performs most checkout and launch functions, is also located on the second floor. The third floor contains the four firing rooms, and each room contains its own copy of the second major component of the Launch Processing System - the Checkout, Control and Monitor Subsystem (CCMS). The fourth floor of the LCC contains conference rooms, offices and mechanical equipment. The LCC is 23.5 meters (77ft) high, 115.2 meters (378ft) long and 55.1 meters (181 ft) wide. Recently the windows and louvers were replaced with new hurricane rated windows.

In 2006, Firing Room Number 1 was renamed the Young-Crippen Firing room. This firing room has been modified to support the Ares I-X mission and will serve as the firing room for future Ares I test and operational launches (Ref [80]).

Modifications to the LCC have begun to support the Ares I program, including the initial support for Ares I-X that recently launched.

C.3.d MULTI PAYLOAD PROCESSING FACILITY (MPPF)

The Multi-Payload Processing Facility (MPPF) is located south of the Operations and Checkout (O&C) building in the KSC industrial area. The MPPF complex, which was constructed in 1994, consists of the MPPF building and the Multi-Operations Support Building (MOSB). The MPPF building contains a highbay, a lowbay, and an equipment airlock, while the MOSB contains offices, and payload control rooms. The MPPF was used in the processing of non-hazardous payloads and was identified as a possible processing location for EELV's, however current NASA plans identify the MPPF for future use with the Constellation Program.

Figure 22: Looking Northwest at MPPF

The MPPF contains the following assets:

- Class 300,000 Airlock
  - 28' L x 39' W x 20' H Processing Space
  - 20' x 15' Door
- Class 100,000 Highbay
  - 135' L x 60' W x 62' H Processing Space
  - 28' x 42' Door
  - 20 Ton Bridge Crane (50' Max Hook Height)
- Capability to process the following number of payloads at one time
  - 4 Small
  - 2 Medium
  - 1 Large

The MPPF is no longer available to support EELV missions and is designated for use with the Constellation Program.

C.3.e OPERATIONS & CHECKOUT (O&C) BUILDING

The Operations and Checkout (O&C) Building is located in the KSC Industrial Area. The O&C building consists of a central high-bay area with a four story laboratory and control area on one side and a single story service area on the other. There is over 60,000 square feet of High-bay area with overhead cranes which are used for processing horizontally integrated payloads. Here payloads are received, assembled, and integrated before they are moved to the Launch complexes. The building has been used for Gemini capsules, Apollo modules, Spacelab, and International Space Station missions. In the 1980's and 1990's, the facility was used to integrate and test all of Spacelab missions. From the 1990's until 2005, the facility had been used to build the S0, P1 and S1 trusses on the International Space Station KSC headquarters building (Ref [77]).

Figure 23: Operations & Checkout (O&C) Building at KSC

The Florida Legislature appropriated $35 million of nonrecurring funds from General Revenue for the 2006-2007 state fiscal budget years. These funds are to be used for infrastructure needs related to the development of the National Aeronautics and Space Administration's (NASA) Crew Exploration Vehicle (CEV). Lockheed Martin Corporation won the NASA competitive contract and is the prime contractor for the Crew Exploration Vehicle, referred to as Project Orion ("Orion"). Space Florida and Lockheed entered into an Economic Development Agreement on December 7, 2006 to establish a new Orion assembly, test and launch facility for the Orion vehicle in the state of Florida (inclusive of federal property reservations) on or before December 31, 2009.

Figure 24: Rendering of Orion Assembly in the O&C

Implementation of the Space Florida contract with Lockheed Martin to modify and upgrade the Operations and Checkout (O&C) Building for Orion Assembly and Checkout is nearing completion. The overall status in all areas continues to be excellent. The completed work data packages for the original 18 work tasks have been delivered to Space Florida. Approximately 20 follow-on work tasks have been identified to complete this contract. These work tasks provide for numerous items which are required to support flight hardware processing that were not included in the original work packages.

Reassignment of the O&C ensures that all future final test and assembly processes of Orion capsule work done is performed in Florida at KSC. This facility provides the opportunity for future work and related operations to migrate to Florida; to shorten the supply chain and reduce costs.

C.3.f ORBITER PROCESSING FACILITIES (OPF)

Figure 25: Looking West at OPF-1&2

Located west (OPF 1&2) and north (OPF 3) of the VAB, the Orbiter Processing Facilities were originally built for horizontal processing of the Space Shuttle Orbiters. In addition to the highbays used for servicing of large flight hardware, the OPFs contain lowbays which house flight hardware storage, GSE storage, processing shops, logistics areas, conference rooms, and offices. Additional conference rooms and offices are provided by the OPF 1&2 Annex. Storage tanks for hypergol deservicing, gaseous oxygen, and gaseous hydrogen are all located south of the dual OPF 1&2 building.

Currently, the Shuttle program uses the OPF high bays for fuel purging, valve verification, TPS repair, payload installation, and nearly all other post- and pre-flight horizontal servicing. The floor of each highbay measures 150' (45.7 m) by 197' (60.0 m), and each highbay is equipped with two (2) 30-ton bridge cranes each with hook heights of 66' (20.1 m). All three high bays are defined as class 300,000 clean work areas. The relative humidity for each highbay is maintained at or below 55% and the temperature is kept between 65°F and 75°F (18.3°C and 23.9°C).

Figure 26: Looking Northeast at OPF-3

Following the end of the Shuttle program, it is anticipated that the OPF's will be used to support the Constellation program.

C.3.g PAYLOAD HAZARDOUS SERVICING FACILITY (PHSF)

The Payload Hazardous Service Facility (PHSF) Building was built in 1987 and is located in the KSC Industrial Area south of the MPPF. The PHSF is a payload processing facility that is capable of hazardous processing operations. The PHSF is designed to accommodate a variety of NASA and NASA customer payloads. The PHSF can support operations such as: ordnance installation, loading of liquid propellants (such as hypergols), hazardous system tests/checkout, propellant leak tests, and other potentially hazardous activities. The PHSF is to be used by NASA/KSC Launch Services Program (LSP) responsible for NASA's missions on Expendable launch vehicles.

Figure 27: Looking Southwest at the PHSF

The PHSF contains the following assets:

- Class 300,000 Airlock
  - 50' L x 85' W x 89' H Processing Space
  - 35' x 75' Door
  - 15 Ton Bridge Crane (75' Max Hook Height)
- Class 100,000 Highbay
  - 60' L x 107' W x 94' H Processing Space
  - 35' x 75' Door
  - Two 50 Ton Bridge Cranes (83' Max Hook Height)
- Capability to process the following number of payloads at one time
  - 3 Small
  - 2 Medium
  - 1 Large

The PHSF is active and capable of supporting NASA EELV missions.

C.3.h REUSABLE LAUNCH VEHICLE HANGER AT THE SLF

Figure 28: Reusable Launch Vehicle Hanger at the Shuttle Landing Facility

The RLV Hangar is a 50,000 square feet (200' x 250') multipurpose facility that was developed in partnership with the NASA Kennedy Space Center. It was originally designed to accommodate NASA's X-33 reusable launch vehicle prototype, for the L-1011 carrier aircraft for the X-34 program, and to serve as a host for RLV development and operations. The facility was developed as part of a broader state of Florida – Kennedy Space Center initiative to expand the capability of the spaceport in order to support government, commercial, and technological research development activities. The hangar has also been used to support a number of other operations and programs, which includes protection of space station flight hardware.

A high-expansion foam fire suppression system and a new Fire Alarm Control Panel were installed in February 2009 to allow for fueled aircraft to be stored in the hangar. One HVAC compressor currently requires replacement. Currently there are no tenant requirements for air conditioning, so all of the HVAC units are shut off.

The hangar is located on the KSC's shuttle landing tow-way facility. It is owned by Space Florida and part of the hangar is leased to Starfighters, a private aerospace company that is storing several de-commissioned U.S. military aircraft (F-104's). Space Florida and Starfighters began initial discussions in 2007 and officially partnered in 2008, when Space Florida reached an agreement for the aerospace

company to house and maintain aircraft in the State-owned and operated Reusable Launch Vehicle (RLV) Hangar, located adjacent to the SLF.

As part of the new agreement, Starfighters will operate its fleet of Lockheed F-104 Starfighters at Kennedy Space Center (KSC). Currently the company has four vehicles in the fleet, but anticipates adding five more in the coming months. The vehicles can simulate suborbital vehicle trajectories and provide both training and technology development for the reusable launch vehicle industry. Starfighters currently has 10 employees scattered across Florida. In the coming months, it will relocate these employees to KSC, and also expects to employ up to 20 additional highly-skilled workers to perform vehicle maintenance and other technical work at its KSC operations. Space Florida and Starfighters are in negotiations to extend the original lease agreement at the RLV Hangar. As part of the alliance, Space Florida may also assist Starfighters in securing additional long-term funding to fully establish their operations and headquarters at KSC.

C.3.i ROTATION PROCESSING AND SURGE FACILITY (RPSF)

The RPSF consists of a primary building for rotating and processing the SRB segments and two secondary surge (storage) buildings. Each surge building is capable of housing 8 segments, enough for a full Shuttle launch.

Figure 29: Rotating Processing and Surge Facility at KSC

It is anticipated that the RPSF will be used to support of NASA's constellation program and may be renovated in the future to support the storage of more segments since each Ares V will require 10 segments instead of the 8 required for the shuttle.

C.3.j SHUTTLE LANDING FACILITY (SLF)

The Shuttle Landing Facility (SLF) serves as the primary landing and recovery site for the space shuttle orbiter. The SLF is 15,000 ft. long and 300 ft. wide with 1,000 ft. of paved overruns at each end. A 2 mile tow-way connects the SLF and the Orbiter Processing Facilities. In addition to the runway, the SLF area houses a Control tower, an Airfield Rescue and Fire facility, support office complex, a convoy equipment shelter, the Landing Aids Control Building (LACB), and a hangar used to support Reusable Launch Vehicles (RLV) which is operated by Space Florida.

NASA and Space Florida are evaluating alternatives to expand the use of the SLF and the related infrastructure. Proposed activities include Horizontal Spaceflight for Governmental and Commercial use, Aviation test programs, Airborne Research and Technology Development, and Ground-based Research and Training activities. NASA has completed a final Environmental Assessment for the SLF expansion program and is working on an Area Development plan for the SLF future use.

Figure 30: Graphic Rendering of Existing Conditions at the SLF [22]

C.3.k SPACE LIFE SCIENCES LABORATORY (SLSL)

The Space Life Sciences Lab (SLSL), previously known as Space Experiment Research and Processing Facility (SERPF), is a 100,000 sq ft facility that serves as the primary gateway for payloads bound for the International Space Station (ISS). Prior to the SLSL being constructed in 2004, NASA used Hangar L at Cape Canaveral Air Force Station to process science payloads. Hangar L was in need of major repairs and was inadequate for International Space Station (ISS) science payload requirements. The state of Florida and NASA partnered to create the Space Life Sciences Lab (SLSL) to meet ISS science payload requirements. After the Columbia accident in 2003, NASA revised its plans for on-orbit research aboard the Space Shuttle and ISS. In fiscal year 2006, NASA's Exploration Initiative significantly reduced funding and projects for the SLSL. At that time, the utilization of the Lab's resources was re-focused on activities associated with exploration to maintain the partnership between the state of Florida and NASA.

Figure 31: Space Life Sciences Lab (Ref [45])

The SLSL is located at Kennedy Space Center on State Road 3 and is owned by the state of Florida. Florida contributed $26.8 million for site development and construction on property obtained through a Land Use Agreement with Kennedy Space Center.

The facility is currently leased to NASA/Dynamac through late 2010. Space Florida is currently negotiating with NASA on a continued partnership structure. SLSL facility personnel are in a high state of activity preparing for upcoming Space Shuttle launches and research which is set to be installed on board both the Shuttle and the ISS. A portion of the research that is in final preparations are the ABRP (Advanced Biological Research Platform) to analyze plant growth in space on the ISS, the Apex Cambrian plant experiment to analyze outer bands of tree/wood formation, and the Tagus experiment to analyze plants growth stress. Near-term additional experiments planned at the Lab include:

- Analyze radiation impact on plants and trees
- Trace contaminates and remove them from water
- Support innovative bone density and Alzheimer's research

The SLSL is a world-class facility for Life Sciences Research with 28 labs supporting cutting-edge life sciences space research containing 15 controlled environmental chambers and 15,000 sq ft of certified Animal Care Facility with a 100K-Class clean room. The facility houses over 30 NASA employees and 85 contractors that support the International Space Station (ISS) and Space Life Science Research. It also houses 15 State university employees and 10 commercial research employees, providing valuable research to industry and State university systems.

C.3.1 SPACE STATION PROCESSING FACILITY (SSPF)

The Space Station Processing Facility (SSPF) is located in the KSC industrial area just east of the Operations and Checkout Building. Construction for the SSPF was completed in 1994 and the facility was designed specifically to support the International Space Station (ISS) flight hardware. Class 100,000 clean work areas are available in the two processing areas, airlock and laboratories. These areas were designed to support non-hazardous ISS and shuttle payloads. In addition to the areas previously mentioned, there are also control rooms, logistics areas, office space, and a cafeteria inside this 457,000 square foot three-story building.

Figure 32: Looking Southeast at SSPF

The SSPF contains the following assets:

- Class 100,000 Airlock
  - 108' L x 46' W x 61' H Processing Space
  - 51' x 41' Door
  - 5 Ton and 15 Ton Bridge Crane (45' Max Hook Height)
- Class 100,000 Highbay
  - 363' L x 79' W x 61'-6" H Processing Space
  - 50' x 41' Door
- Two 30 Ton Bridge Cranes (50' Max Hook Height)

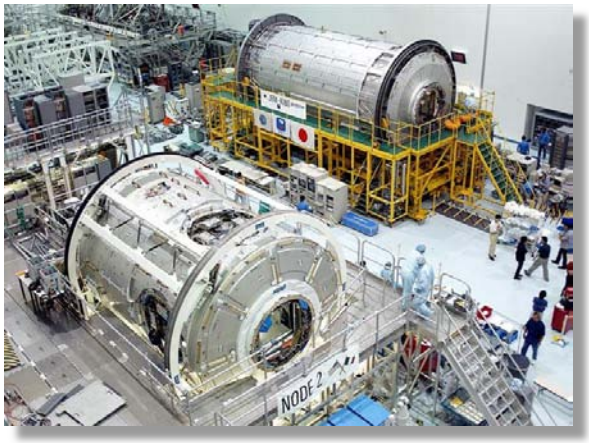


Figure 33: Processing of Space Station Modules

Future NASA plans for the SSPF are unknown.

C.3.m VEHICLE ASSEMBLY BUILDING (VAB)

The Vehicle Assembly building was constructed in the 1960s to support the Apollo program and was sized to fit the Saturn V launch vehicle and Mobile Launcher (ML) with Launch Umbilical Tower (LUT). The VAB is 525 ft tall and has four high bays, each sized for processing a single Saturn V launch vehicle.

Figure 34: Construction of the Vehicle Assembly Building at KSC in 1965 (Ref [78])

Highbay's 2 & 4 were modified to support storage of the shuttles external tanks and have provided temporary storage for orbiters on occasion. Recently, one the shuttle highbays has been modified to support the Ares I-X mission. In recent years several major renovations and modifications were made to the VAB. The VAB High Bay Roof Replacement project at elevation 527' above grade was completed in 2007. The VAB Low Bay Roof Replacement which included replacement of 9 different roofs was completed in 2008. The VAB Siding project which upgraded the VAB siding for the entire building to withstand hurricane wind loading is a 3-1/2 year long construction project that will be completed by the end of 2009. Refurbishments to the VAB's very large doors are nearing completion with the east high bay doors and North Transfer Aisle doors completed between 2005 and 2007.

Figure 35: Vehicle Assembly Building at KSC

Following the end of the Shuttle program additional modifications to the VAB will be completed to support the Constellation program.

C.4 CAPE CANAVERAL AIR FORCE STATION FACILITIES OVERVIEW

Figure 36: Historical Photo of Cape Canaveral Air Force Station in 1964 (Ref [48])

The Cape Canaveral Air Force Station (CCAFS) is an installation of the Air Force Space Command's 45th Space Wing (45 SW), headquartered at nearby Patrick Air Force Base. Located on Cape Canaveral, CCAFS is the primary Launch Head of the Eastern Range. The Eastern Range has been operational since 1954. At that time the host agency was the Eastern Space & Missile Center (ESMC). In 1991, the ESMC was transformed into an operational wing of the Air Force thereby activating the 45th Space Wing. The launch squadrons' roles under the 45th Space Wing continued the traditions developed from the 1960s through the 1980s. Some of the launch vehicles that have operated from CCAFS include: Athena I/II, Atlas I/II/III/V, Delta II/IV, Pegasus, Poseidon, Saturn IB, Titan 34D, Titan IV, and Trident. The current launch vehicles in use include the Delta II (soon to be retired), Delta IV, and Atlas V (Ref [39]).

CCAFS conducts launch operations and provides range support for military, civil, and commercial launches. Existing infrastructure includes telemetry and tracking facilities, jet and Shuttle capable runways, special vehicle reentry corridors, operations control center, movable hangar, fuel tanks, water towers, and launch pads. CCAFS currently supports 4 active orbital Space Launch Complexes (with others reserved for future use and the Skid Strip capable of supporting the horizontal launch of a Pegasus rocket) and more than 25 inactive or dismantled launch complexes. The AFS Skid Strip is an airfield with a 10,000 foot runway for military airlift aircraft delivering heavy and outsized satellite payloads to the Cape.

Presently at CCAFS only launch complexes SLC-17, SLC-37, SLC-40, and SLC-41 are active and capable of immediately supporting orbital space launch missions. SLC-46 is active and capable of support Trident ground testing for the US Navy, and SLC-47 is licensed to support suborbital sounding rockets. In 2007, Space Florida assisted SpaceX in obtaining their 45 SW real property license for SLC-40 to launch their Falcon 9 launch vehicle with its first mission scheduled for 2010. Space Florida is also providing funding for SpaceX's Horizontal Launch Facility at SLC-40.

Table 3: CCAFS Launch Complex and Associated Launch Vehicle Summary

Space Launch Complex (SLC)	Status of SLC	Associated Launch Vehicles	Status	First Launch Date	Last Launch Date
17 A&B	17A (Inactive)	Thor	Retired	January 25, 1957	November 5, 1975
	17B (Active)	Delta	Retired	May 13, 1960	June 12, 1990
		Delta II	**Active**	February 14, 1989	Active
		Delta III	Retired	August 27, 1998	August 23, 2000
36 A&B	Inactive*	Atlas	Retired	May 18, 1962	April 25, 1997
		Atlas II	Retired	December 7, 1991	August 31, 2004
		Atlas III	Retired	May 24, 2000	February 3, 2005
37	**Active**	Saturn I	Retired	October 27, 1961	July 30, 1965
		Saturn IB	Retired	February 26, 1966	July 15, 1975
		Delta IV	**Active**	November 20, 2002	Active
40	**Active**	Titan III	Retired	9/1/1964	5/6/1965
		Titan 34D	Retired	10/30/1982	9/4/1989
		Titan IV	Retired	2/7/1994	10/19/2005
		Falcon 9	In Development	N/A	N/A
41	**Active**	Titan III	Retired	6/18/1965	9/5/1977
		Titan IV	Retired	6/14/1989	4/9/1999
		Atlas V	**Active**	8/21/2002	Active
46	**Active Navy****	Athena I/II	Retired	8/1/1995	9/30/2001
		Trident II	Standby	1/15/1997	1/27/1999
47	**Active**	Super Loki	**Active**	--	Active

* Space Florida intends to obtain/renew licenses from FAA/AST for both SLC-36 & SLC-46
** SLC-46 is still active for Trident ground testing for the Navy

To operate a launch or reentry site in the U.S. or U.S. territories for non-federal use, it is necessary to obtain a license through the FAA/AST. Table 3 is a summary of launch complexes and associated launch vehicles launched at CCAFS from launch complexes that are either currently in use or proposed for near-term use. Figure 38 and Figure 39 provide a graphical summary of the active and inactive launch complexes at CCAFS.

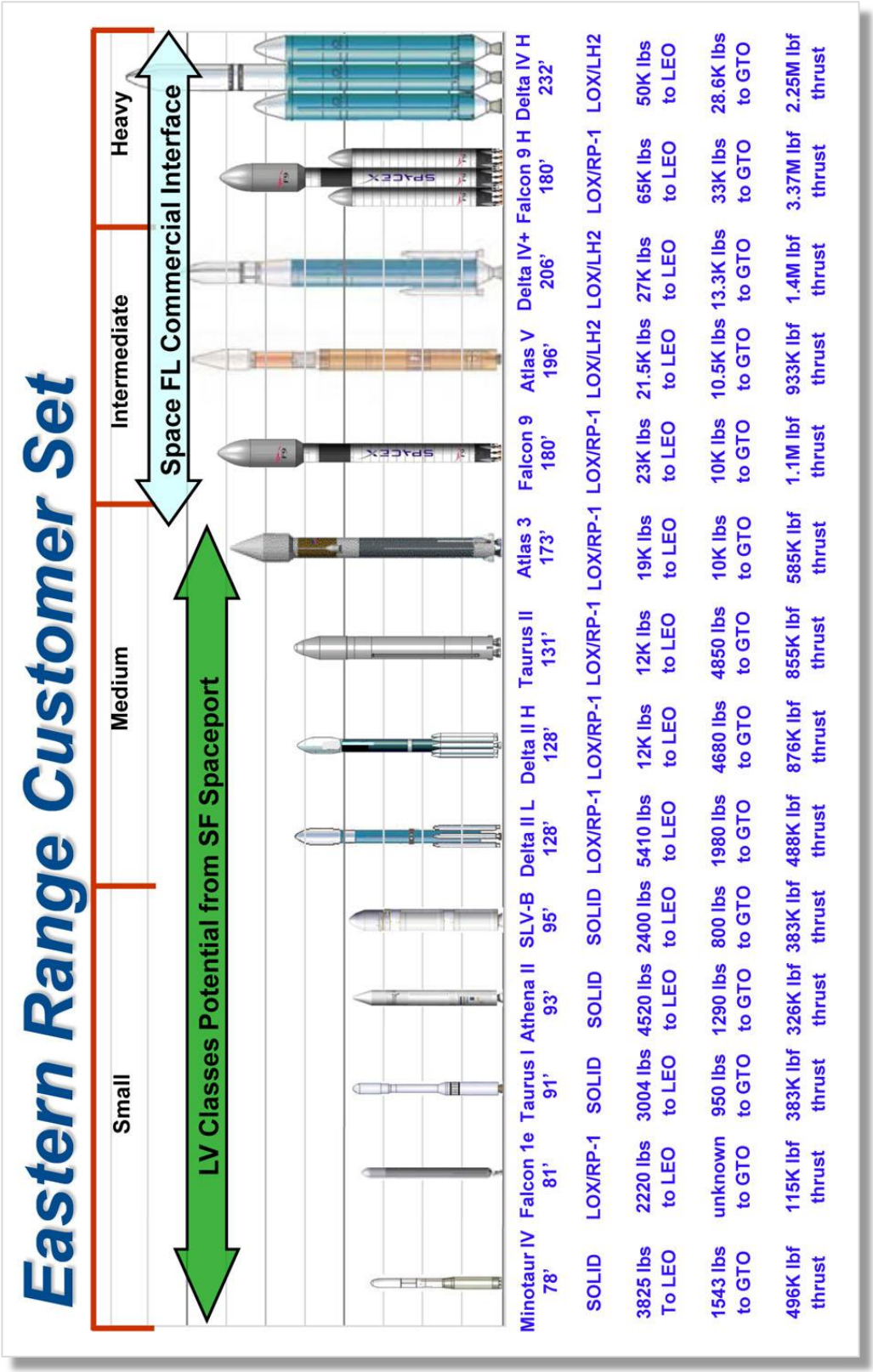


Figure 37: Eastern Range Customer Set Summary

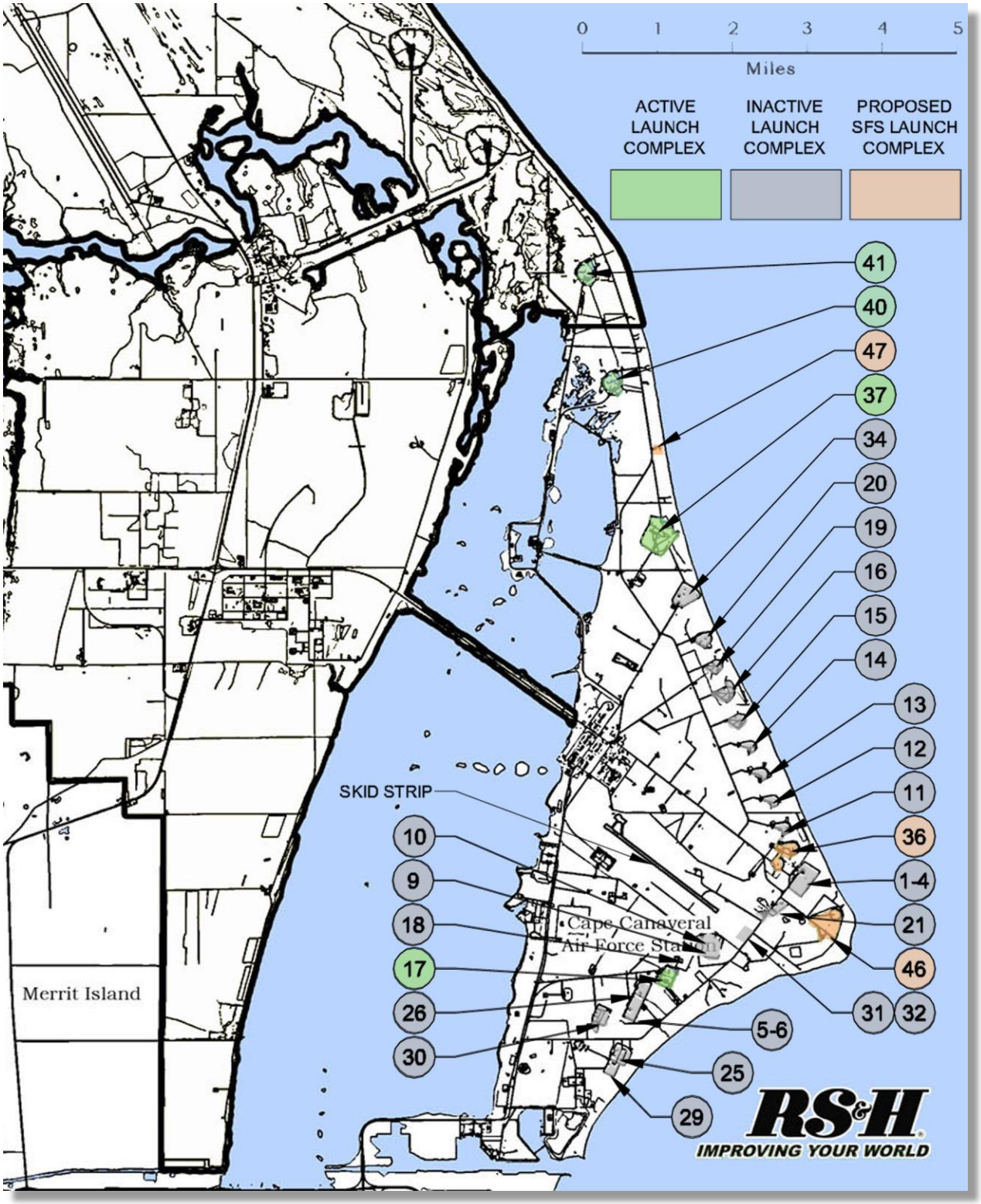


Figure 38: CCAFS Launch Complex Status Map - 2009

Active Launch Complexes

SLC 41
Status Active
User ULA EELV
Vehicle Atlas V
MC Intermediate
SLC Acreage 40.1

SLC 40
Status Active
User SpaceX
Vehicle Falcon 9
MC Intermediate/ Heavy
SLC Acreage 37.6
Other: SLC 40 is currently being refurbished for the Falcon 9 series of vehicles

SLC 37
Status Active
User ULA EELV
Vehicle Delta IV
MC Heavy, Intermediate
SLC Acreage 111.6

Skid Strip
Status Active
User USAF, Commercial
Vehicle Pegasus XL
MC Small
Orientation 31/13
Length 10,000 ft.
Width 300 ft.
Surface Asphalt

SLC 36
Status FAA/AST License Pending
User USAF, Space Florida
Vehicle TBD
MC Intermediate
SLC Acreage 47.5
Other: Space Florida plans to convert this into a vertical launch complex capable of supporting customer launch vehicle configurations

MC = Mass Class
SLC = Space Launch Complex

SLC 17 A&B
Status Active
User USAF, Boeing
Vehicle Delta II & III
MC Medium
SLC Acreage 38.6

SLC 46
Status Active Navy (FAA/AST License Pending)
User Space Florida, Navy
Vehicle Trident, Athena, others
MC Small
SLC Acreage 79.9

SLC 47
Status Active
User USAF, Space Florida
Vehicle Loki, Super Loki
MC Small
SLC Acreage 4.0

Inactive Launch Complexes

SLC 1, 2, 3, 4
Status Dismantled
Reuse Potential Unsafe
In Airfield Clear Zone

SLC 5, 6, 26
User USAF Space Museum
Status Inactive
Reuse Potential None
In museum area and Historic Landmark

SLC 9, 10, 31, 32
Status Dismantled
Reuse Potential Unsafe
In Airfield Clear Zone

SLC 11
Status Dismantled
Unemcumbered - machine shop in use

SLC 13
Status Dismantled
Unemcumbered

SLC 14
Status Dismantled
Mercury 7 historic landmark & blast buffer

SLC 15
Status Dismantled
Unemcumbered - Audiovidual lab in use

SLC 16
Status Dismantled
Unemcumbered

SLC 18
Status Dismantled
Reuse Potential Unsafe
In Airfield Clear Zone

SLC 19
Status Dismantled
Gemini historic landmark & blast buffer

SLC 20
Status Dismantled
Reuse Potential Unknown
Unemcumbered

SLC 21, 22
Status Dismantled
Reuse Potential Unsafe
In Airfield Clear Zone

SLC 25, 29
User USAF disaster ctrl. center
Status Dismantled
Reuse Potential Unsafe
Too close to civilian population

SLC 30
User USAF fire training center
Status Dismantled
Reuse Potential Unsafe
Too close to civilian population

SLC 34
Status Dismantled
Apollo Historic Landmark

Figure 39: CCAFS Launch Complex Status Table – 2009

C.4.a SPACE LAUNCH COMPLEX 17 (SLC-17)

Space Launch Complex 17 (SLC-17) consists of two ELV (Expendable Launch Vehicle) launch pads (A&B). Since 1989, SLC-17 has supported over 100 Delta II launches. The Delta II program is currently operated by NASA and United Launch Alliance to launch Delta II rockets for NASA missions. As of August 2009 Pad A has been deactivated only Pad B is active. The Delta II program operated at SLC-17 is expected to continue through 2012.

Figure 40: Delta II on SLC-17B at CCAFS

SLC-17 will be deactivated following the last Delta II mission in 2012.

C.4.b SPACE LAUNCH COMPLEX 36 (SLC-36)

Space Launch Complex 36 (SLC-36) at Cape Canaveral Air Force Station has a long and interesting history. SLC-36A & B were built under the sponsorship of NASA in support of the Atlas/Centaur program in 1961 and 1963 respectively. NASA surrendered the site to the Air Force and General Dynamics in 1989, at which time it was modified to support the Altas II/Centaur commercial program. The first Atlas II launch was from 36B on December 7, 1991. In the late 1990's pad 36B was once again modified to support the Atlas III vehicle. Its first launch occurred on May 24, 2000. The final Atlas III launch from CCAFS occurred on February 3, 2005 from Pad 36B. In total, SLC-36 has launched a combined total of 145 rocket launches from its two pads.

In June 2007, both Mobile Service Towers on SLC-36 were toppled as part of their overall site demolition. Since then most structures at both pads A and B have been removed, including the perimeter fence. Following the recent demolition of all launch facilities at SLC-36, the only remaining structures include the Blockhouse and Annex (Building #5501) and Support Building (#5550) as identified

in Figure 41. Underground utilities, including electrical power, communication lines, sewer, and potable water are still provided to the site. In 2009 an Environmental Baseline Study (EBS) was completed and approved for SLC-36.

Figure 41: View of SLC-36 in Present Configuration (Modified Satellite Photo)

The existing blockhouse at SLC-36, shown in Figure 42, consists of a reinforced concrete, two story structure that is 150' in diameter. The blockhouse was originally built as a launch control center. Since new range safety evaluations, the blockhouse can no longer be occupied during a launch.

Figure 42: SLC-36 Blockhouse & Annex Building

The envelope of the blockhouse is in good condition however some rooms of the building suffered damage during demolition activities. Many power and data transmission lines from the CCAFS have terminations in the blockhouse. The termination points to CCAFS infrastructure are vital for the proposed launch complex. The existing Block House Annex building is in moderately good condition although it requires some renovations. The envelope of the building is in good condition however some rooms of the building suffered damage during demolition activities.

Figure 43: SLC-36 Support Building (Building #5550)

SLC-36 is reserved for future use as a commercial Spaceport. In 2008, Space Florida received from the U.S. Air Force a "Right of Entry" to SLC-36, similar to a lease, and is seeking a Site Operator's License from the FAA. Space Florida envisions developing SLC-36 into a commercial launch complex for private companies using liquid-fuel rockets. Space Florida obtained approval from the FAA/AST office to consolidate the launch site operator license request for SLC-36 into the SLC-46 request which is already underway. SLC-36 will be re-built as a liquid propellant vertical launch complex capable of supporting specific launch vehicle configurations ranging from low lift to medium lift into low-earth orbit and beyond per customer requirements. The envelope of the Support Building, shown in Figure 43, is in excellent condition and the interior is open and clean. This building is an ideal place for SLC-36 on-site office space and can be utilized with minimal renovation.

SLC-36 is currently inactive and planned for inclusion in the Space Florida Spaceport.

C.4.c SPACE LAUNCH COMPLEX 37 (SLC-37)

Space Launch Complex 37 (SLC-37) is operated by United Space Alliance to launch Boeing's Delta IV EELV (Evolved Expendable Launch Vehicles). SLC-37 previously supported NASA's Saturn I program in the 1960's. The pad was modified recently to support the Delta IV program including the addition of a 330 ft Mobile Service Tower (MST), two large lightning protection towers, and a fixed pad erector. A Horizontal Integration Facility (HIF), located outside SLC-37 about 3,300 ft from the launch pad is used to process the Delta IV's Common Booster Cores. The HIF contains 3 processing bays measuring 250 ft by 100 ft each that can collectively of hold up to 9 boosters at a time.

Figure 44: Delta IV on SLC-37 at CCAFS

Figure 45: Delta IV HIF at CCAFS

SLC-37 is currently active and supports the Delta IV launch vehicle program.

C.4.d SPACE LAUNCH COMPLEX 40 (SLC-40)

SLC-40 is being refurbished to support the launch of SpaceX Falcon Rocket. Space Exploration Technologies (SpaceX) is a Commercial Space Transport Company. The Launch complex is licensed by the Air Force to SpaceX to launch Falcon 9 series of rockets. These rockets will be the launch vehicles for the Dragon spacecraft, a reusable automated cargo vehicle which is being developed by SpaceX to transport cargo to and from the International Space Station. The Air Force has granted SpaceX a non-exclusive license to operate SLC-40 with the Falcon 9 inaugural launch targeted for 2010.

Figure 46: Falcon 9 on SLC-40 at CCAFS

SpaceX has modified SLC-40 to support their Falcon 9 launch vehicle. Major modifications are nearing completion and the launch complex should be active soon.

C.4.e SPACE LAUNCH COMPLEX 41 (SLC-41)

Space Launch Complex 41 (SLC-41) was originally developed to support the Titan III program in the 1960's. Following the last Titan launch in 1999, the launch site was renovated by Lockheed Martin to support their Atlas V EELV. The first Atlas V to launch from SLC-41 was on August 21, 2002. Major modifications to SLC-41 in support of the Atlas V program were the removal of the Titan Mobile Service Tower, Umbilical Tower and modifications to all pad and launch vehicle services. A 300 ft tall Vertical Integration Facility is located about 1,800 ft from the pad and can integrate one Atlas V at a time on top of a mobile launch platform that transfers the launch vehicle to the pad along rails.

Figure 47: Looking Southwest at SLC-41 and VIF at CCAFS

SLC-41 is currently active and supports the Atlas V launch vehicle program.

C.4.f SPACE LAUNCH COMPLEX 46 (SLC-46)

The SLC-46 site was established in 1954 as a fire-fighter training area and utilized for this purpose until 1965. SLC-43, located adjacent to SLC-46's current location, was used for meteorological rocket launches from 1962 through 1985. When operations on SLC-43 ceased in 1985, it was demolished in preparation for construction of SLC-46. In 1984, SLC-46 was redesigned to support the US Navy's Trident II ballistic missile efforts at CCAFS. The first Trident II missile was launched from SLC-46 in 1987. Subsequently eighteen more Trident II's were launched between March 1987 and January 1989 before Trident II launch operations were moved out to sea in late 1989.

Figure 48: Aerial View of SLC-46 from July 2008

Since 1999 SLC-46 has not been utilized for commercial space activities and minimal maintenance has been completed on the structure. In 2004 the MAS received some minor damage as a result of Hurricane Frances. By November 2007, Space Florida had completed numerous repairs and maintenance procedures including corrosion mitigation, cleaning, hardware and pneumatics testing, and exercising the movable platforms.

Presently the MAS is in a "safed" configuration and must be renovated before it can be used for future commercial space activities. The primary structural steel is in very good condition; the mechanical systems on the tower need some upgrades or possible replacement. The roads are in good condition and the area is fenced with security gates.

Figure 49: SLC-46 Mobile Access Structure

Many of the previous agreements and licenses for using SLC-46 have expired. The previous FAA/AST Launch Site Operator's License expired on May 22, 2007. The Memorandum of Agreement (MOA) with USN/NOTU and the Real Property License with USAF have also expired. Space Florida is presently pursuing a renewal of the license with the 45th Space Wing and the agreement with the Naval Ordnance Test Unit. Space Florida is also in the process of renewing its FAA Launch Site Operators License.

The current capabilities of SLC-46 provide for the support of solid-fueled launch vehicles with a maximum height of 120 feet and payloads up 10 feet (3m) in diameter. The Navy maintains capability to resume Trident II missile testing if required. SLC-46 is planned to be included in the Space Florida Spaceport.

C.4.g SPACE LAUNCH COMPLEX 47 (SLC-47)

Space Launch Complex 47 (SLC-47), shown in Figure 50, is located at Cape Canaveral Air Force Station along Samuel C. Phillips Parkway, south of SLC-40 and north of SLC-37. In 1984, the site was developed and SLC-47 constructed.

Figure 50: SLC-47 at CCAFS

Space Florida currently has a Real Property License from the 45th Space Wing in order to operate and maintain SLC-47. Space Florida has partnered with the 45th Space Wing, FAA/AST, Florida Space Institute (FSI), University of Central Florida (UCF), and Brevard Community College (BCC) to provide a launch site that is capable of launching Loki and Super Loki suborbital rockets to altitudes exceeding 200,000 ft. As part of its role in enabling the continuation of small rocket launches for research and education, Space Florida acts as liaison between the 45th Space Wing and potential customers to support planned and future launches from SLC-47. In September 2008, Space Florida hosted a successful Super Loki launch from SLC-47. A rocket motor test stand developed by Florida Technical University under a Space Florida contract awarded in 2006 can potentially be used at SLC-47.

SLC-46 is a suborbital rocket launch complex that is planned to be included in the Space Florida Spaceport.

C.4.h THE SKID STRIP

The Skid Strip is a 10,000 foot long x 200 foot wide paved runway. It is primarily used by the USAF by large military transport aircraft delivering satellite payloads and other specialized space related shipments. Launches from the Skid Strip via carrier aircraft have been conducted for Pegasus launch vehicles. This facility is well suited to support horizontal launch vehicles, horizontal recovery landings, vertical powered recovery landings, and parachute recovery landings with minimal modifications. Orbital Sciences Corporations has launched five (5) Pegasus missions from Florida, one from the Shuttle Landing Facility and four from the Skid Strip at CCAFS. The first mission was February 9, 1993 and used a B-52 from the SLF. Since then four other Pegasus missions were launched from the skid strip (October 22, 1998, October 9, 2000, February 5, 2002, and January 25, 2003), all of which were from a modified L-1011 carrier aircraft.

Figure 51: Pegasus from Skid Strip (Ref [81])

Even though there are no current Pegasus missions planned from Florida, the Skid Strip maintains the capability to support them.

C.4.i SPACE OPERATIONS CONTROL CENTER (SOCC)

The Space Operations Control Center is located at the Space Florida CCAFS South Gate Campus at 100 Spaceport Way, Cape Canaveral, FL 32920 just outside the south security gate to Cape Canaveral Air Force Station. The SOCC is currently occupied by Space X and is being operated as a Launch Control Center for their SLC-40 Falcon 9 operations. A new polyurethane foam roof was applied in 2008. The building is carpeted throughout and the renovated interior is in excellent condition.

Figure 52: SOCC at Space Florida's CCAFS South Gate Campus

C.5 FLORIDA'S PROPOSED SPACEPORTS

Launch and reentry sites, are the nations gateways to and from space. Although individual capabilities vary, these facilities may house launch pads and runways as well as the infrastructure, equipment, and commodities needed to process and prepare launch vehicles and their payloads for launch. Since 1996, the FAA has licensed the operations of seven launch or reentry sites, some of which are co-located with existing federal facilities. These spaceports serve both commercial and government launch operators (Ref [16]). There are two proposed Non-Federal Spaceports in the state of Florida; Space Florida Spaceport and Cecil Field Spaceport.

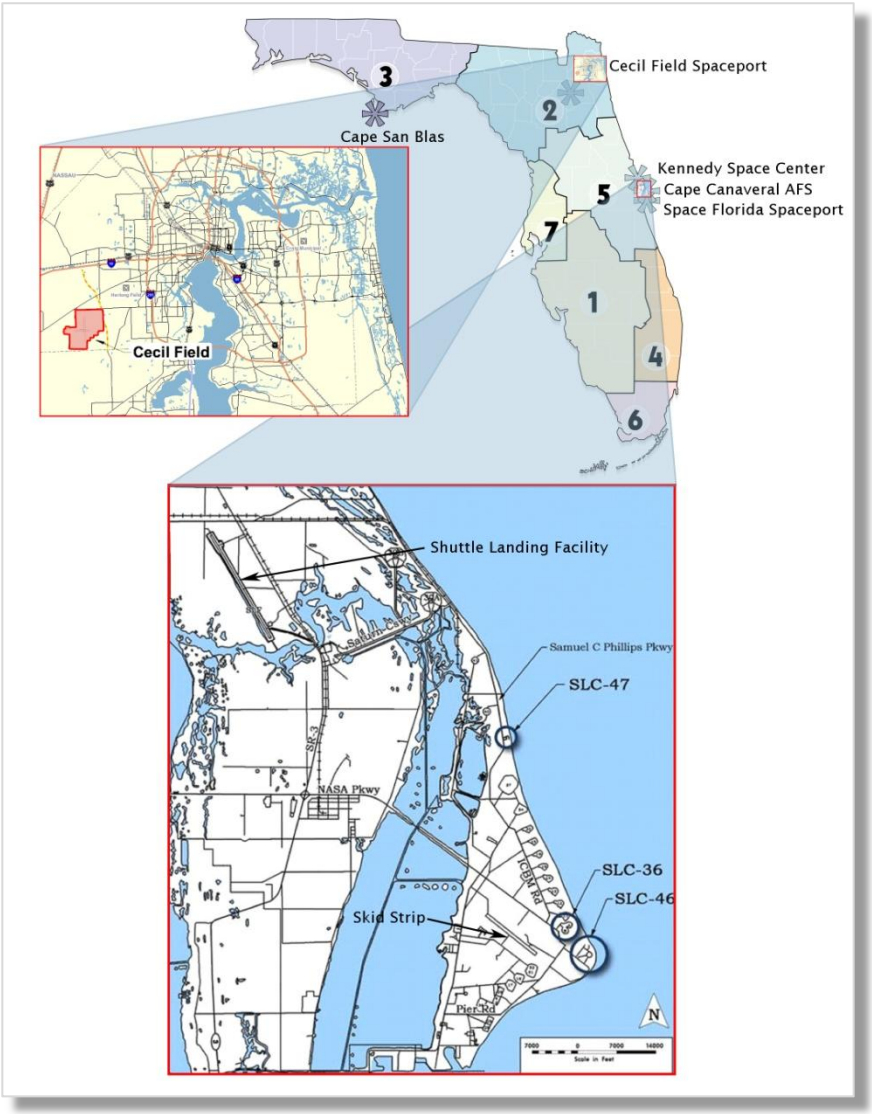


Figure 53: Florida's Proposed Spaceports

C.5.a SPACE FLORIDA SPACEPORT

Space Florida is coordinating with the 45th Space Wing to utilize SLC-36 and SLC-46 as commercial launch sites, with SLC-36 being developed as a liquid vehicle launch site and SLC-46 being developed as a solid launch vehicle site. SLC-47 is licensed to Space Florida to support the Super Loki and University Rocket Programs. Space Florida will continue to coordinate with the Air Force and CCAFS to determine if any excess facilities may become available for commercial use.

Additional Information on the development of the Spaceport Florida Spaceport is available in Section F (page 156) with a detailed evaluation of the spaceport provided in Section H (page 211).

Figure 54: Proposed Development of SLC-36 & SLC-46 within the Space Florida Spaceport at CCAFS

C.5.b CECIL FIELD SPACEPORT

Originally developed as a Naval Air Station, Cecil Field was proposed for closure by the Base Realignment and Closure (BRAC) process in 1993. Five years later, three different government entities assumed ownership of what was NAS Cecil field, the City of Jacksonville, Clay County, and the Jacksonville Aviation Authority (JAA). There are over 6,000 acres of property controlled by JAA as part of a 17,000 acre mixed-use master-planned development. The airport was identified as a potential launch site in the feasibility study of a Florida commercial spaceport. JAA is currently pursuing a launch site operator's license.

Figure 55: Cecil Field Airport

Cecil Field's assets include: 175 major buildings totaling 2.9 million square feet. There are over 425,000 square feet of warehouse, industrial, and general-use space. Four runways**:** one at 12,500 feet and three at 8,000 feet. Cecil Field has 537,000 square yards of concrete apron, eight aircraft hangars And 225,000 square feet of general office and support facilities (Ref [51]). In addition, a 40,000 square foot aircraft coating hangar and MRO facility is under construction. Additionally, Alenia-North America is in the planning phase of constructing a 327,000-square-foot aircraft facility and hangar complex for assembly of the C-27J Spartan military cargo plane which could be constructed as early as 2010. JAA has land available for construction of additional aviation facilities on the Southwest and Southeast Quadrant of the airport. In particular, development in the Southeast quadrant has been set aside for spaceport development (Ref [16]).

Figure 56: Proposed Cecil Field Spaceport

The Current Tenants of Cecil Field (October 2009) include:

- Jacksonville JetPort
- Boeing Company
- Division of Forestry
- Flightstar Aircraft Services, Inc.
- Florida Army National Guard
- Florida Community College at Jacksonville
- Fleet Readiness Center, South East
- Jacksonville Fire & Rescue
- Jet Turbine Service, Inc.
- Logistic Services International, LSI
- Robinson Van-Vuren & Associates
- L3 Communications
- US Coast Guard
- US Customs and Border Patrol

JAA has developed an extensive plan for modernizing and expanding the capabilities of Cecil Field. JAA's Capital Improvement Plan from March 2009 through 2014 listed nearly 60 Capital Improvement projects.

Selection and Licensing of Cecil Field Spaceport

Based on the results of a 2005 "Feasibility Study of a Florida Commercial Spaceport" by the Florida Space Authority (Space Florida's predecessor entity), JAA decided to move forward in the development of a Commercial Spaceport outside of the existing federal sites at Kennedy Space Center and Cape Canaveral Air Force Station. The feasibility study identified a variety of characteristics among existing facilities that make some potential sites more attractive than others. Some of the characteristics identified include:

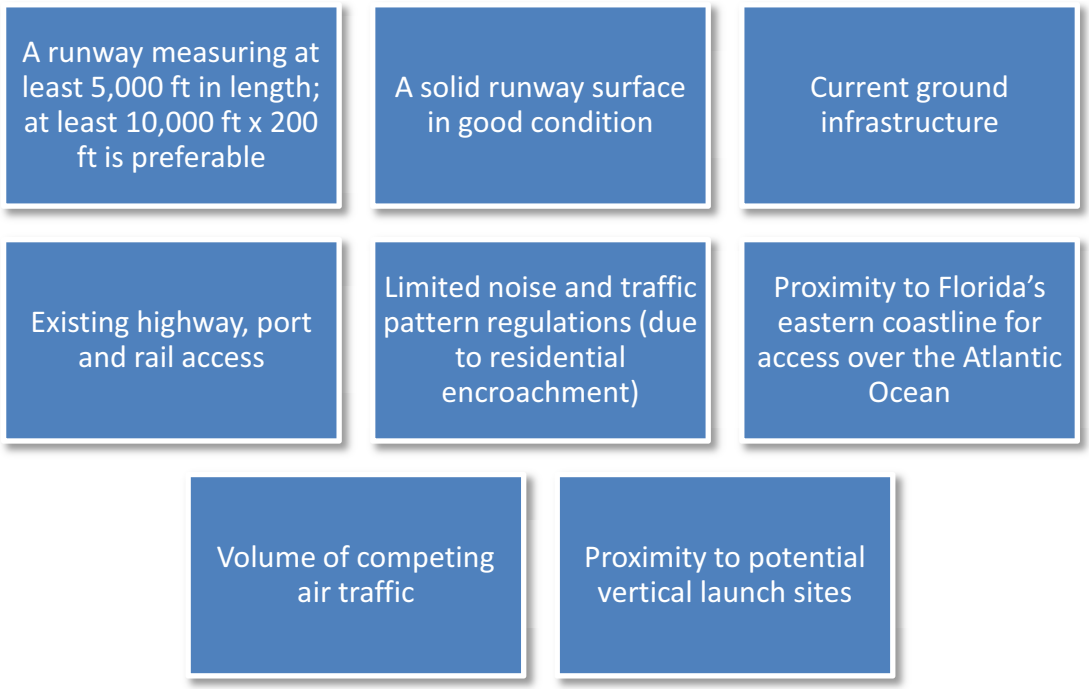


Figure 57: Preferred Characteristics of Potential Suborbital RLV Sites in Florida

Of all the possible airports within the state of Florida to support suborbital RLV missions, Cecil Field Airport was identified as the "best airport for aircraft-like launch vehicles…" (See Figure 58). Cecil Field offers a current runway operating length of 12,500 ft and is the only airport, out of the nine-reviewed, with a runway width of 200ft, preferred by most vehicle providers (Ref [30]).

Airport	Runway	Runway Dimensions (ft)	Pavement Surface Type
Jacksonville Cecil Field	18L-36R	12,500 x 200	Concrete/Asphalt
Dade-Collier Training and Transition	9-27	10,499 x 150	Asphalt
Miami Opa-Locka Airport	9L-27R	8,000 x 150	Asphalt, Grooved
Titusville Space Coast Regional	18-36	7,320 x 150	Asphalt, Grooved
St. Augustine/St. Johns County Airport	13-31	6,939 x 150	Asphalt
St. Lucie County International Airport	9-27	6,492 x 150	Asphalt
Boca Raton Airport	5-23	6,276 x 150	Asphalt, Grooved
Martin County Airport - Witham Field	12-30	5,826 x 100	Asphalt
Miami Kendall - Tamiami	9L-27R	5,001 x 150	Asphalt

Source: Figure 9, Feasibility Study of a Florida Commercial Spaceport, Futron Corporation, 2005.

Figure 58: Potential Non-Federal RLV Sites in Florida

Based on this information, JAA began taking the steps required to develop Cecil Field into a Spaceport. The first step was to coordinate with the FAA/AST office. Following the initial FAA coordination, JAA and RS&H began the process of preparing an Environmental Assessment (EA). During the development of the EA, JAA also coordinated with RS&H and the FAA to prepare the Launch Site Operators License Application in accordance with the federal regulations 14 CFR Part 420. The following figure provides a timeline of the key milestones in the spaceport development process.

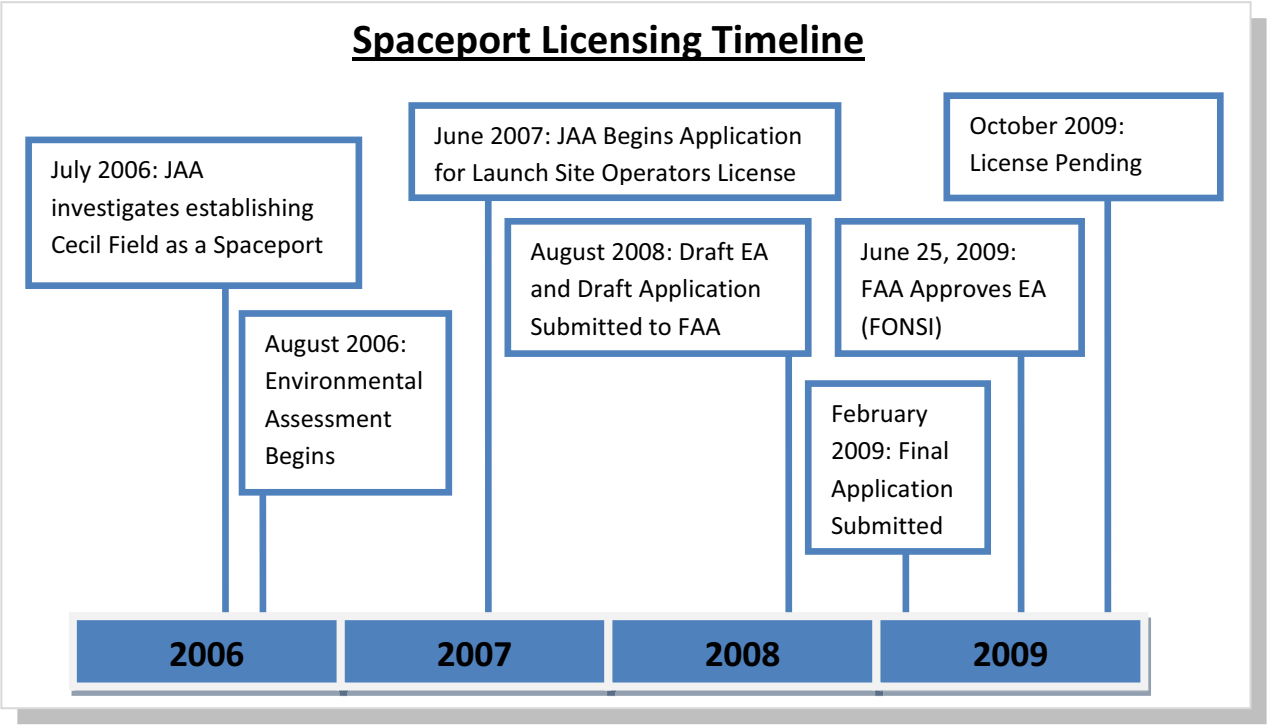


Figure 59: Cecil Field Spaceport Licensing Timeline

Status of Spaceport Licensing

In June of 2009 the FAA approved the Environmental Assessment (EA) for Cecil Field Spaceport with the result being a Finding of No Significant Impact (FONSI). The Final Launch Site Operators License application, submitted in February of 2009 is currently pending approval from the FAA.

Proposed Launch Vehicles

The suborbital Reusable Launch Vehicle (RLV) market is still in an emerging state and several types of concept vehicle designs are being researched and developed. JAA selected two concept RLV types for consideration for inclusion in the license application for Cecil Field Spaceport. The two concept launch vehicle "types" for potential operation at Cecil Field include the Concept X and Concept Z RLVs described below and describe a genre of RLV's instead of a specific RLV.

Table 4: Comparison of RLV Concepts

Characteristics	Concept X	Concept Z
Takeoff Orientation	Horizontal	Horizontal
Takeoff Method	Jet Powered	Jet Powered
Uses Carrier Aircraft	No	Yes
Landing Method	Glide or Jet Powered	Glide / Expendable
Suborbital or Orbital	Suborbital	Suborbital
Manned or Unmanned	Manned	Manned
Examples	Rocketplane XP	Scaled Composites SpaceShipOne

A "Concept X" launch vehicle is an all-in-one RLV, similar to an airplane that takes off from a runway using jet power and flies to a safe location before igniting its rocket engines to complete its launch profile. Upon completion of its mission, the Concept X launch vehicle will return for a horizontal landing by either restarting its jet engines or by gliding unpowered. Current generation Concept X launch vehicles would be capable of providing suborbital flights for both passengers and cargo. An example of a Concept X launch vehicle is the Rocketplane XP being developed by Rocketplane Global, Inc.

Figure 60: Example Concept X RLV (Rocketplane XP)

A "Concept Z" launch vehicle is a two part launch vehicle consisting of a reusable carrier aircraft and an RLV. The carrier aircraft is powered by jet engines and designed/modified to carry the launch vehicle to a high altitude where the two components detach and the rocket engine of the launch vehicle is ignited. The carrier aircraft returns to the spaceport and lands normally. The launch vehicle completes its mission profile and returns for a horizontal landing. An example of Concept Z launch vehicles includes Scaled Composites SpaceShipOne and its carrier aircraft the White Knight.

Figure 61: Example Concept Z RLV (SpaceShipOne)

Planned Mission Profiles

In support of the two concept RLV types, Cecil Field has planned for a nominal mission profile where the RLV's are launched from Cecil Field Airport under jet power and travel to a safe location in the Atlantic Ocean before transitioning to rocket power. Through close coordination with FAA Air Traffic in the development of the necessary airspace letters of agreement, it has been determined that the planned profile is feasible to accommodate the proposed RLV operations. The following figure and table outlines the nominal launch phases for missions from Cecil Field Spaceport.

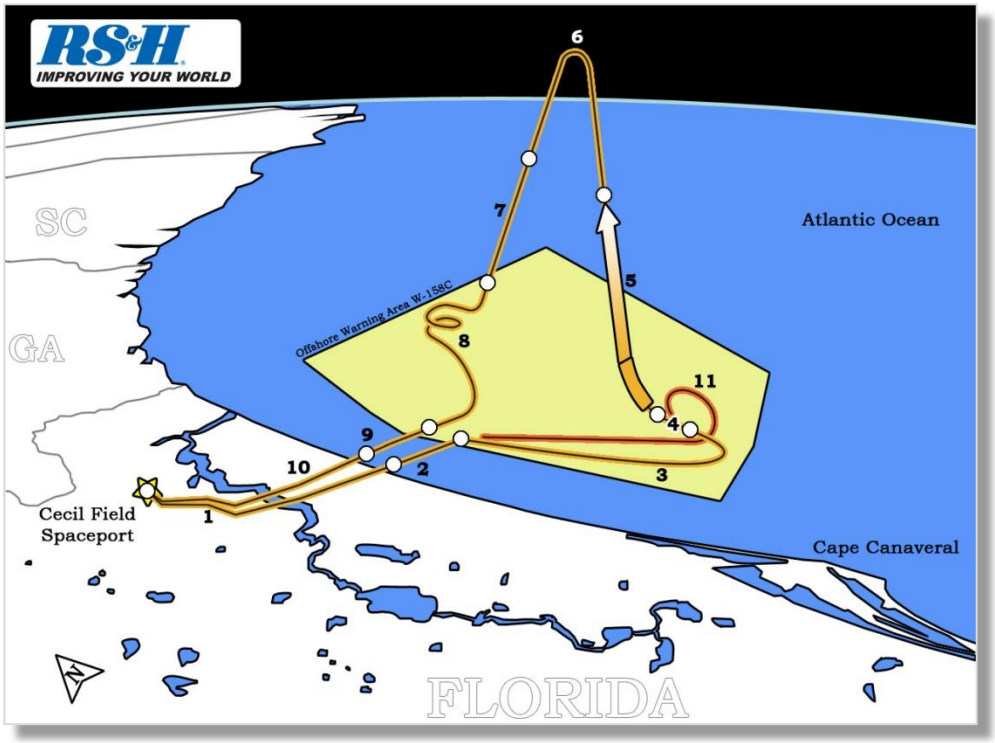


Figure 62: Nominal Mission Profile

Table 5: Nominal Launch Phases

Nominal Launch Phases	Flight Configuration
(1) Takeoff from Cecil Field and Flight to Coast	Launch Vehicle & Carrier Aircraft (if applicable)
(2) Flight from Coast to Offshore Warning Area (W-158C)	
(3) Flight to Launch Point	
(4) Separation and Glide to Launch	Launch Vehicle
(5) Launch and Boost Phase	
(6) Suborbital Trajectory	
(7) Ballistic Reentry	
(8) Return to Aerodynamic Flight & Glide	
(9) Glide from Offshore Warning Area to Coast	
(10) Glide to Cecil Field and Landing	
(11) Carrier Aircraft Returns to Cecil Field	Carrier Aircraft Only

Development of Cecil Field Spaceport

To support RLV missions from Cecil Field Spaceport, JAA plans to utilize its 12,500 ft runway for both takeoffs and landings. The following areas have been identified on the Explosive Site Plan in Figure 63 to accommodate RLV Operations:

- Temporary Oxidizer Storage Areas
- Liquid Fuel Storage Area
- Liquid Fuel Loading Area
- Solid Propellant Storage Area
- Oxidizer and Passenger Loading Area
- RLV Operating Area
- RLV Storage

JAA Plans to add the following infrastructure and facilities to support RLV missions from Cecil Field:

- A 54,000 square foot RLV Hanger that will support RLV storage, integration, and administration.
- A taxiway and apron for use by Reusable Launch Vehicles that will be 75 ft wide.
- A RLV fueling facility that will support the fueling requirements of Reusable Launch Vehicles.

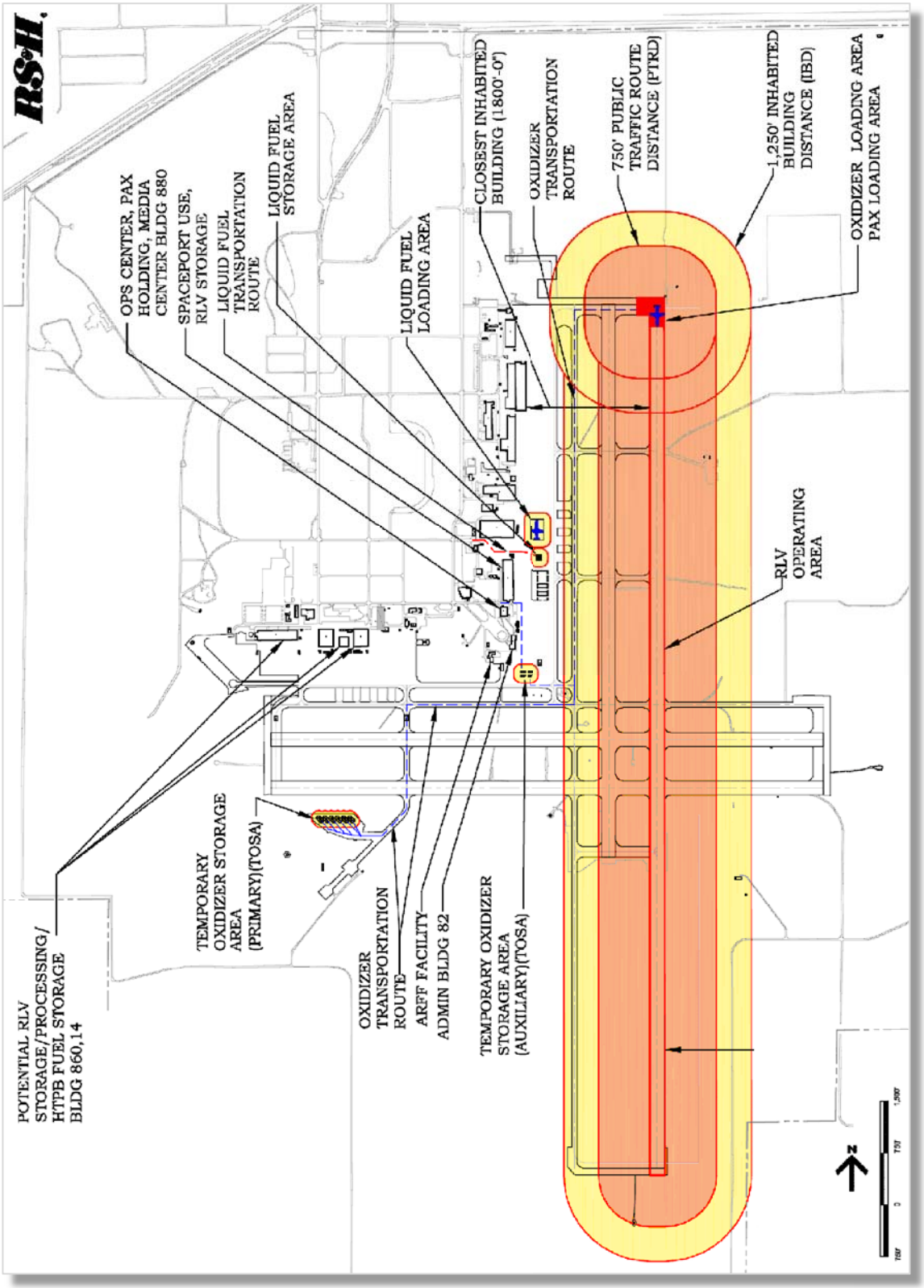


Figure 63: Cecil Field Explosive Site Plan and Facilities Layout

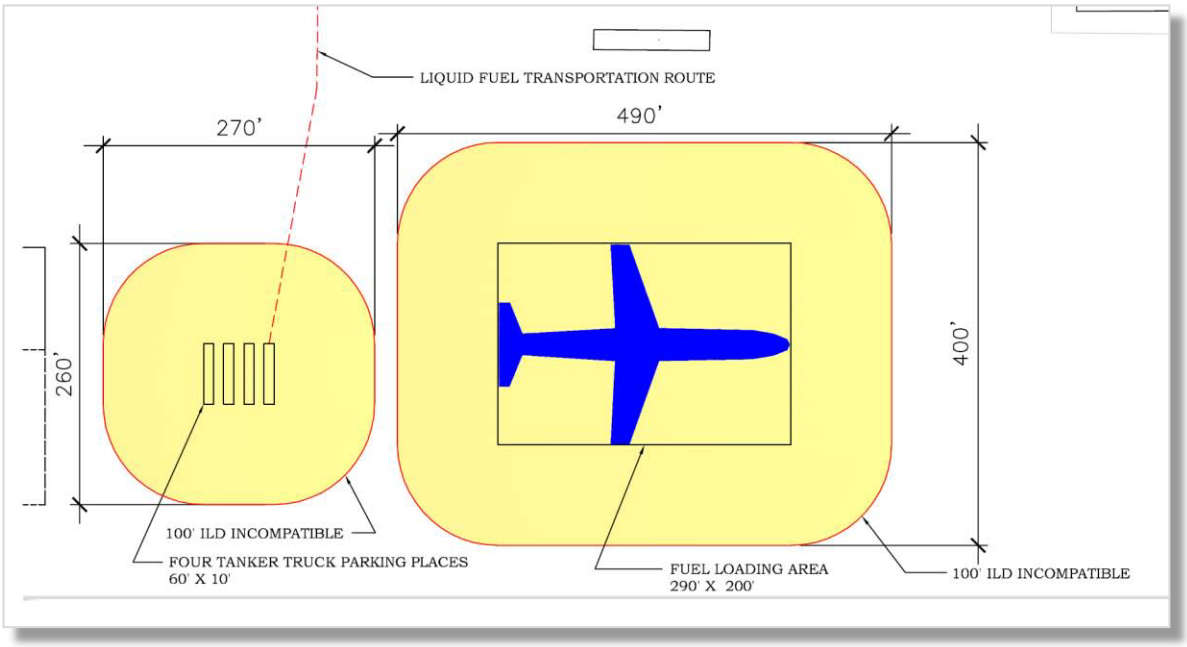


Figure 64: Liquid Fuel Storage Area and Liquid Fuel Loading Area

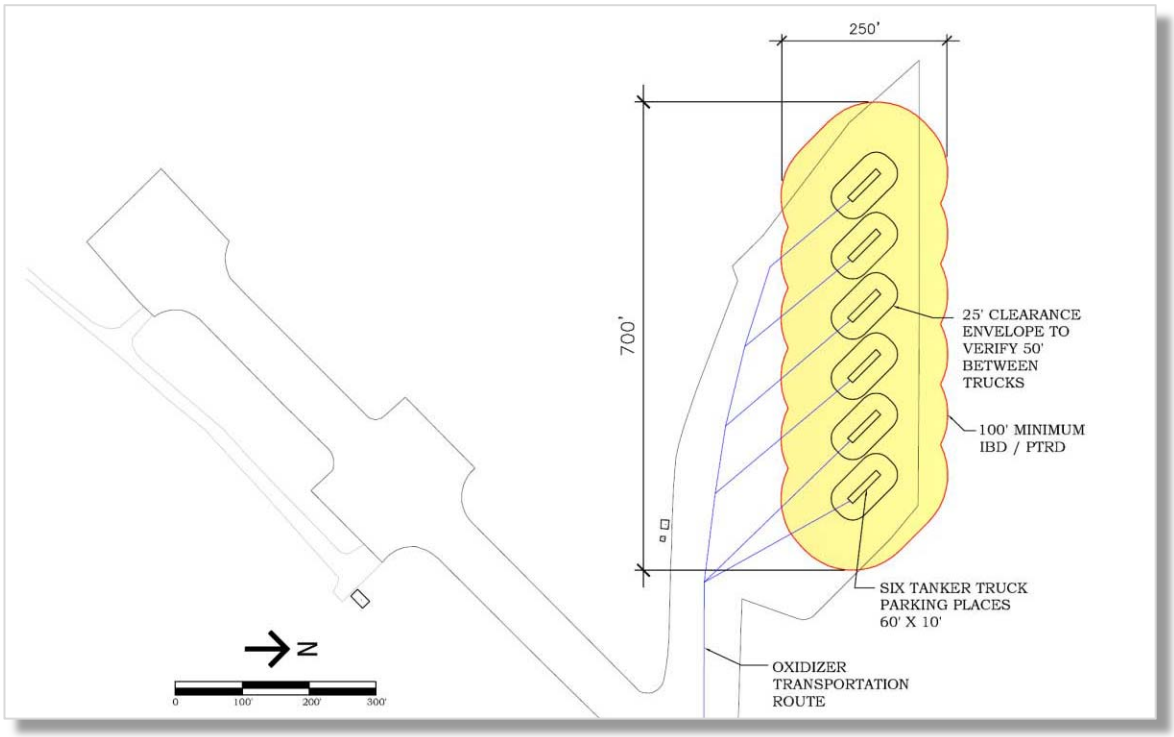


Figure 65: Primary Temporary Oxidizer Storage Area

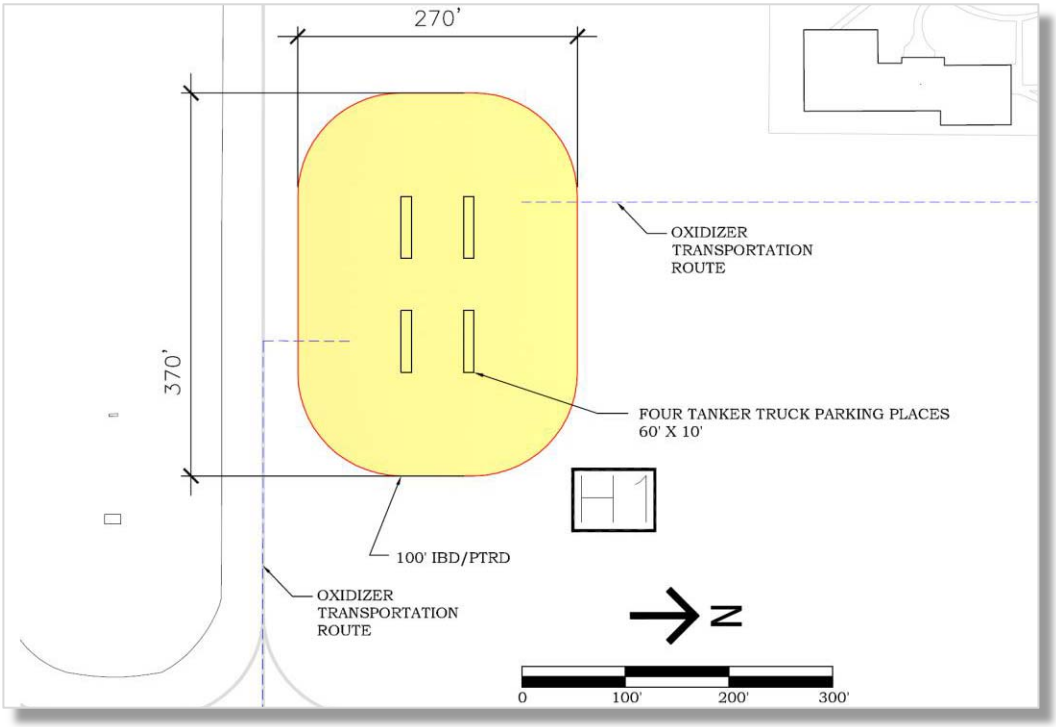


Figure 66: Auxiliary Temporary Oxidizer Storage Area

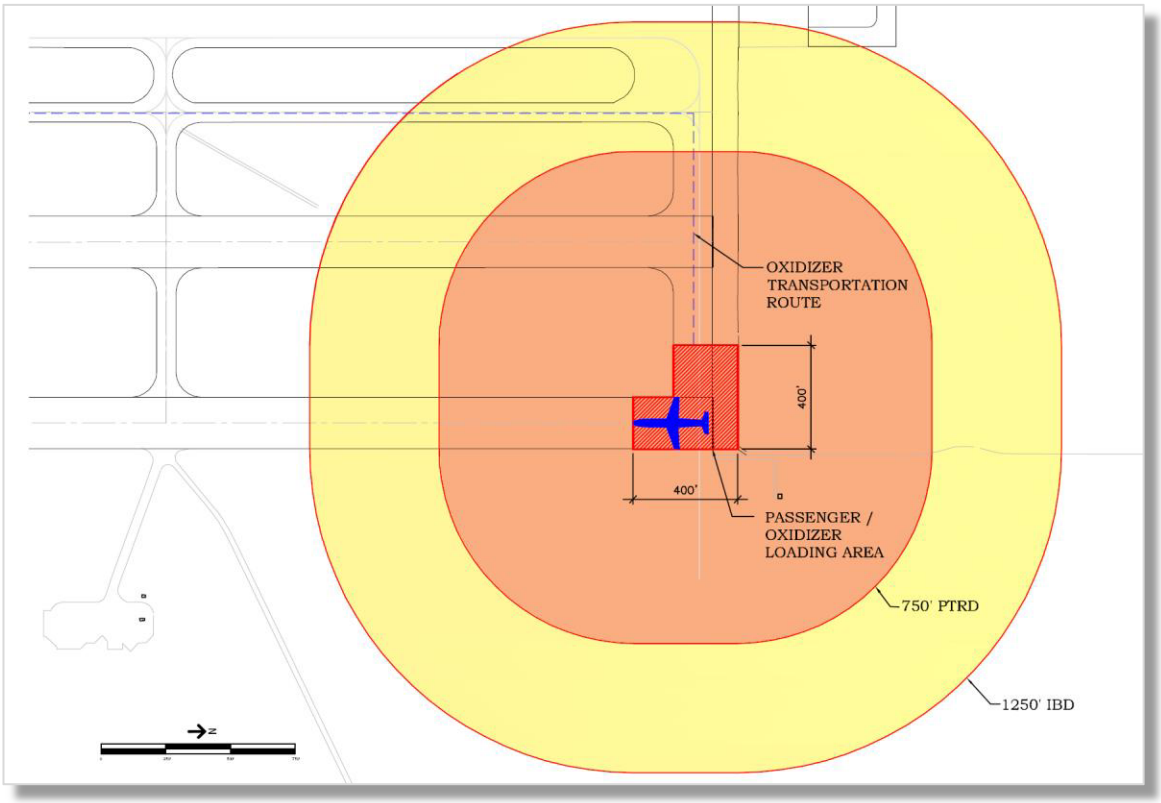


Figure 67: Oxidizer and Passenger Loading Area

C.6 OTHER SPACE SUPPORT FACILITIES

Not all space transportation facilities are located within an existing or proposed spaceport. The following facilities are located in different areas of Florida and contribute to the infrastructure of the State Space Transportation System.

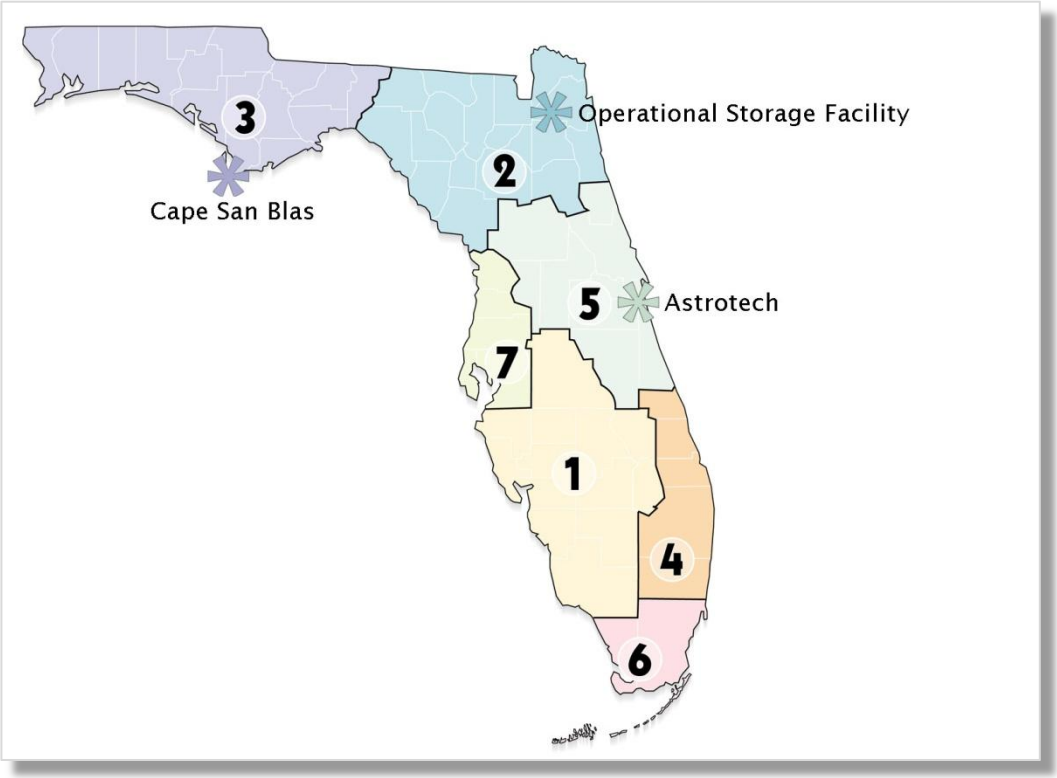


Figure 68: Other Spaceport Support Facilities

Table 6: Summary of Other Spaceport Support Facilities

#	Spaceport Support Facilities	Utilization	Location	FDOT District
1	Astrotech	Payload Processing	Titusville, FL	5
2	Operational Storage Facility	Solid Rocket Motor Storage	Camp Blanding	2
3	Cape San Blas Launch Site	Suborbital Launch Pad (Inactive)	Eglin Air Force Base	3

C.6.a ASTROTECH

The Astrotech Florida facilities are located on 62 acres of company-owned property just outside the gate of Kennedy Space Center; in Titusville approximately 20 miles West of most CCAFS launch complexes. With over 140,000 square feet of processing space, the Florida facility consists of nine major buildings dedicated to spacecraft non-hazardous and hazardous processing, payload and hardware storage and customer office accommodations. The newest addition to the campus is a 46,500 square foot spacecraft processing facility designed to support processing of five-meter class spacecraft in support of the Delta IV and Atlas V launch vehicle programs. Between 1999 and 2008 Astrotech in Florida supported 107 missions or payloads. Processing cleanrooms are rated at Class 100,000 with capability to achieve a Class 10,000 rating with the addition of its modular filtration system. Processing cells also have overhead cranes, control rooms, facility and technical power, communications systems and dedicated fiber optic cable to all active CCAFS launch complexes.

Figure 69: South Side of Payload Processing Facility at Astrotech

Astrotech provides a full complement of services, both standard and on-demand, to their payload customers. Standard services include aircraft off-load and on-load support, ordnance receiving, inspection & staging, storage & transportation of liquid propellants, consumables (inert gases, solvents, etc.), sampling and analysis of gases, propellants and cleaning materials, emergency medical and fire assistance, personnel protective suits (SCAPE), splash suits, and related training and support for spacecraft propellant loading operations, traffic escorts and DOT permitting for hazardous and/or oversized articles, hardware and personnel safety oversight, and payload components dynamic balancing. Special services available include procurement/shipping of spacecraft propellants, spacecraft propellant loading services, global launch site safety and logistics support, freight forwarding including equipment packing and crating, ground support equipment design, fabrication, test, and maintenance, and precision cleaning. Astrotech facilities meet all EPA and OSHA requirements.

C.6.b CAMP BLANDING – OPERATIONAL STORAGE FACILITY (OSF)

The Operational Storage Facility is located in Camp Blanding Joint Training Site at the Florida National Guard Base 10-miles East of Starke, Florida, in Clay County. Lockheed Martin and the Spaceport Florida Authority (Space Florida's predecessor organization) proposed a Long Term Storage Facility (LTSF) in Florida to store Titan IV Solid Rocket Motor Upgrade (SRMU) for both CCAFS and VAFB missions. After intense competition with California, Utah, and Mississippi for the project site, a site at Camp Blanding was selected. It was considered the best location because of its proximity to railroads, existing Titan support infrastructure at CCAFS, and other Florida-based Lockheed facilities and personnel associated with Titan IV operations. Florida is also the state from which most Titan IV launches had occurred and the state provided an attractive environment for space-related industrial activity. Lockheed Martin was interested in a Florida location for SRMU storage because it would provide cost, convenience, and efficiency benefits for the Titan IV program. Following the completion of the Titan IV program the facility began providing storage of Atlas V solid rocket motors. Space Florida currently owns the buildings and the Florida Armory Board owns the land.

Figure 70: Operational Storage Facility

Since the retirement of the Titan IV program, the facility is currently leased to United Launch Alliance (ULA) to store Atlas V solid rocket motors in preparation for launches from the Cape Canaveral Air Force Station. The lease began on May 15, 2007 with 10 one year renewable options starting on October 1, 2007. To date ULA has exercised 3 of the 10 renewable options. An additional ordnance magazine for storing Space Florida's Super Loki sounding rockets was added in 2007.

The 13 year old Operational Storage Facility (OSF) is comprised of 4 buildings:

- Building 1 - Transfer/Inspection and Maintenance Facility (TIMF), 11,780 Sq ft.
- Building 2 - Segment Storage Facility (SSF), 28,925 Sq ft.
- Building 3 - Covered Air-bearing Roadway (CAR), 26,800 Sq ft. (1006 feet length)
- Building 4 - Security Entry Control Building (SECB), 2,055 Sq ft.

The facility also contains a 200-ton bridge crane with 125-ton auxiliary crane. This crane has a 65-foot hook height. In addition, there is an on-site Track Mobile, two flat cars, and two golf carts. All systems are in good condition and the facility has unique capabilities to safely store significant quantities of solid rocket propellant. Further, it meets the needs of commercial contractors with government contracts to store solid rocket motors in preparation of launches from the Cape Canaveral Air Force Station.

C.6.c CAPE SAN BLAS

Figure 71: Launch Site at Cape San Blas

Spaceport Florida Authority (Space Florida's predecessor organization) launched a Microstar rocket in August 1992 from a Mobile Launcher at Cape San Blas (on Elgin/Tyndall Air Force Base) for a suborbital weather mission. Spaceport Florida Authority joined with the Florida Space Institute (FSI)/University of Central Florida (UCF) in a partnership to provide a launch capability for the University System in Florida. The mobile launcher was transferred to Florida Space Institute (FSI) in October of 2001 to support this partnership. Space Florida is investigating further Super Loki mobile launch site capability at this location and others around the state to provide a remote launch area for university rocket development and operations.

C.7 MULTIMODAL CONNECTORS TO FLORIDA'S SPACEPORTS

Plans for surface transportation facilities, including highway, rail, and waterway facilities are developed and maintained by the Florida Department of Transportation (FDOT), primarily through Florida's Strategic Intermodal System (SIS). FDOT plans for the development of aviation facilities through the Continuing Florida Aviation Systems Planning Process (CFASPP).

At the regional and local levels, planning for SIS and non-SIS transportation facilities is carried out by metropolitan planning organizations (MPOs), which are also identified as transportation planning organizations (TPOs). Centered in Brevard County, the Space Coast TPO (SC TPO) is the MPO with responsibility for transportation planning in the area that includes the Kennedy Space Center, the Cape Canaveral Air Force Station, and the Space Florida Spaceport. The North Florida TPO, centered in Jacksonville, is responsible for transportation planning in the region that includes the Cecil Field Spaceport.

Florida's Strategic Intermodal System (SIS)

The SIS is a statewide network of high-priority transportation facilities, including the state's largest and most significant commercial service airports, spaceport, deepwater seaports, freight rail terminals, passenger rail and intercity bus terminals, rail corridors, waterways and highways. These facilities are the workhorses of Florida's transportation system, carrying more than 99 percent of all commercial air passengers, virtually all waterborne freight tonnage, almost all rail freight, and more than 68 percent of all truck traffic and 54 percent of total traffic on the State Highway System (Ref [82]).

To enhance the economic competitiveness of the state of Florida, the Florida Department of Transportation (FDOT) has identified a "Strategic Intermodal System (SIS)" of transportation facilities. Under state law, capacity projects that are included in the Florida Strategic Intermodal System (SIS) have a higher priority for state funding than other capacity projects that are not included in the SIS.

The SIS for the state of Florida was established in 2003 and is focused on a network of existing and emerging intermodal hubs, including airports, seaports, rail terminals, intermodal passenger facilities, and a single existing spaceport hub, identified in the SIS as the "Cape Canaveral Spaceport" in Brevard County (FDOT District 5). As identified in the SIS, the Cape Canaveral Spaceport hub presently includes the Space Florida Spaceport facilities, as well as additional spaceport facilities located at both the Kennedy Space Center and the Cape Canaveral Air Force Station. It can be expected that more spaceport hubs will be added to the SIS as new spaceport facilities are developed, including the Cecil Field Spaceport.

Including the Cape Canaveral Spaceport hub, all of the hubs in the SIS are linked together via a network of designated corridor and connector facilities, including highway, rail, and waterway facilities.

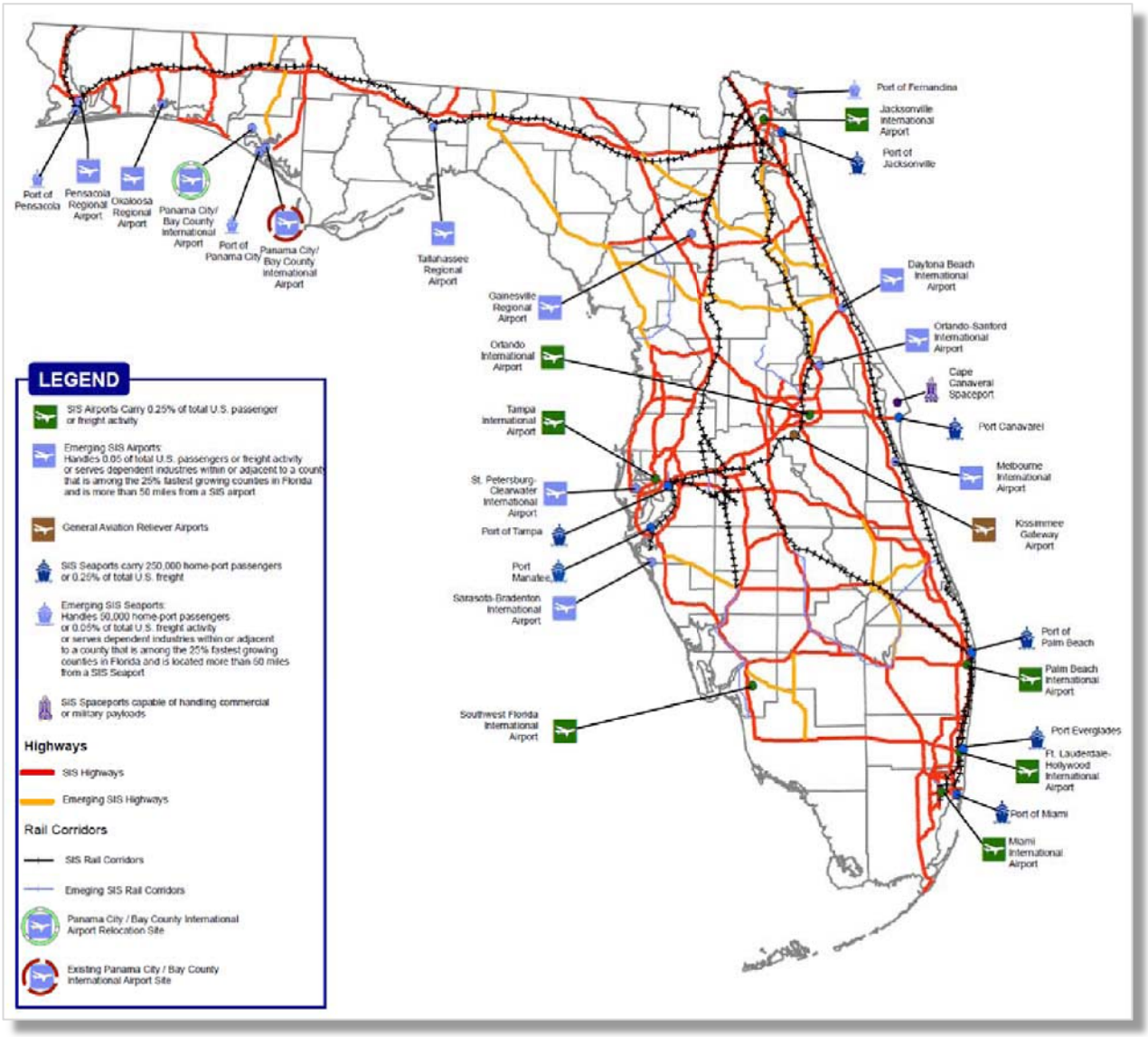


Figure 72: Florida Strategic Intermodal System (SIS) January 2009 (Ref [36])

Continuing Florida Aviation Systems Planning Process (CFASPP)

The state of Florida maintains the Continuing Florida Aviation Systems Planning Process (CFASPP), as a means for identifying and prioritizing improvements to designated civil aviation facilities in Florida, including primary, reliever, and general aviation airports. The CFASPP is known as a bottom up approach to master planning. A primary function of CFASPP is to help keep the Florida Aviation System Plan (FASP) in step with the continually changing aviation environment. The most recent update of the FASP, designated as FASP 2025, incorporates traditional aviation system planning elements as well as an analysis of the intermodal aspects of the state transportation system which have impact on airports and aviation.

C.7.a SPACE FLORIDA SPACEPORT HIGHWAY AND MULTIMODAL CONNECTOR

SIS Facilities

Unlike existing or potential commercial spaceport facilities in other states, the Space Florida Spaceport is served by a comprehensive network of intermodal access facilities. From the north and south, I-95 provides highway access to the Space Florida Spaceport. Multilane arterial highways, including SR 50 and SR 528, provide for spaceport access from Orlando, located about fifty miles to the west of the Cape Canaveral.

In addition to excellent highway accessibility, the Cape Canaveral Spaceport is also accessible via aviation, water and rail facilities. Nearby aviation facilities include military, air carrier and general aviation airports in Brevard County, including the Melbourne International Airport. The Orlando International Airport in Orange County, and Orlando Sanford International Airport, in Seminole County, are both major gateways to and from the USA, and are both located less than fifty miles from the Cape Canaveral Spaceport.

The officially designated SIS connectors to Port Canaveral and the Space Florida Spaceport are listed in Figure 73 and shown in Figure 74 based on Inset H of the 2008 SIS per District 5(a).

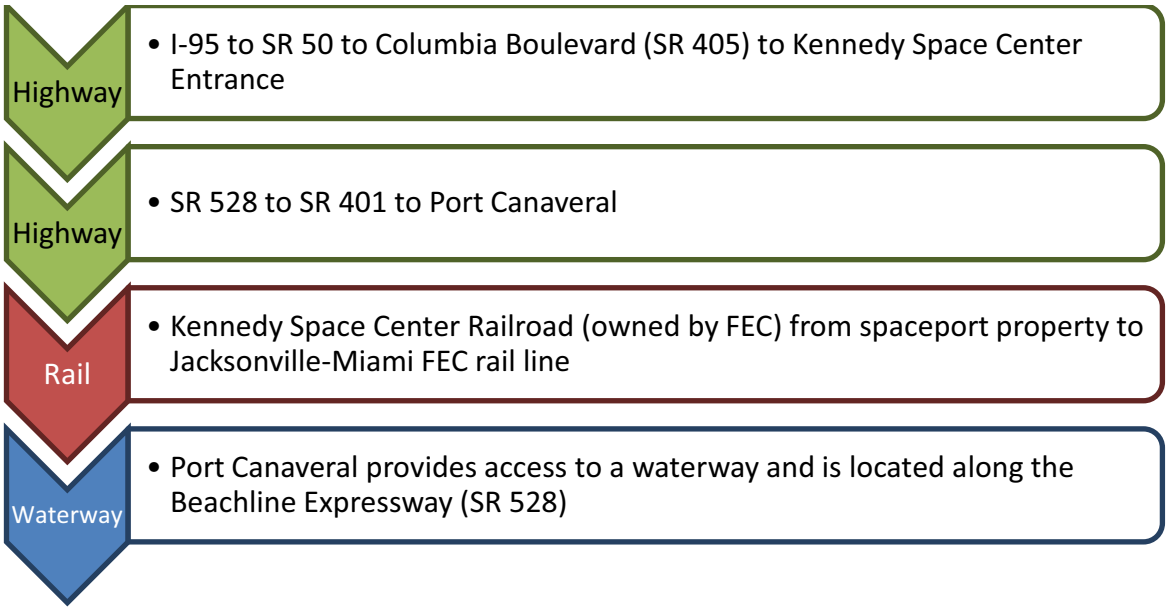


Figure 73: Strategic Intermodal System (SIS) Connectors to SIS Cape Canaveral Spaceport Hub

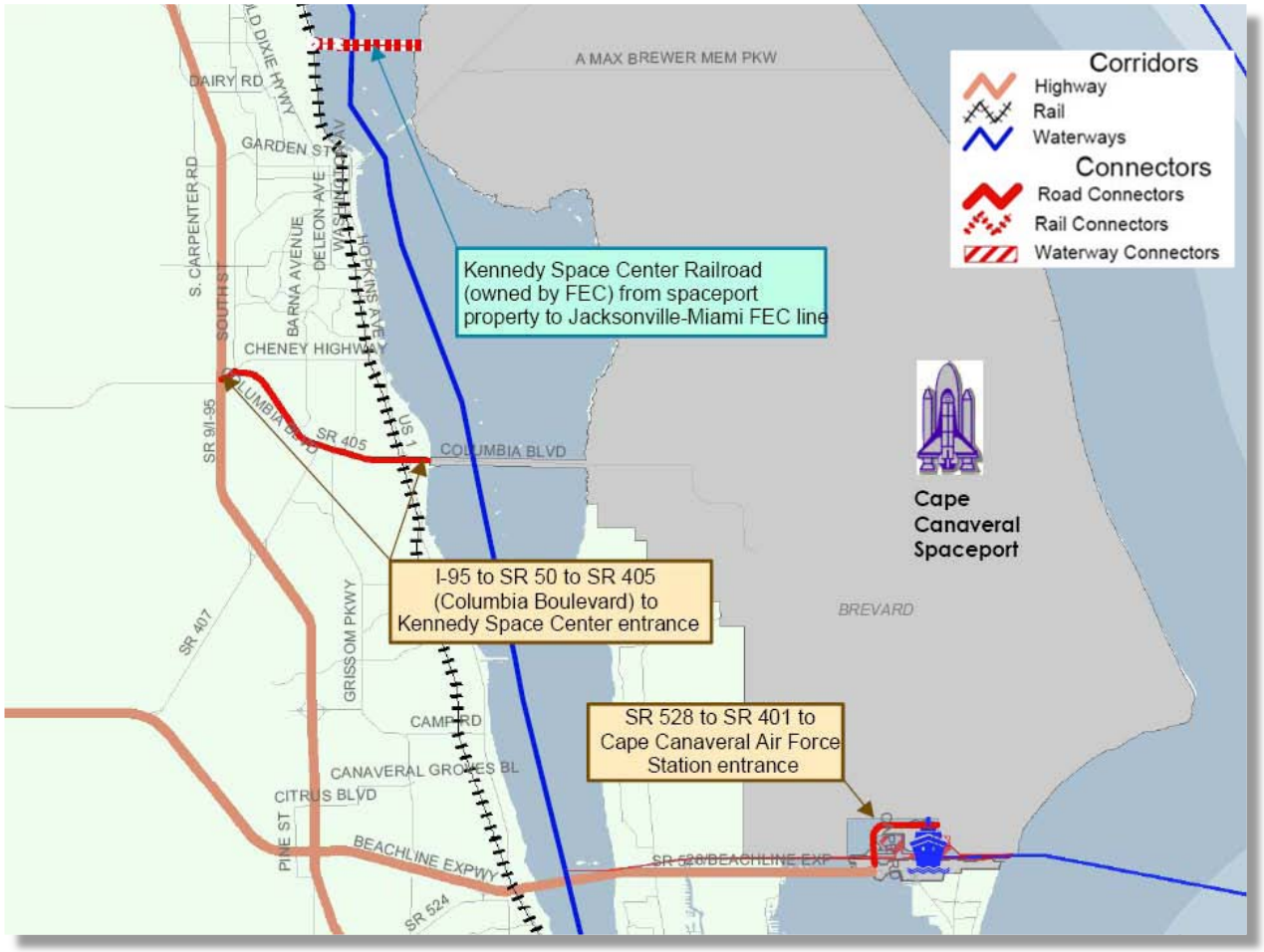


Figure 74: Connectors to Cape Canaveral Spaceport (District 5 SIS Maps) – Ref [44]

As discussed below in the section entitled SIS Highway Corridor Assessment, a "choke point" has been identified at the interchange of I-95 at SR 50 that could potentially obstruct oversize shipments by highway to or from the Cape Canaveral Spaceport. As an alternative to the reconstruction of this interchange in order to remove this choke point, improvements have been recommended that would allow the use of the interchange of I-95 at SR 407, immediately to the south of the I-95 interchange at SR 50, as part of an alternative connector route between I-95 and the Cape Canaveral Spaceport Hub.

A preliminary design and engineering (PD&E) study has been completed for a project that would widen SR 528 to six lanes between I-95 and SR 401. This project is included on the list of priority projects that was adopted in September 2009 by the Space Coast TPO. From east of the Indian River Bridge to east of the SR 401 interchange, resurfacing of SR 528 is expected to begin in January 2010, as of the date of this report.

Improvements to SR 401 are also included in the list of priority projects that was adopted in September 2009 by the Space Coast TPO.

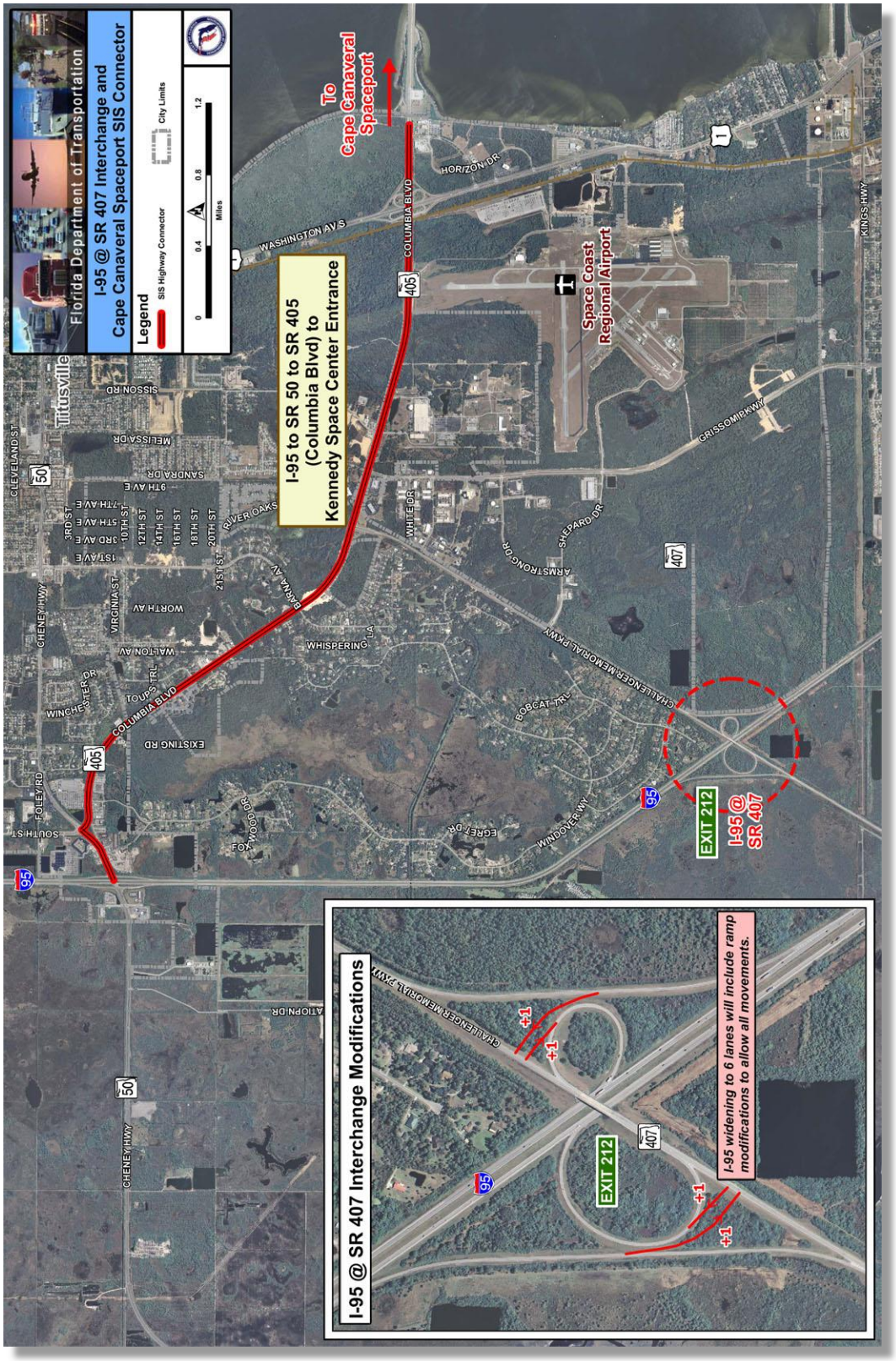


Figure 75: I-95 @ SR 407 Interchange Modifications (FDOT / HDR Engineering, Inc.)

SIS Highway Corridor Assessment

A Transportation Master Plan was conducted by Wilbur Smith Associates in 2002 for the Florida Space Authority, which is the predecessor agency to Space Florida. The 2002 Transportation Master Plan identified a "space hardware corridor" in Florida, including:

- I-10 at the Alabama state line to I-295 in Duval County
- I-295 in Duval County to I-95 in Duval County
- I-95 in Duval County to SR 50 in Brevard County
- SR 50 to SR 405
- SR 405 to the NASA Causeway at Gate 3

Within this corridor (See Figure 76), the 2002 Transportation Master Plan identified the locations of five "choke points" where shipments of oversize space hardware might be obstructed. As a part of this Spaceport Master Plan Study, a review was conducted in order to determine if any projects had been undertaken that would have eliminated any of these five choke points. As a result of this review, the list of five choke points has been shortened to four items (See Table 7). The choke point at I-10 under Chaffee Road has since been resolved.

Table 7: Chokepoints Along Cape Canaveral Space Hardware Corridor (From 2002 Transportation Master Plan - Ref [37])

#	Choke Point Description	Country	FDOT District	Resolved Since 2002?
1	I-10 under U.S. 231	Marianna - Jackson County	3	No
2	I-10 under U.S. 221	Greenville – Madison County	2	No
3	I-10 under Yellow Water Road	Duval County	2	No
4	~~I-10 under Chaffee Road~~	~~Duval County~~	~~2~~	~~Yes~~
5	I-95 at SR 50	Brevard County	5	No

With regard to the choke point that was identified on I-95 at SR 50 in Brevard County, (the last choke point on the above list), the recommendation in the 2002 Transportation Master Plan was for a modification of the I-95 interchange at SR 407 in Brevard County, which is located immediately south of the I-95 interchange at SR 50. The recommended modification would provide for movements that are not currently allowed at this interchange, i.e.

- I-95 southbound to SR 407 eastbound, and
- I-95 northbound to SR 407 westbound

If these modifications are implemented, then traffic between I-95 and the Kennedy Space Center would be rerouted away from the choke point that has been identified at the interchange of I-95 at SR 50.

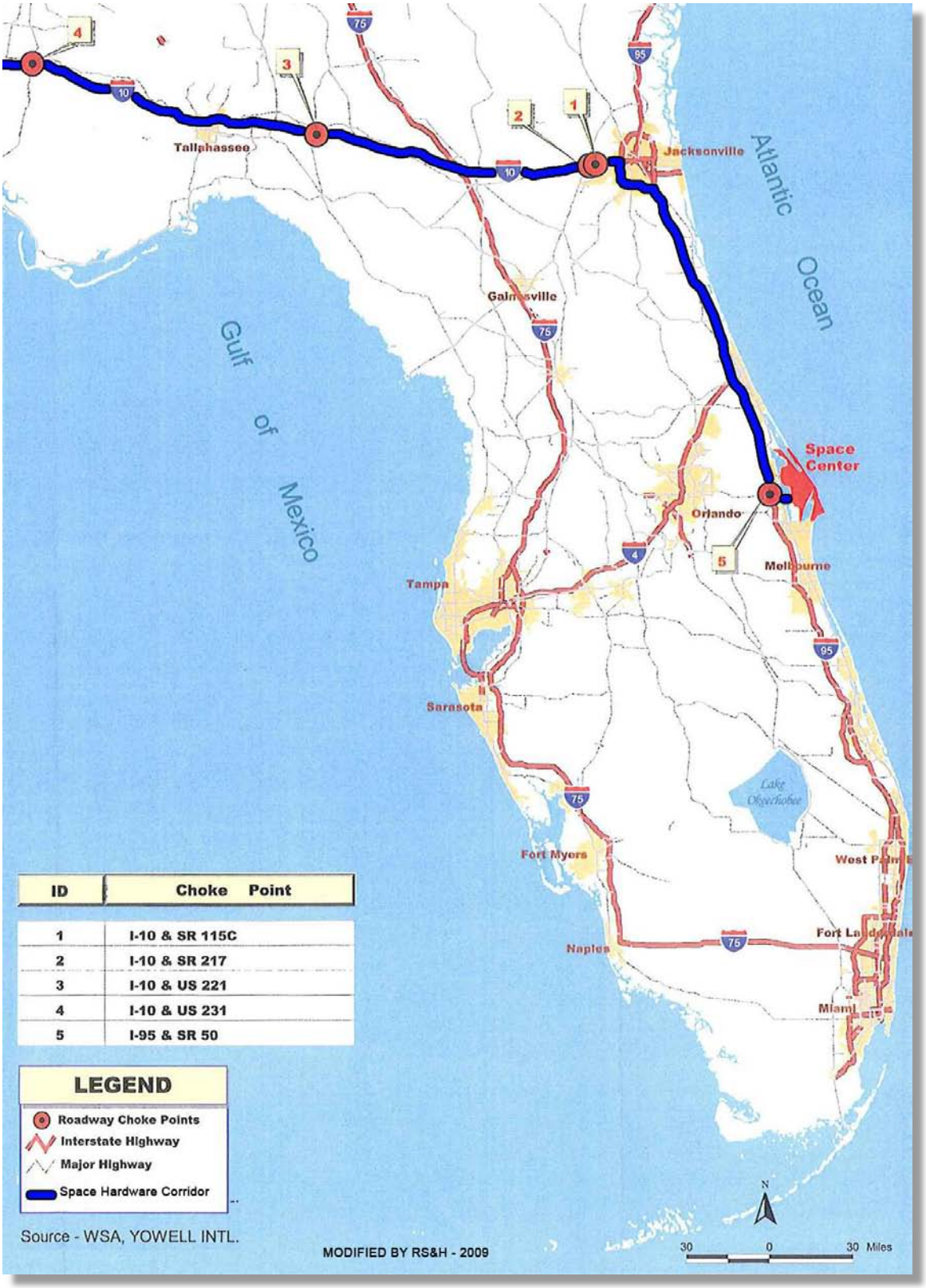


Figure 76: Cape Canaveral Space Hardware Corridor and Choke Points (Ref [37])

This project was also identified in a Preliminary Design and Engineering (PD&E) study that was prepared in 2004 by CH2MHill, and it has been included in the annual list of priority projects that was adopted by the Space Coast TPO in 2009.

In June of 2009, FDOT District 5 obtained approval from the US DOT Federal Highway Administration (FHWA) for the improvements needed to make the SR 407/I-95 interchange fully directional. Funding for this is included in the project for the future six lane widening of this segment of I-95, which in turn is included in the SIS Cost Feasible Plan. If funds are made available, the SR 407 interchange improvement could also be advanced as a separate project.

FDOT has designated a number of projects that will lead to the widening of I-95 from four to six lanes, in Brevard County, where the Cape Canaveral Spaceport is located. From SR 519 to SR 528, FDOT completed the widening of I-95 in July 2009. In addition FDOT has allocated construction funds for the widening of I-95 as far north as SR 50 in Brevard County. Although right of way acquisition funds have been allocated for the widening of the balance of I-95 in Brevard County, i.e. from SR 50 north to the Volusia County line and beyond, construction funds have not yet been allocated for these segments of I-95. The Space Coast TPO has designated the widening of I-95 as its #1 priority among SIS projects.

Non SIS Highway Connectors to Cape Canaveral Spaceport Hub

In addition to the highways that provide access to the Cape Canaveral Spaceport and that are designated as SIS facilities, access to the Cape Canaveral Spaceport is also provided by additional highway connectors, which are listed in Table 3 and shown in figure below.

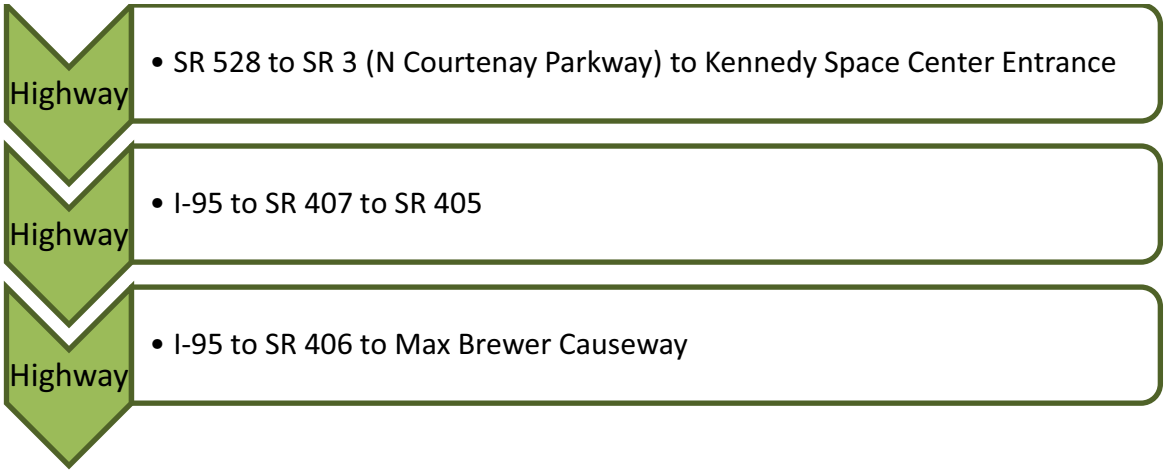


Figure 77: Non SIS Highway Connectors to SIS Cape Canaveral Spaceport Hub

Improvements to SR 3 (N Courtenay Parkway) are not included on the list of priority projects that was adopted in September 2009 by the Space Coast TPO. Improvements to the I-95 at SR 407 interchange are discussed in the section above, entitled SIS Highway Corridor Assessment.

As of the date of this report, improvements to the I-95 interchange at SR 406 are scheduled to begin in FY 2011. These improvements will add a right turn lane and a traffic signal for the northbound off-ramp.

In May 2009, FDOT began a project for the replacement and enhancement of the A. Max Brewer Bridge on the Max Brewer Causeway. The replacement bridge will include two 12' travel lanes and will replace the existing swing span structure with a high level fixed span bridge. The projected completion date for the project is Spring 2011. Funds for this project have been fully committed, with an estimated construction cost of $44.75 million.

Major Roadways within the Cape Canaveral Spaceport

As shown on the previous map, the major roadways within the Cape Canaveral Spaceport include SR 3 (N Courtenay Parkway becomes Kennedy Parkway within KSC), the NASA Causeway, Space Commerce Way and Samuel C. Phillips Parkway.

No improvements are currently recommended for SR 3 (Kennedy Parkway) within the Cape Canaveral Spaceport.

Space Commerce Way runs within the southwest quadrant of the intersection between the NASA Causeway and SR 3 (Kennedy Parkway), and provides direct access to Exploration Park. Space Commerce Way is currently two lanes wide except at the approaches to SR 3 (Kennedy Parkway) and the NASA Causeway, where it is four lanes wide. To provide for efficient traffic circulation and convenient access to Exploration Park, it is recommended that Space Commerce Way be widened to four lanes along its entire length.

Recent improvements to the NASA Causeway have included concrete repair and corrosion control on the Roy Bridges Bridge over the Banana River. Seawalls on the Indian River Bridge have also been refurbished recently.

Within the Kennedy Space Center, a resurfacing project has been proposed for the NASA Causeway. The estimated cost for this project is $6.7 million.

Figure 78: Non-SIS Highways Connectors and Major Roads in Cape Canaveral Spaceport

Aviation Facilities

Of the 20 airports in the state of Florida that are designated as primary airports in the Florida Aviation Systems Plan (FASP), three of these airports are located within fifty miles of the Space Florida Spaceport., i.e. Melbourne International Airport, Orlando International Airport, and Orlando Sanford Airport. Even closer to the Space Florida Spaceport are the Space Coast Regional Airport and the Merritt Island Airport, which are both designated as FASP reliever airports.

Figure 79: FASP Airports near the Cape Canaveral Spaceport Hub

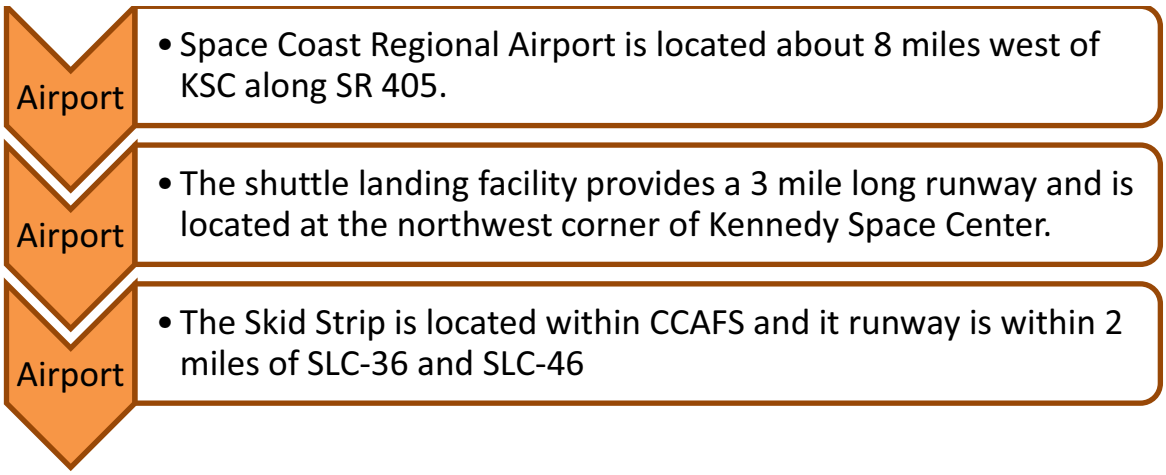


Figure 80: FASP Airports near the Cape Canaveral Spaceport Hub

For specialized space related shipments to Cape Canaveral Spaceport, the skid strip military airport is located at Cape Canaveral Air Force Station. Plans are also underway for the development of aviation facilities and supporting services at the Shuttle Landing Facility at Kennedy Space Center. Figure 80 lists the FASP airports that are located near the Cape Canaveral Spaceport Hub.

Port Facilities

Port Canaveral, a major cargo and cruise ship terminal, is adjacent to Cape Canaveral. To allow for barge delivery of large spacecraft components, additional deepwater port facilities are located within the Cape Canaveral Spaceport territory itself.

Waterways are used at the Cape Canaveral Spaceport and Port Canaveral to transport payloads, construction material, Shuttle External Tanks, and other large spacecraft components. Within the SIS Cape Canaveral Spaceport hub, waterfront facilities at KSC include the VAB basin and KARS park boat basin. CCAFS uses the AF hangar wharf to receive SRBs after they have been recovered offshore. Areas within Port Canaveral; namely the Army Transportation wharf, EELV berth, the Poseidon and Trident wharves, and the Trident turning basin; are used for shipping space components via water.

Kars Park Boat Basin is primarily used as a recreational marina for Government and contractor employees. On occasion the Coast Guard or Florida Department of Environmental Management Marine patrol uses this basin in order to secure small (22 to 26 ft) vessels.

Solid Rocket Boosters from the Shuttle operations are recovered and transported to the CCAFS Hangar AF Wharf for disassembly and maintenance inside the AF hangar (See Figure 82). The wharf is accessed from a navigable barge channel dredged in the Banana River to accommodate the 176 ft long vessels with drafts ranging from 9.5 to 11 ft. Two berths with a notch between allow the Boosters to be floated

into position and lifted from the water with a travel lift. The concrete wharf north and south of the Booster recovery notch provides approximately 120 and 200 linear feet of berthing.

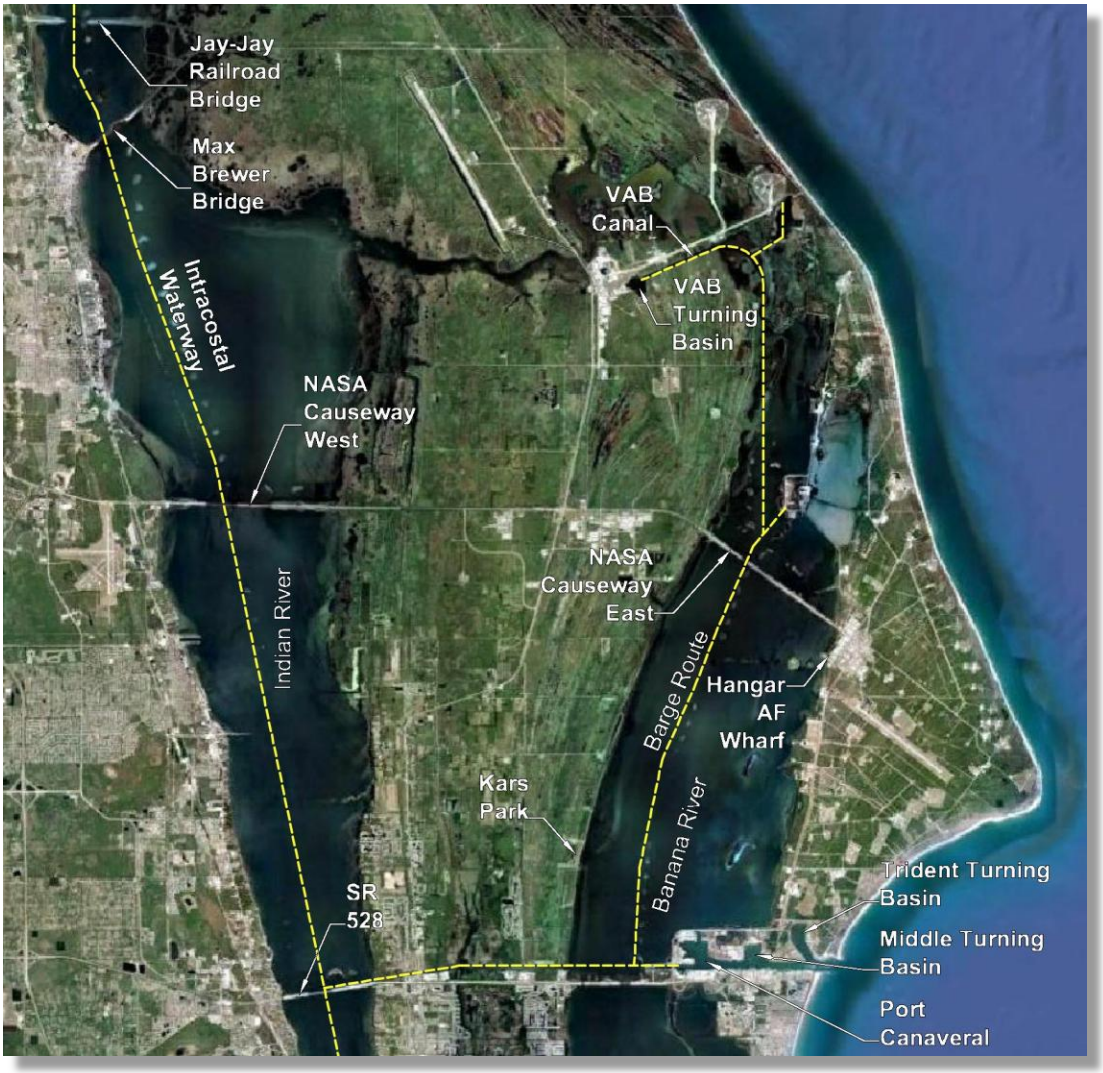


Figure 81: Spaceport Area Waterways

The military owns or controls several waterfront areas within Port Canaveral at the south entrance to CCAFS. Middle Turning Basin is jointly used by commercial, US Navy, Military Transportation Management Command (MTMC), and other vessels. The turning basin supports a 39-foot project depth and 1450 foot diameter turning circle. The Army Transportation Wharf, also called Air Force Wharf or MTMC wharf is a 600 foot long wharf with a minimum water depth of 25 feet. A Roll on, Roll off ramp is located on the North side. The EELV berth and waterfront facility, east of the Army Transportation wharf, was built to support a specially equipped vessel and to facilitate receipt and handling of Delta IV rocket boosters. The berth consists of a 330 feet long row of piles connected with a concrete personnel

walkway with railings. Four concrete pile-supported dolphins are equipped with mooring bollards and high energy, buckling column fenders. Minimum depth is 16 feet below Mean Low Water (MLW).

Figure 82: AF Hangar Wharf Cape Canaveral AFS

The Poseidon wharf at the East side of the Middle Turning Basin is 1220 feet long and 58 feet wide, minimum water depth is 35 feet below MLW and the wharf deck is about 10 feet above MLW. The wharf provides three 400 foot berths, three 60-61 ft accesses, and one 20 ft wide access. A 45-ton portal crane is available for ship service.

The Trident Turning Basin is used by U.S. Navy Fleet Ballistic Missile submarine forces and commercial use. The basin is dredged to the Trident wharf is 1,220 ft long and 68 ft wide. The wharf deck is 14 ft above mean low water. Project depth at the wharf is 41 ft at MLW. The wharf has three 60 ft wide accesses and a rail-mounted 120-ton portal crane. Ancillary facilities adjacent to the Trident wharf include three missile storage magazines, a shop support facility and portal crane. Both berths of Trident wharf are sited for handling explosives. Both the Poseidon and Trident wharves support the Navy Ordinance Training Unit (NOTU) mission requirements and are used by KSC and CCAFS on a non-interference with Navy operations basis. Port Canaveral is the busiest cruise port in the world with 4.6 million passengers passing through during 2006.

Port Canaveral also has a high volume of cargo traffic, with an estimated three million tons of bulk cargo moving through the Port each year. Commonly shipped cargo includes cement, petroleum, and aggregate. The commercial dock is 1060 feet long with a depth of 33 feet.

Figure 83: Waterfront Facilities at Port Canaveral Used for Transportation of Spacecraft Components

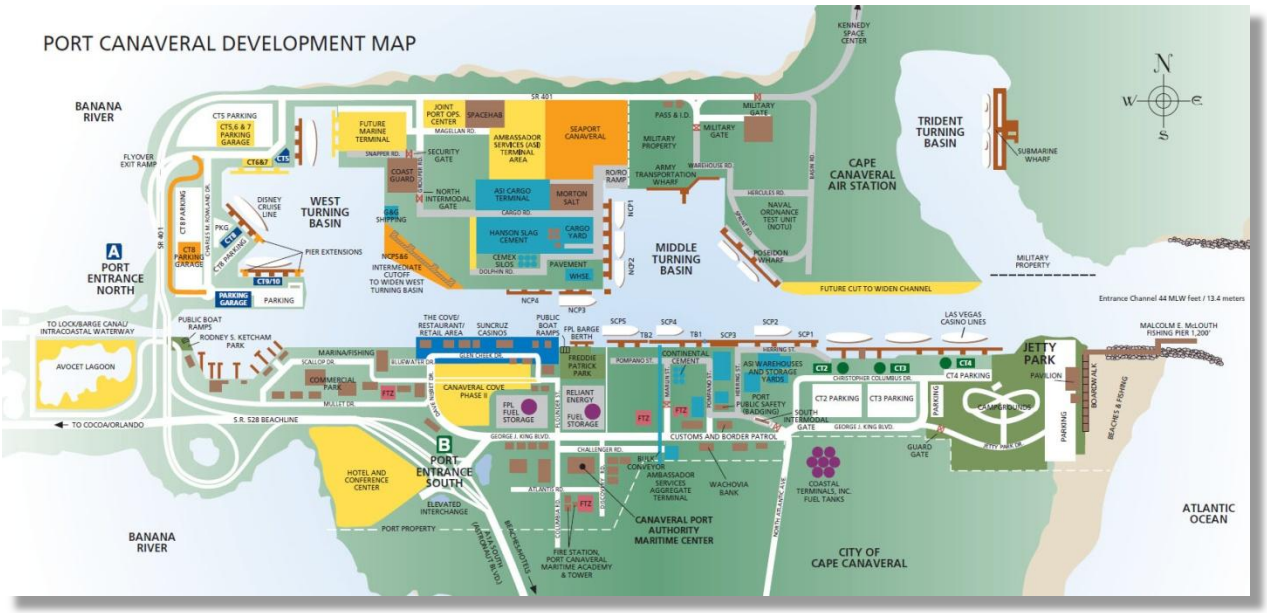


Figure 84: Port Canaveral Development Map

Rail Facilities

The NASA rail at Cape Canaveral Spaceport connects to the main line of the at the SIS rail connector which crosses the Indian River via the Jay Jay railroad bridge.

The Jay Jay railroad bridge (See Figure 85) has a movable span, with a horizontal clearance of 90 feet and a vertical clearance of 7 feet in the closed position. The bridge is owned by NASA and is located at mile 876.6 of the Atlantic Intracoastal Waterway (Ref [29]). As of the date of this report, a project by NASA to rehabilitate the Jay Jay railroad bridge is nearly complete. The project includes design modifications to the bridge, pile repairs, corrosion control, and the re-shaping of the bridge approaches to include seawall repair.

Figure 85: KSC Locomotive No. 3 Transporting SRB Segments over the Jay Jay Bridge

The NASA rail has three sections, called the Main line, East leg, and West leg. The Main line begins at the SIS connector at the entrance to Merritt Island and continues east to the Wilson Junction. From the Wilson Junction the West leg runs approximately 10 miles down the middle of the Island past the VAB area and terminates at the vehicle loading and unloading ramp in the KSC industrial area.

The East leg includes tracks owned by both the KSC and CCAFS. A number of spurs and sidings have been constructed along this leg, their current us is contained in the table below.

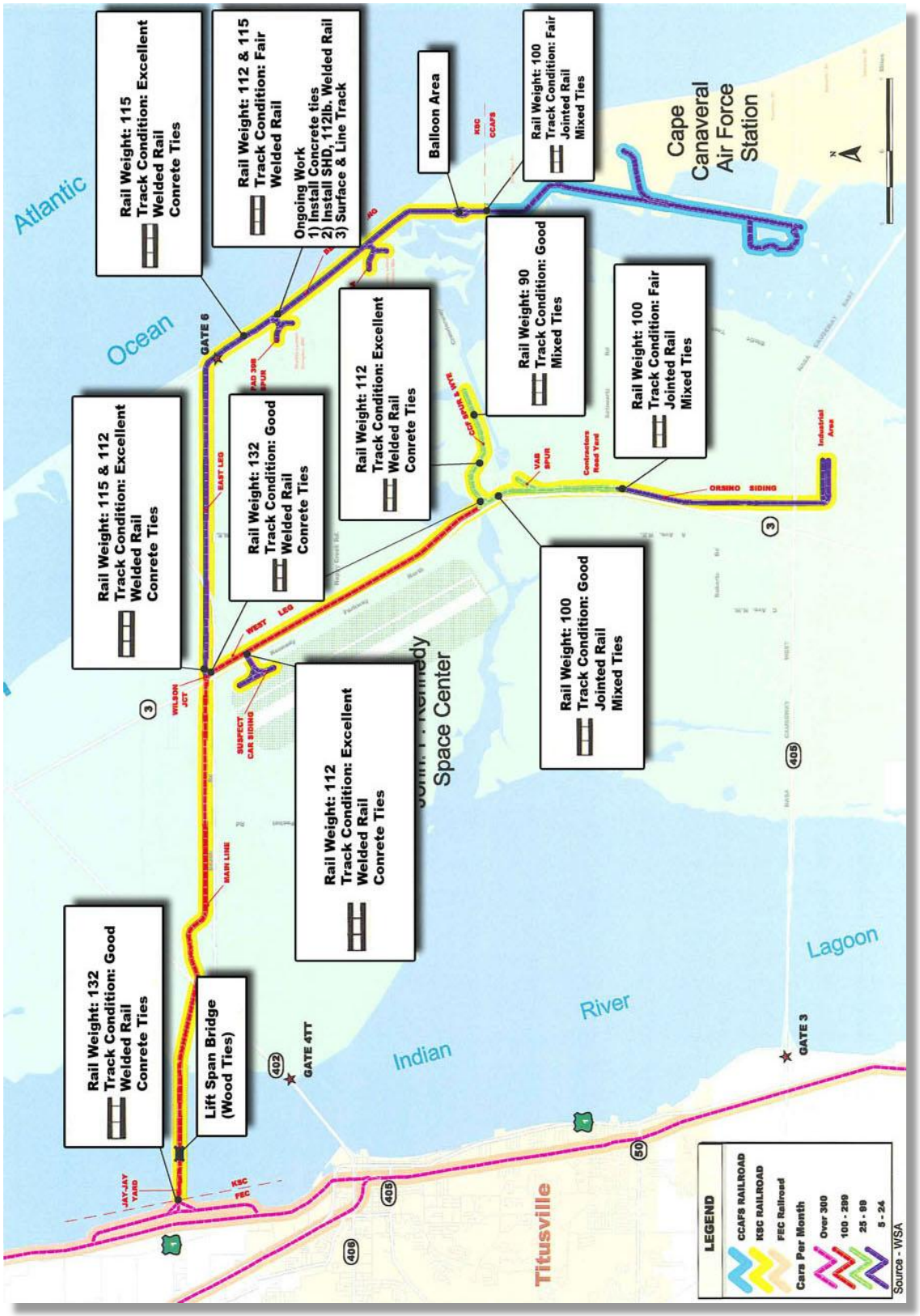


Figure 86: Locations of Railroad Facilities at KSC & CCAFS [7]

Table 8: Rail Spurs within Cape Canaveral Spaceport

Location	Facility/Spur	Use
Mile Post 17.5W North End of SLF	Suspect Car Siding	Built to store leaking Cars or those that contain Hazardous Material in an isolated area. Currently used for staging cars containing fully fueled Solid Rocket Motor (SRM) Segments.
Mile Post 12.1W Begins at Wye extends 1.5 miles eastward	CCF spur and Wye North of VAB	This Spur carries SRM segments to the RPSF via several sidetracks. East of the RPSF is the CCF area where numerous helium rail cars are changed out each month. This spur also supports a railcar for solvent delivery
Milepost 12.5W	VAB Spur	The spur leads to two tracks inside the VAB. Tracks were installed to deliver SRM segments prior to construction of RPSF. Currently out of service.
Mile post 13.1W to 14.1W	Contractors Road Yard	Used as the Locomotive Maintenance Facility and Operational Center for all rail services. Contains 3 tracks parallel to the mainline. South of this area SRM casings and oversized equipment are loaded on/off railcars. Spares are stored here.
Milepost 16.1W Adjacent to CD&SC	Orsino Siding	Adjacent to the Communications Distribution and switching Center (CD&SC). Positions engines for delivering cars into the various industrial spurs. Stages railcars into the industrial area.
Milepost 17.5W	Industrial Area Sidings	A majority of the cargo is process at supply houses in this area which have small sidings for unloading the cars. Rails terminate at a flatbed loading ramp.
East Leg	39B spur	Unused
East Leg	39A Spur	Unused
East Leg Between LC39 A & B	Beach Siding	Used to stage liquid Nitrogen tanker cars.
East leg	Balloon Siding	This is the interchange between KSC & CCAFS and is used for temporary storage of railcars containing materials used by the Air Force

Figure 87: Railroad & Interstate Highways in Florida

C.7.b POTENTIAL FUTURE CECIL FIELD SPACEPORT HUB

Cecil Field Airport in District 2, owned and operated by the Jacksonville Aviation Authority (JAA), has submitted a final application to FAA/AST for a launch site operator's license to operate a commercial spaceport.

JAA has requested that Cecil Field Airport, located within the Cecil Commerce Center, be considered for designation as an Emerging SIS Strategic Intermodal System Hub by the FDOT. In conjunction with this designation, JAA has also requested that the Brannan Field-Chaffee Road be designated as an Emerging SIS Connector that would link the Cecil Field Spaceport hub to the I-10 SIS Corridor and eventually the I-95 SIS Corridor, through Clay County & St. John's County.

Jacksonville International Airport (JIA) is currently the only designated SIS or emerging SIS aviation hub in the SIS Northeast economic region. The Cecil Field Airport is currently designated as a reliever airport for JIA. The driving time between Cecil Field Airport and JIA is approximately 44 minutes. The Cecil field airport serves clusters of aviation dependant industries in or adjacent to counties with projected population growth among the top 25% statewide.

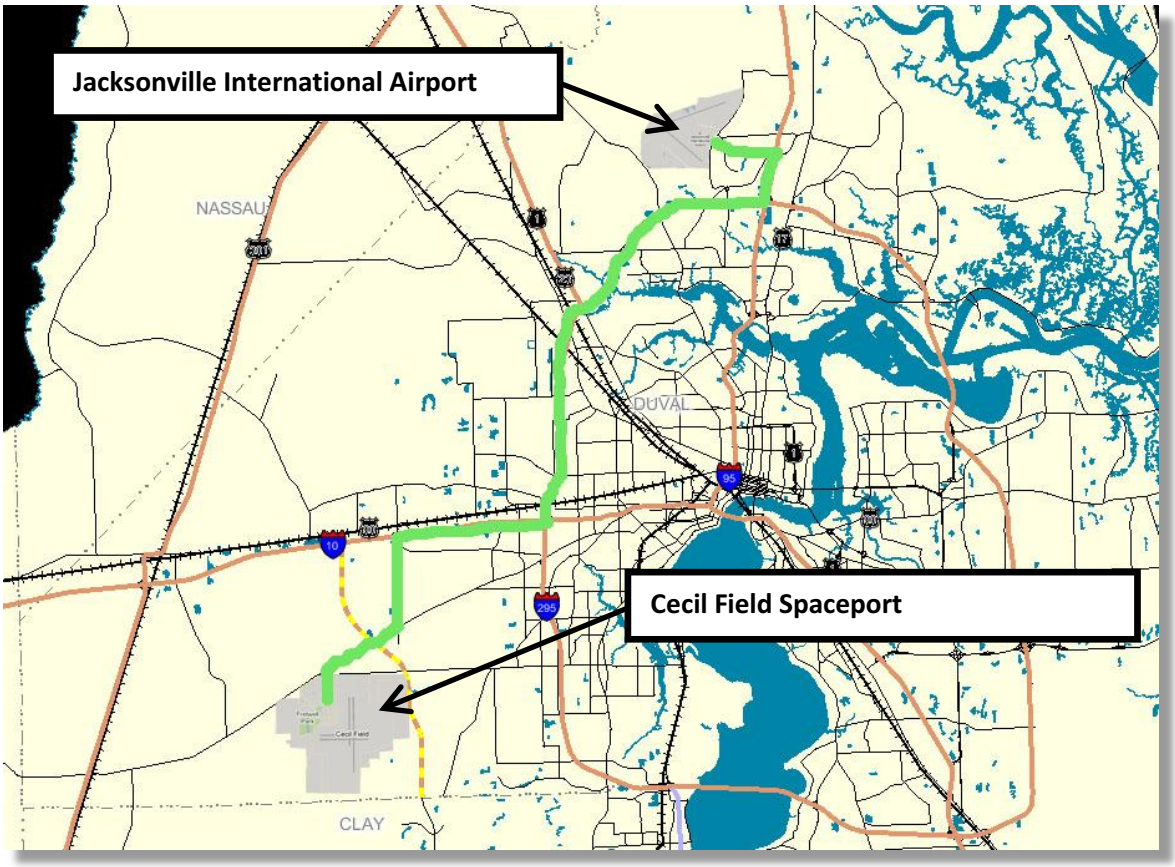
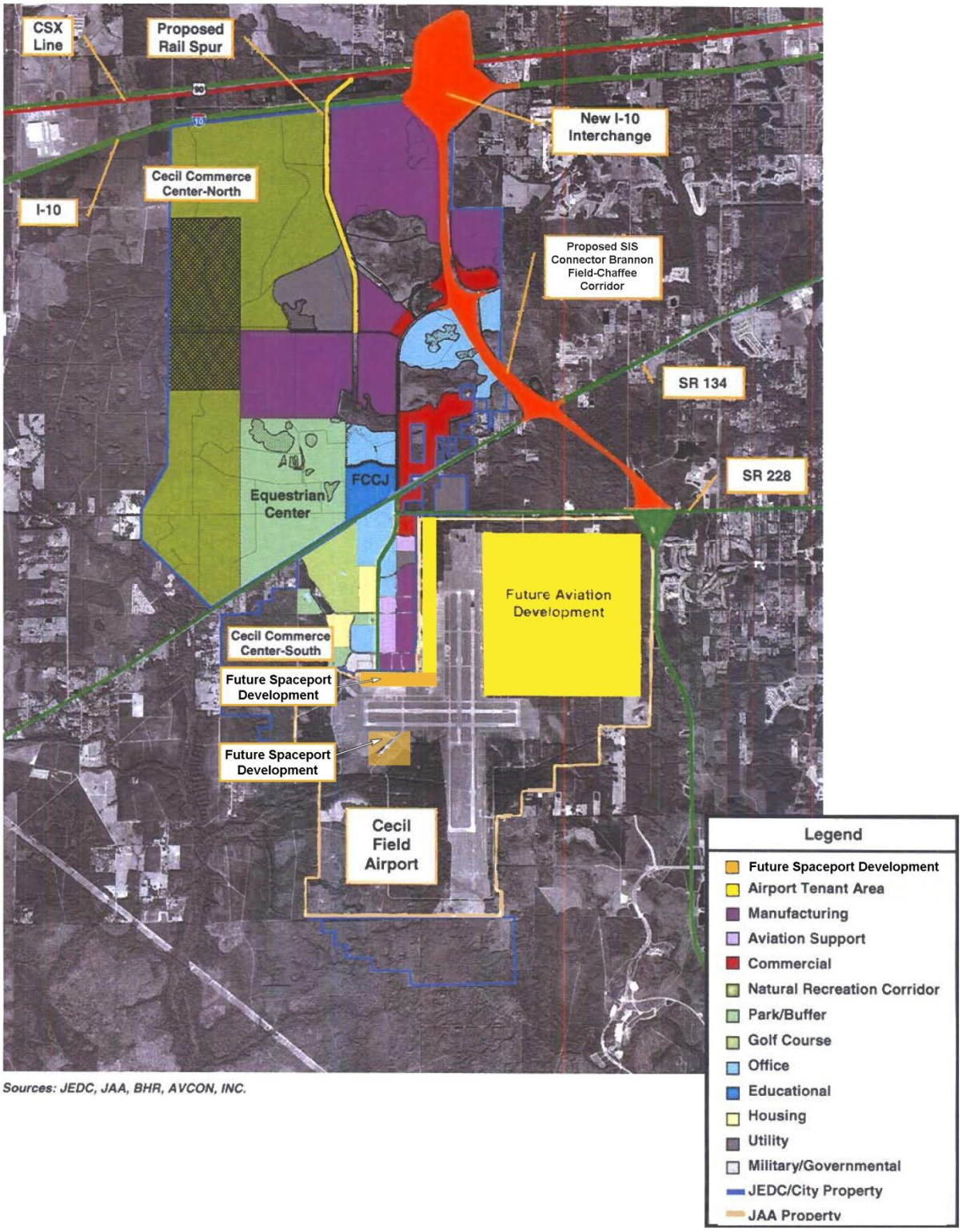


Figure 88: Cecil Field-JIA Driving Route

Currently the closest SIS/Emerging SIS roadway corridor or connector to the Cecil Commerce Center is Interstate 10 which serves as the northern property boundary to the center. The City of Jacksonville has improved the access from I-10 to the commerce center and to Clay County by constructing the first two lanes of the Brannon Field-Chaffee road connector and I-10 interchange. The second phase will provide the "Southern connector" linking Brannon Field-Chaffee with I-95 in St. Johns County. These improvements should greatly improve the potential of freight-based business developments and enhance user access to the Cecil Commerce Center. The City of Jacksonville has recently undertaken roadway improvements in the Southern Section of the Commerce Center, greatly enhancing vehicular access to the Cecil Field Airport and the industrial park facilities in this section of the Center.

Users of the Cecil Commerce Center have the opportunity to utilize a rail spur located in the Northern section of the Cecil Commerce Center. Currently a single-track rail bed, approximately 0.4 miles in length exists to the northern property boundary at I-10. Existing plans for the Commerce Center show the proposed reactivation and extension of this rail line by 2.2 miles in the north section of the center. This line connects into the CSX east-west line designated Class I and an SIS rail corridor, located between I10 and US 90. This east-west CSX line also provides connections with both Norfolk-Southern and Florida East Coast rail lines (both designated SIS corridors) in downtown Jacksonville. These rail connections are less than 20 miles from JAXPORT facilities, making it convenient for businesses to capitalize on shipping components via water (Ref [52]).



Sources: JEDC, JAA, BHR, AVCON, INC.

Figure 89: Connectors to Cecil Field Airport– Ref [52]

SECTION D: NEED, MARKET DEMAND, AND SPACE ACTIVITY FORECASTS

WHY WE ARE DOING THIS

Space Transportation is a global market with competition coming from launch sites and operators all around the world. While Florida is currently a major player in the global Space marketplace it is important to understand the existing market by analyzing existing Spaceports and available space activity forecasts. The review of spaceports in this Spaceport Master Plan is limited to Existing and Proposed Spaceports in the United States and excluded Foreign Spaceports. The space activity discussion provides a broad global look at commercial satellite and launches forecasts and summarizes the findings. To further understand the specifics of the Space market as it pertains to Florida, a public workshop was hosted in October 2009 to elicit input from stakeholders in Florida. The input received during this public workshop is also provided.

D.1 SPACEPORT MARKETS IN THE UNITED STATES

Florida currently faces competition from private and public spaceports on the national and global level. The unique characteristics of the evolving national spaceport launch-scape are identified and discussed in this section. As shown in Figure 90, the FAA/AST currently identifies 6 U.S. Federal spaceports, 5 non-Federal spaceports, and 3 proposed non-Federal spaceports.

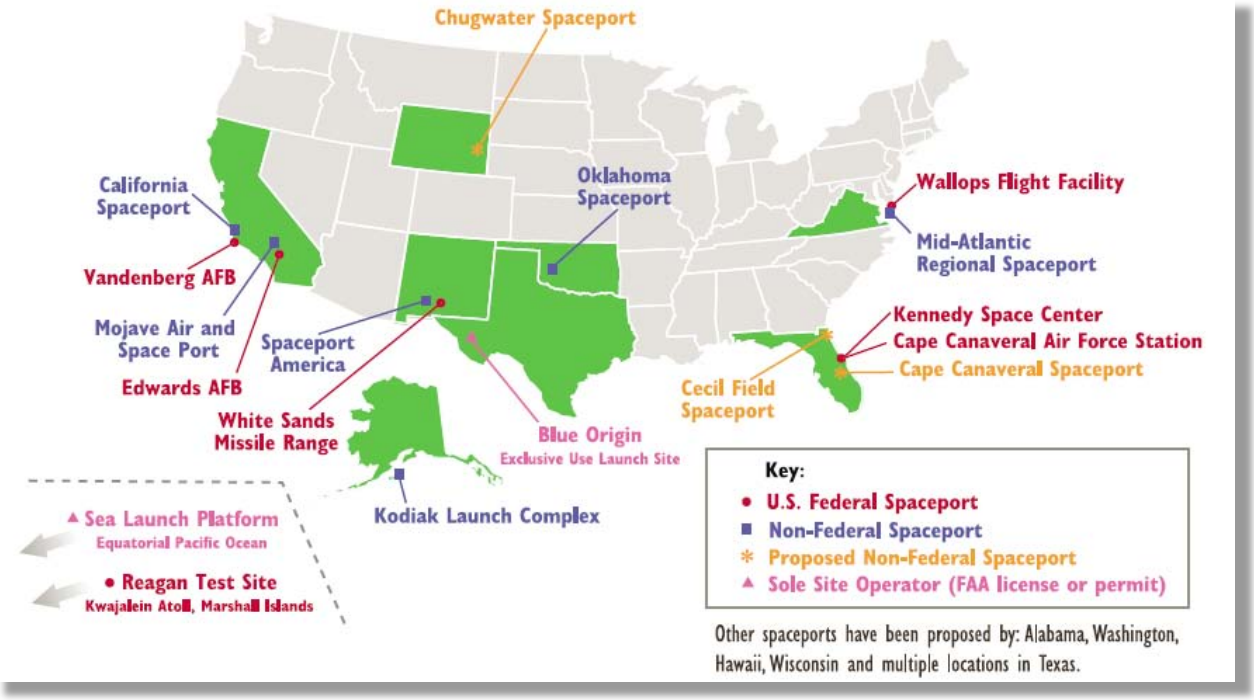


Figure 90: 2009 FAA/AST Identification of US Spaceports & Launch Sites (Ref [4])

D.1.a EXISTING FEDERAL RANGES & SPACEPORTS

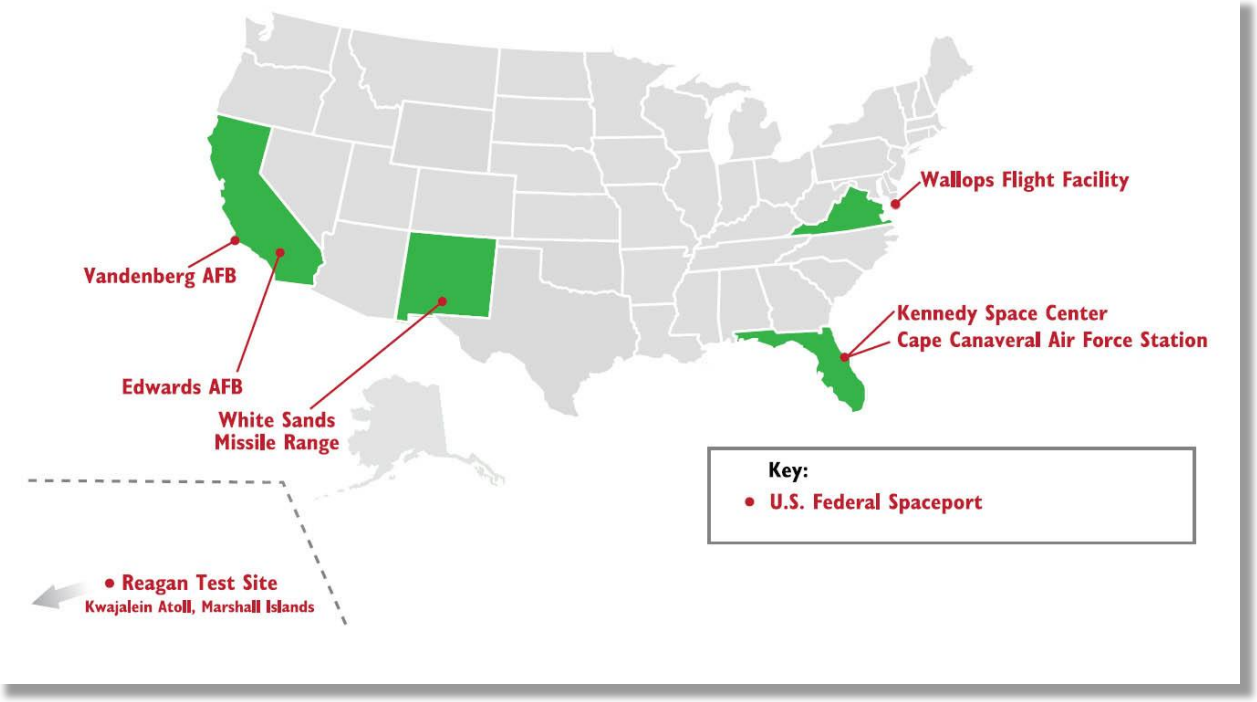


Figure 91: United States Federal Spaceports (Ref [4])

Federal Ranges have historically provided our Nation's access for Military and Civilian (NASA) space launch. These Spaceports are primarily located within or adjacent to active military bases. Their primary function is to enable space launch for National Security/ DOD programs and National prestige programs.

<u>Kennedy Space Center, FL</u>

Kennedy Space Center (KSC) is located on Merritt Island between the Banana and Indian Rivers. A more detailed discussion of KSC and its facilities is provided in Section C.

<u>Cape Canaveral Air Force Station, FL</u>

Cape Canaveral Air Force Station (CCAFS) is located South and East of Kennedy Space Center, FL. A more detailed discussion of CCAFS and its facilities is provided in Section C.

Vandenberg Air Force Base, CA

Figure 92: Vandenberg Air Force Base (SLC-3E - Atlas V)

Cooke Air Force base was transferred to the US Air Force in 1957 and renamed to Vandenberg Air Force Base (VAFB) one year later. Between March 1, 1966 and December 20, 1968, the Air Force also purchased approximately 15,000 acres from the Sudden Ranch property, located south of the installation's original boundaries through the law of eminent domain. This acquisition enlarged the base to its current 98,000 acres of which only 15% is developed. The 30th Space Wing currently is based at Vandenberg Air Force Base. Because of its specific coastal geometry Vandenberg is the only military installation in the continental United States that launches unmanned government and commercial satellites into polar orbit. It is also the only site from which ICBMs are launched toward the Kwajalein Atoll to verify weapon system performance.

The proximity to the coast offers an excellent location to safely conduct test firings of strategic missile weapon systems and space launch systems historically including: Thor, Atlas I/II/V, Titan I/II/III/IV, Minuteman I/II/III, Peacekeepers, Minotaur, Taurus, and Delta I/II/IV. In 1972, Vandenberg was selected as the West Coast Space Shuttle launch and landing site, but it has never been used as such. Since the demise of the shuttle program at Vandenberg, SLC-6 has once again been reconfigured, this time to support polar-orbit satellite launches by the Delta IV family of launch vehicles. (Ref [40]). At VAFB presently several launch complexes are currently active and capable of immediately supporting space launch missions. These launch complexes include SLC-2, SLC-3E, SLC-6, SLC-8, and SLC-576.

Edwards Air Force Base

Figure 93: Space Shuttle Landing at Edwards Air Force Base

Edwards Air Force Base (EAFB) is located in California about 100 miles north of Los Angeles. Edwards is the original landing site for the Space Shuttle and has supported a large number of shuttle landings over the years. An Environmental Assessment for reentry corridors to EAFB was completed to support lifting entry launch vehicles like the X-38. An additional environmental assessment is being developed that will allow flight tests within the atmosphere for ranges of 400 and 825 nautical miles (Ref [4]).

White Sands Missile Range

White Sands Missile Range (WSMR) is located about 16 miles northeast of Las Cruces, New Mexico and covers about 3,100 square miles. White Sands is the largest overland test range in America and attracts a wide range of customers to its site including the US government agencies, foreign nations, and private industry. White Sands is also a tertiary landing site for the Space Shuttle if both Kennedy Space Center and Edwards Air Force Base are unavailable (Ref [4]).

Wallops Flight Facility, Virginia

Figure 94: Wallops Flight Facility (Ref [4])

Wallops Flight Facility (WFF) is located on the eastern shore of Virginia. Established in 1945 under NASA's predecessor, the National Advisory Committee for Aeronautics (NACA), Wallops is one of the oldest launch sites in the world. In the early years, research at Wallops was concentrated on obtaining aerodynamic data at transonic and low supersonic speeds. Between 1959 and 1961, Project Mercury capsules were tested on suborbital flights from Wallops in support of NASA's manned space flight program before the astronauts were launched from the Cape Canaveral Air Force Station in Florida.

Since 2001, engineers at NASA Wallops Flight Facility have been developing new range technologies, systems and approaches to improve the cost and responsiveness of launch and flight test activities, within the constraints of available funding and program schedules. With its sounding rocket and balloon flights carrying scientific payloads, its aeronautical systems testing, its range support for Space Shuttle launches, and its educational outreach activities, WFF supports all of NASA's Mission Directorates.

The Wallops Island Launch Site includes six launch pads, three blockhouses for launch control, and assembly buildings to support the preparation and launching of suborbital and orbital launch vehicles. The launch vehicles at this spaceport include Minotaur and sounding rockets. Sounding rockets are an instrument carrying rocket designed to take measurements and perform scientific experiments during its sub-orbital flight (Ref [41]). WFF is also conducting Small Launch Vehicle Research. The Small Launch Vehicle Research Project (SLVR) is a Wallops effort to develop and provide a comprehensive, end-to-end payload preparation, integration and test, launch and on-orbit support capability for small payloads (Ref [42]).

Wallops Flight Facility is also home to the Mid Atlantic Regional Spaceport (MARS). MARS is mentioned in more detail on page 111.

Reagan Test Site, Kwajalein

Figure 95: Kwajalein Atoll (Ref [4])

The Ronald Reagan Ballistic Missile Defense Test Site, commonly referred to as the Reagan Test Site (RTS) is located in the Republic of the Marshall Islands. The Kwajalein Atoll extends from 8”45’ north to 9”25’ north latitude and from 166”45’ east to 167”50’ east longitude. The nearest United States location is Hawaii, located approximately 2500 miles East Northeast of Kwajalein.

For domestic space operations, RTS is one of several tracking stations located around the globe that provides nearly continuous coverage of all manned space flight missions. Working in close cooperation with NASA, RTS has participated in numerous space experiments, providing ground radar and optical observation of experimental objects. The Reagan Test Site encompasses approximately 750,000 square miles, although the total land area is only about 70 square miles.

It primarily functions as a test facility for U.S. missile defense and space research programs. The Reagan Test Site is under the command of the US Army Kwajalein Atoll. Launch activities at the test site include ballistic missile tests, ABM interception tests, meteorological sounding rockets and a Falcon 1 commercial spaceport for SpaceX at Omelek Island (Ref [43]).

D.1.b EXISTING COMMERCIAL SPACEPORTS

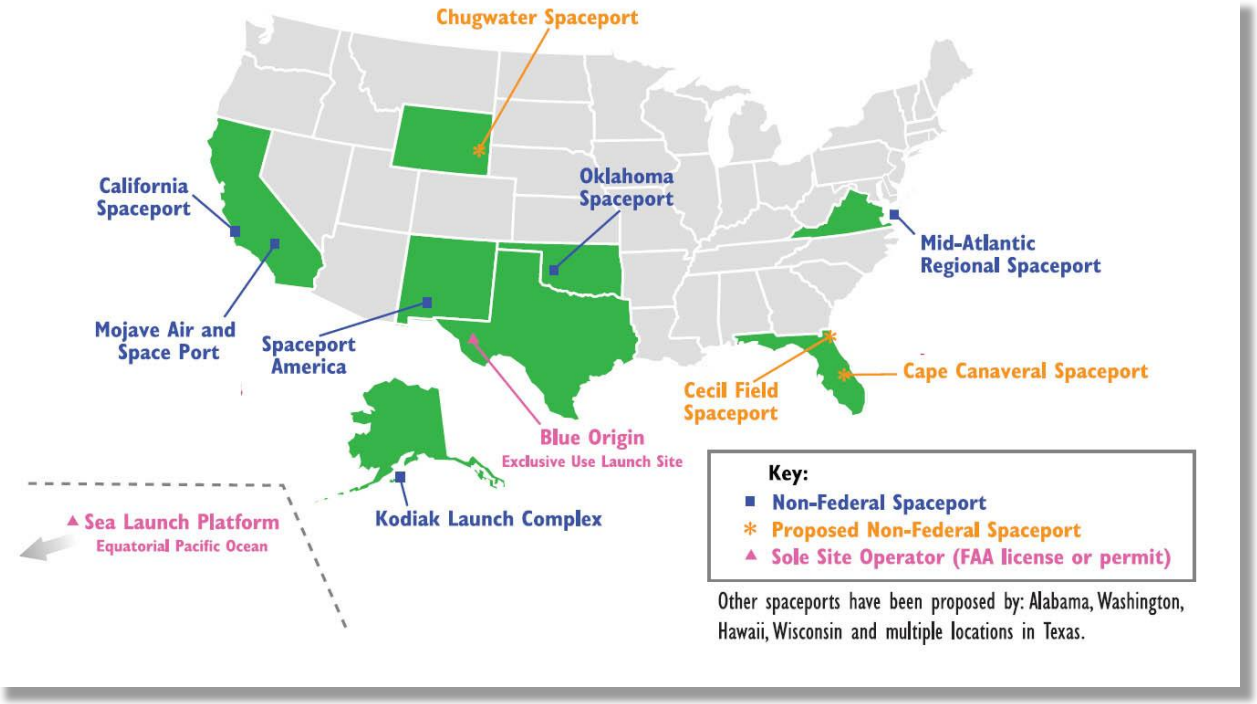


Figure 96: Non-Federal US Spaceports (Existing & Proposed) (Ref [4])

Commercial spaceports are being developed throughout the United States to support a wide range of commercial space related activities including space research, suborbital, and orbital missions. The following is a brief description of some of these commercial spaceports.

<u>Mid-Atlantic Regional Spaceport, VA (1998)</u>

The Mid-Atlantic Regional Spaceport (MARS) is located at NASA's Wallops Flight Facility (WFF) on Wallops Island, in Virginia. MARS is a partnership between the Virginia Commercial Space Flight Authority, NASA, Virginia Economic Development Partnership, Old Dominion University, Virginia's Center for Innovative Technology, and Maryland Department of Business and Economic Development Partnership. Using these partnerships, MARS has been able to provide tax incentives and financial assistance to bring new space related businesses to their area.

MARS has been operating since 1998 and provides access to two launch pads (Pad 0-A, and Pad 0-B), a multiple bay vehicle processing facility, multiple clean room areas, an instrumented heavy-lift airport, and services provided from the NASA launch range. At this time MARS is currently in the process of modifying Launch Pad 0-A to support Orbital Science's Taurus II orbital launch vehicle.

In March 2008, Virginia created the "Zero Gravity, Zero Tax" incentive that eliminated taxes on business earnings related to human spaceflight training or actual space flights launched from the MARS (Ref [4])

Kodiak Launch Complex, AK (1998)

The Alaska Aerospace Development Corporation (AADC) completed the Kodiak Launch Complex (KLC) in 2000. It is located in Narrow Cape, Alaska on Kodiak Island and at the time was the first new U.S. "Greenfield" launch site built since the 1960s. Funding originally came from the U.S. Army, U.S. Air Force, NASA, state of Alaska, and various private firms. Alaska provided the property and the port was given a tax-free status. The site is currently self-sufficient (Ref [4]).

The KLC is located at 57 degrees North latitude. This 4.8-square mile site is 272 miles south of Anchorage and 25 miles southwest of the city of Kodiak. The markets served vary from military, space science payloads under 2,200 lbs, government and commercial telecommunications and some remote sensing. Kodiak is designed to launch up to the Castor 120-based vehicles and can launch suborbital as well as orbital payloads capable of reaching the Low Earth Orbit (LEO), Polar and Molniya elliptical orbits. Kodiak provides testing for the nation's missile defense system as well.

The associated facilities supplied at Kodiak include a payload processing facility, a launch service structure, an orbital launch pad, an assemblies/spacecraft transfer facility, a suborbital second launch pad, a launch control center, a maintenance and storage facility, a Range Safety and Telemetry System (RSTS), and an Integration and Processing Facility. New facilities are being planned for future expansion. Roadways have been improved upon and fiber optic connectivity to the mainland is in place.

California Commercial Spaceport, CA (1999)

California Commercial Spaceport is located at 34 degrees North latitude within Vandenberg Air Force Base, California. This FAA licensed port is operated by Spaceport Systems International (SSI) on a 25-year leased property as of 1995. Missions can range from a variety of low-polar-orbit inclinations of azimuths between 220 and 165 degrees. Minotaur launches can be completed at SLC-8 which has an infrastructure consisting of a pad deck, support equipment building, launch equipment vault, launch duct, launch stand, access tower, communications equipment, and Integrated Processing Facility (IPF) launch control room as well as Western Range interfaces needed to support a launch. In 2008 a modification was completed to the access tower at SLC-8 provide for 100k clean room operations. Orbital Sciences also announced that the inaugural flight of the Minotaur IV is scheduled to take place from the California Spaceport's launch pad in 2010 (Ref [4]).

Original payload processing services revolved around the refurbishment of the Shuttle Payload Preparation Room. The clean room is large enough to process three space shuttle payloads at once and is now leased by California Spaceport as the IPF. A few examples of work completed here include

booster processing, upper stage processing, encapsulation, satellite processing for military commercial and civil services, and related administrative activities. The IPF is believed to be capable of handling all customer payload processing needs.

Mojave Air & Space Port, CA (2004)

The Mojave Air & Space Port is located in Mojave, California and was licensed by the Federal Aviation Administration's Commercial Space Transportation (FAA/AST) in June 2004 to support horizontal launches of suborbital Reusable Launch Vehicles (RLV).

Infrastructure and facilities include but are not limited to an air traffic control tower, three runways with associated taxiways, terminal and industrial area, hangars, offices, maintenance shop, fuel services facilities and aircraft storage. The main runway has been extended to 12,500 feet for larger aircrafts and RLV's and was completed in 2006. Many upgrades have been completed with the majority of the costs being covered by FAA airport improvement program funds. Many organizations call the airport home and it is the location of many new record-breaking events including the Scaled Composites winning the Ansari X Prize with the successful launches of SpaceShipOne.

Oklahoma Spaceport, OK (2006)

The Oklahoma Spaceport is part of the Clinton-Sherman Industrial Airpark near Burns Flat, Oklahoma. In June 2006, Oklahoma Space Industry Development Authority (OSIDA) received the FAA/AST license to operate a launch site for horizontal takeoff and landing suborbital RLV. This port has its own airspace and does not require military permission to operate. The five year license granted by the FAA still requires individual operators to apply for a separate launch license or permit.

Oklahoma launch infrastructure consists of a 13,500 foot runway, a 50,000 square foot manufacturing facility, maintenance and painting hangar, 6 commercial hangars, control tower, crash/rescue facility and 168 square miles of land for future construction.

Spaceport America, NM (2008)

Spaceport America, previously known as Southwest Regional Spaceport, is currently in development in Sierra County, New Mexico. While the spaceport has been hosting suborbital rocket launches since 2006, it only recently obtained the FAA/AST license for vertical launch activity in December 2008. Development of the spaceport continues with an influx of state, local, and private financing. Virgin Galactic has signed a 20-year lease at the spaceport and onsite construction will begin this year with the goal of having the terminal and hanger facilities completed by 2010.

Cecil Field Spaceport, FL (Spaceport Application Pending)

A discussion on Cecil Field Spaceport is provided in Section C.5.b and page 70.

Space Florida Spaceport, FL (Spaceport Application Pending)

The Space Florida Spaceport is identified in the "2009 FAA/AST US Commercial Space Transportation Development and Concepts" (Ref [4]) as the Cape Canaveral Spaceport. A discussion on Space Florida Spaceport is provided in Section C.5.a on page 69.

Commercial Spaceport Licensing Status

Not every commercial spaceport is created equal and depending on the FAA/AST license obtained the spaceports may be limited to very specific launch activity. The following table provides a summary of the current status of FAA/AST launch site licensing for the identified commercial spaceports.

Table 9: Commercial Spaceport FAA/AST Licensing (Ref [4])

Spaceport	State	Orbital		Suborbital	
		Vertical	Horizontal	Vertical	Horizontal
MARS	VA	✓			
Kodiak Launch Complex	AK	✓		✓	
California Spaceport	CA	✓			
Mojave Air and Space Port	CA				✓
Oklahoma Spaceport	OK				✓
Spaceport America	NM			✓	
Cecil Field Spaceport	FL				Pending
Space Florida Spaceport	FL	Pending		✓	

D.2 MARKET ANALYSIS

This market analysis focuses primarily on the space industry as it pertains to Space Florida's objectives. Much of the information below is from the draft Space Florida Strategic Business Plan, Version 2009, dated May 15, 2009 (Ref [14]). Global, U.S., and Florida space markets were assessed to evaluate and illustrate past, present, and projected markets in order to align Space Florida's resources and pursuits with current and developing space market environments.

D.2.a SUMMARY OF KEY FINDINGS

- The space industry is a significant contributor to the global marketplace with estimated revenues around $257 billion and steady yearly increases despite shifting economies.
- Commercial activity, including infrastructure, satellite services, and launch services, comprised 68% (approximately $175 billion) of the space industry revenues in 2008.
- Commercial launches in US accounted for more than a third of all successful orbital US launches in 2008 with the remaining launches supporting NASA and DoD missions.
- Over the past ten years about 32% of all successful commercial orbital launches in the world occurred within the US. In the same time only 37% of all successful orbital commercial launches from the US occurred in Florida.
- From the beginning of 2007 through the end of 2008 only one of the 15 commercial launches in the US occurred in Florida (Ref [16]).
- The space industry is becoming a significant global growth market as businesses find more opportunities to harness space for a range of commercial applications.
- Florida has a formidable position within the aerospace industry, with strengths in space launch, space vehicle processing, and space research.
- Aerospace is a very competitive industry and has been targeted by other states and nations, all seeking leadership in the economic growth and technological advancements linked with increased commercial activities in space.
- Every dollar earned in the space and aeronautics industry in Florida generates $2.83 in earnings for other sectors of the economy.
- Although the launch sector contributed the smallest proportion of total satellite industry revenues, it employed the second-highest number of satellite personnel in the United States. With this level of workforce expertise in satellites, Florida is well-positioned to expand into additional areas within the satellite value chain, including satellite design and manufacturing.
- Florida has great opportunities in the aerospace market over the next several years to:
    - Secure the State's dominant role in U.S. vertical launches for military and civil (i.e., NASA) markets, and make significant progress in bringing back commercial launch business that has been lost to offshore competitors
    - Capture a larger share of the supply chain activity for space vehicles and related equipment, particularly within NASA's Constellation and COTS/CRS programs

- Position Florida to capture a significant share of the emerging global market for horizontal launches, including sub-orbital personal spaceflight transportation and cargo, and orbital payload delivery
- Position for global leadership in new space markets and technologies

D.2.b GLOBAL MARKET OVERVIEW

The space industry includes the design, manufacture, repair, refurbishment, and maintenance of missiles, propulsion units, spacecraft, satellites, and their components; various aspects of defense technology; satellite services; the transportation of people and goods via space; and related research, technology, and support services. Space is a diverse field and spans across commercial, civil, and military applications (See Figure 97).

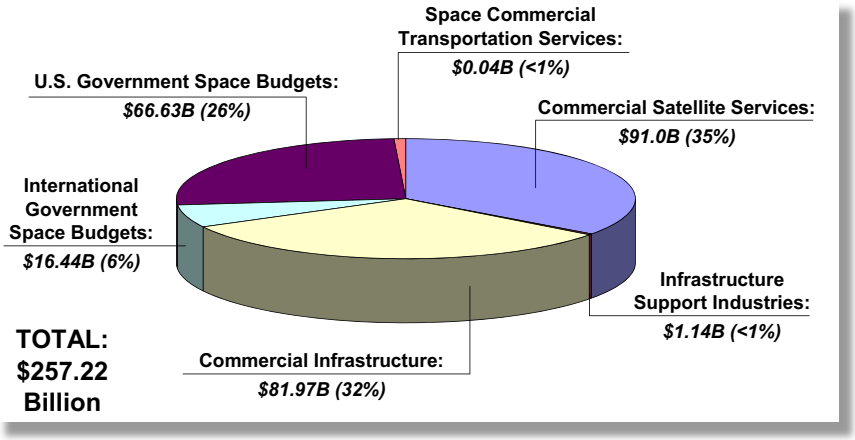


Figure 97: Global Space Activity, 2008 (Ref [15])

In Futron's 2009 Space Competitiveness Index, Executive Summary, it was noted that in the ten year period **between 1999 and 2008, the US share of the global launch market averaged about 35%**. The Futron analysis included both commercial and non-commercial launches around the world during this time.

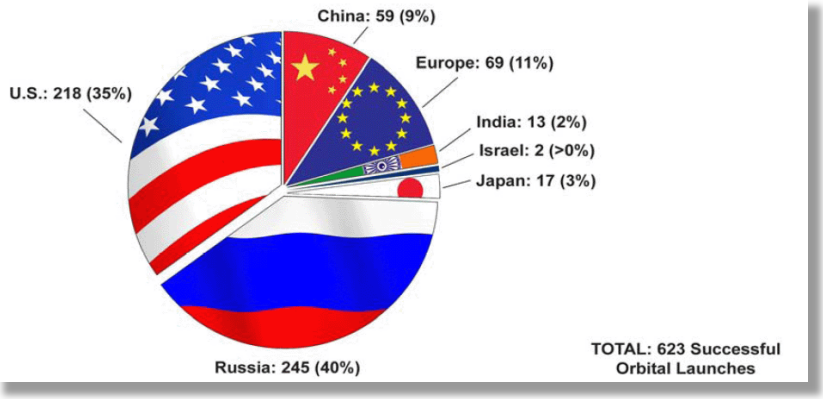


Figure 98: US Share of Global Launch Market (1999-2008) (Ref [27])

In March of 2009, The Teal Group released revised figures for the Worldwide Mission Model survey of future space payloads (See Table 10). The study encompasses 2,033 payloads proposed from 2009-2028. Note that the satellite forecast does not equal launch forecasts because many of the projected payloads will be launched on rockets carrying multiple satellites.

Table 10: Worldwide Satellite Forecast for 2009-2028 – The Teal Group

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	TOTAL
SATELLITES	313	338	295	175	115	135	111	86	48	42	46	32	36	24	28	56	49	52	39	13	2033

Commercial payloads, which include traditional telecommunications and TV broadcasting, digital radio and direct TV broadcasting, broadband and mobile communications, and earth imaging satellites, account for 41% of the payloads in the Model, with 39% for civil payloads, 17% for military, and 3% for university. The United States alone accounts for 39% of these payloads.

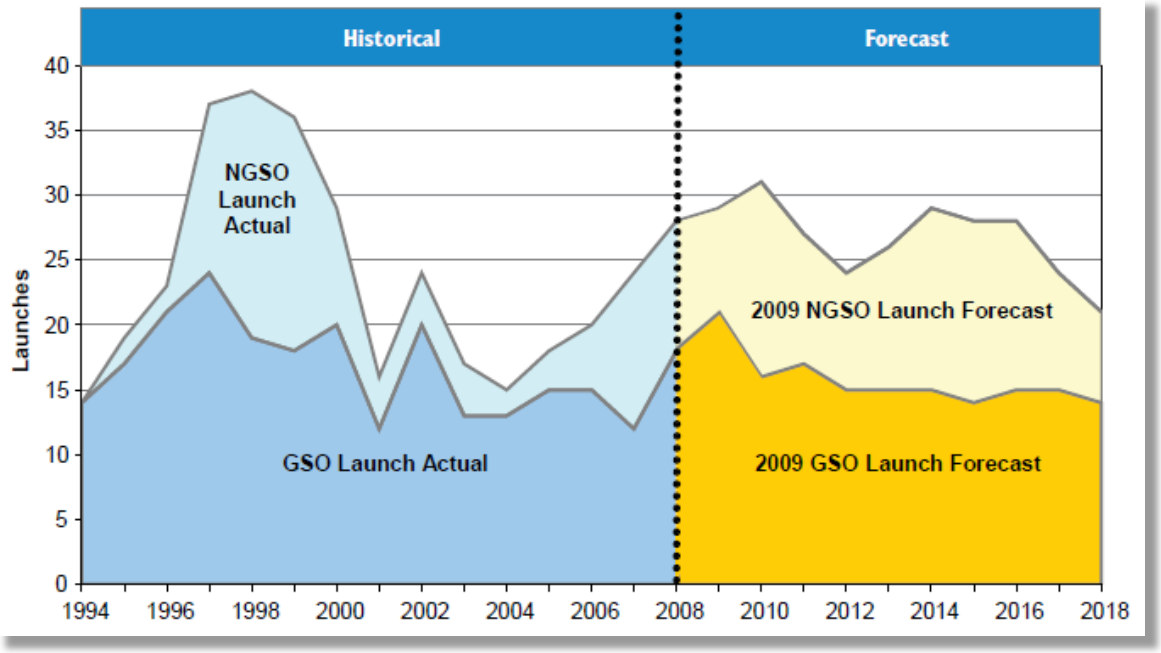


Figure 99: Global Combined GSO and NGSO Historical Launches and Launch Forecasts (Ref [16])

The commercial space transportation market is driven largely by the demand for launches of geosynchronous orbit (GSO) telecommunications satellites and, and to a lesser extent, a variety of non-geosynchronous orbit (NGSO) satellites. A geosynchronous orbit is 21,480 mi above the equator and is an orbit around the Earth with an orbital period matching the Earth's rotation period. Since 2004, nearly

70 percent of commercial launches have been to GSO, which generates more revenue than the NGSO market and generally deploys larger payloads.

GSO satellites lead again in 2009 and they will likely still be the primary commercial market driver in the near term. The following trends are expected:

- Limited growth of launch demand for GSO communications satellites;
- A near-term trend of heavier GSO satellites followed by a decline;
- Some limited growth in small mass GSO satellites; and
- Some growth in launch demand for non-geosynchronous orbits communication satellites as existing constellations are replenished or replaced with next-generation systems and as new vehicles become available.

Non-geosynchronous orbits include orbits such as low Earth orbit (LEO), medium Earth orbit (MEO), elliptical orbits (ELI), and external orbits (EXT) such as to the Moon or other Solar System destinations.

Low Earth Orbits (LEO) are the lowest altitude a spacecraft must achieve in order to orbit the Earth. This ranges from 100 miles to 1,500 miles in altitude, varying between 0 degrees inclination for equatorial coverage to 101 degrees inclination for global coverage. These orbits circle the Earth once in approximately ninety minutes. Most satellites, the International Space Station, the Space Shuttle, and the Hubble Space Telescope are all in LEO.

Medium Earth Orbits (MEO) begin at an altitude of 1,500 miles, typically at 45 degrees inclination to allow for global coverage using fewer high-powered satellites, and is particularly suited for constellations of satellites mainly used for telecommunications.

Elliptical Orbits (ELI) are egg shaped orbits and have apogees ranging from 4,725 miles to 22,000 miles in altitude and up to 116.5 degrees inclination, allowing satellites to “hang” over certain regions of the earth.

External Orbits (EXT) or non-geocentric orbits are centered on a celestial body other than Earth. They differ from ELI in that they are not closed loops around the Earth and a spacecraft in EXT will not return to an Earth orbit.

Today’s NGSO launch market is characterized by:

- An increase in activity by telecommunications satellites weakened by constricted capital markets;
- A steady demand by international science;
- The new and promising sector of orbital facility assembly and services; and
- A small but steady launch demand for commercial remote sensing satellites.

Table 11: FAA/AST Commercial Space Transportation Satellite and Launch Forecast (Ref [16])

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	Average
SATELLITES												
GSO Forecast (COMSTAC)	27	21	22	20	20	20	19	20	20	19	208	20.8
NGSO Forecast (FAA)	19	53	26	12	14	37	41	36	12	10	260	26.0
Total Satellites	46	74	48	32	34	57	60	56	32	29	468	46.8
LAUNCH DEMAND												
GSO Medium-to-Heavy	21	16	17	15	15	15	14	15	15	14	157	15.7
NGSO Medium-to-Heavy	6	10	6	7	8	12	12	11	6	5	83	8.3
NGSO Small	2	5	4	2	3	2	2	2	3	2	27	2.7
Total Launches	29	31	27	24	26	29	28	28	24	21	267	26.7

Fifty-one (51) percent of all satellites seeking commercial launch services during the next ten years are in the telecommunications sector. Each launch is expected to be multi-manifested at a rate of six satellites per launch.

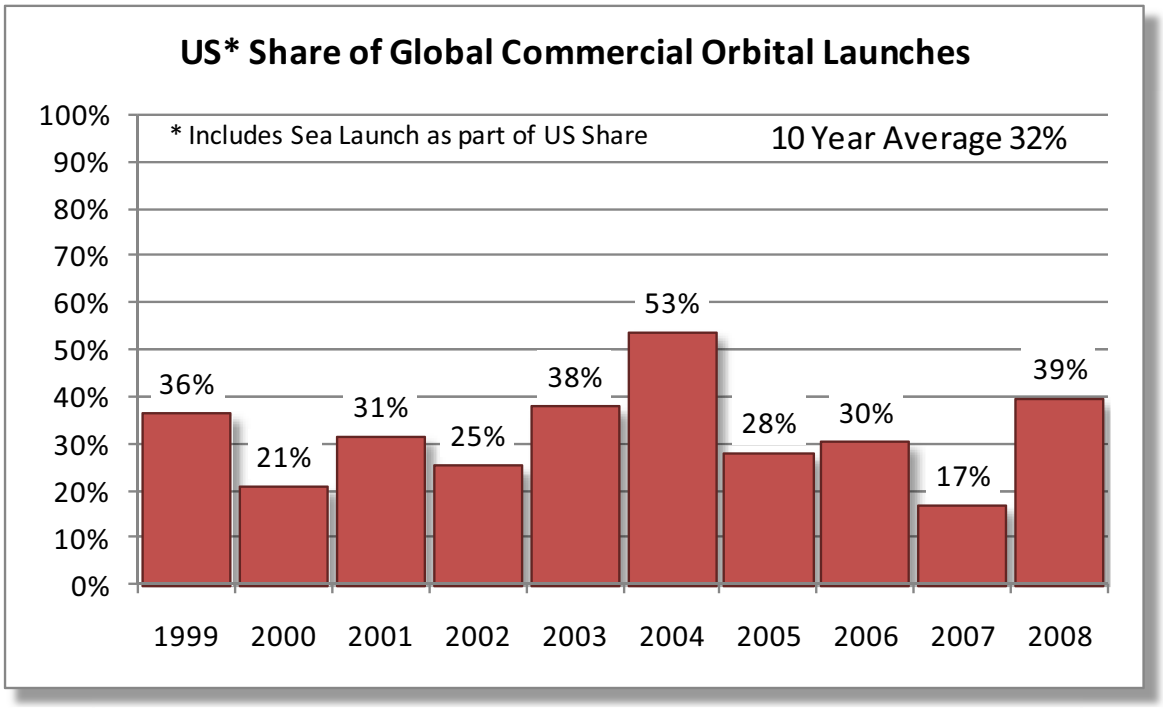


Figure 100: US Share of Global Commercial Orbital Launches

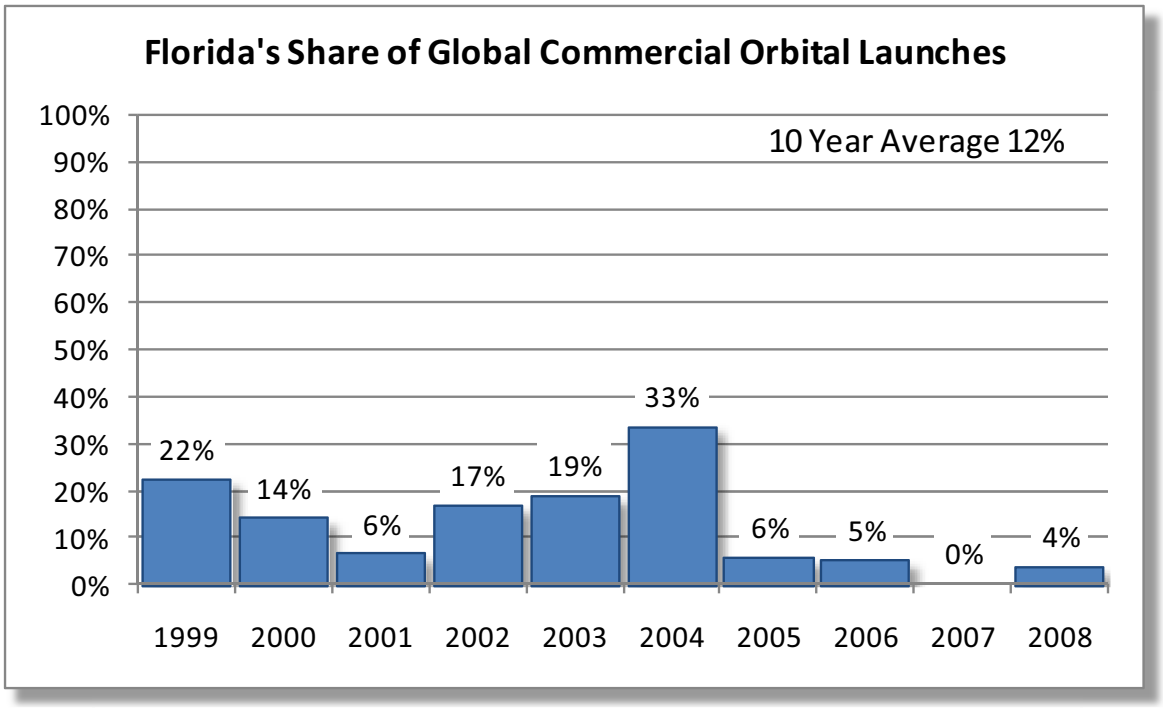


Figure 101: Florida's Shares of Commercial Orbital Launches

Florida has historically averaged about 12% of all Worldwide Commercial launches. If we apply this average to the Total Launches in Figure 16, it is expected that Florida should host an average of three (3) commercial launches annually over the next 10 years.

With Florida currently averaging only 12% of the global commercial space launch market there is great potential for Florida to be more competitive in the international launch market and secure a larger share of the launches.

D.2.c UNITED STATES MARKET OVERVIEW

Between 1999 and 2008, the US share of the global launch market was about 35%. During that same time, the US share of the global commercial market was about 32%. The US Share of both commercial and non-commercial launches is split between the major US Spaceports, including Cape Canaveral Air Force Station, Kennedy Space Center, Vandenberg Air Force Base, Wallops Flight Facility, Kodiak Launch Complex, Kwajalein, and Sea Launch (Multinational).

As shown in Figure 102, Florida's share of the US share of commercial orbital launches averaged about 37% a year with decreasing trend over the past several years. When looking at all successful orbital

launch activity in the past ten year, Florida averaged a larger share of 47% annually, receiving a bump from the Space Shuttle missions.

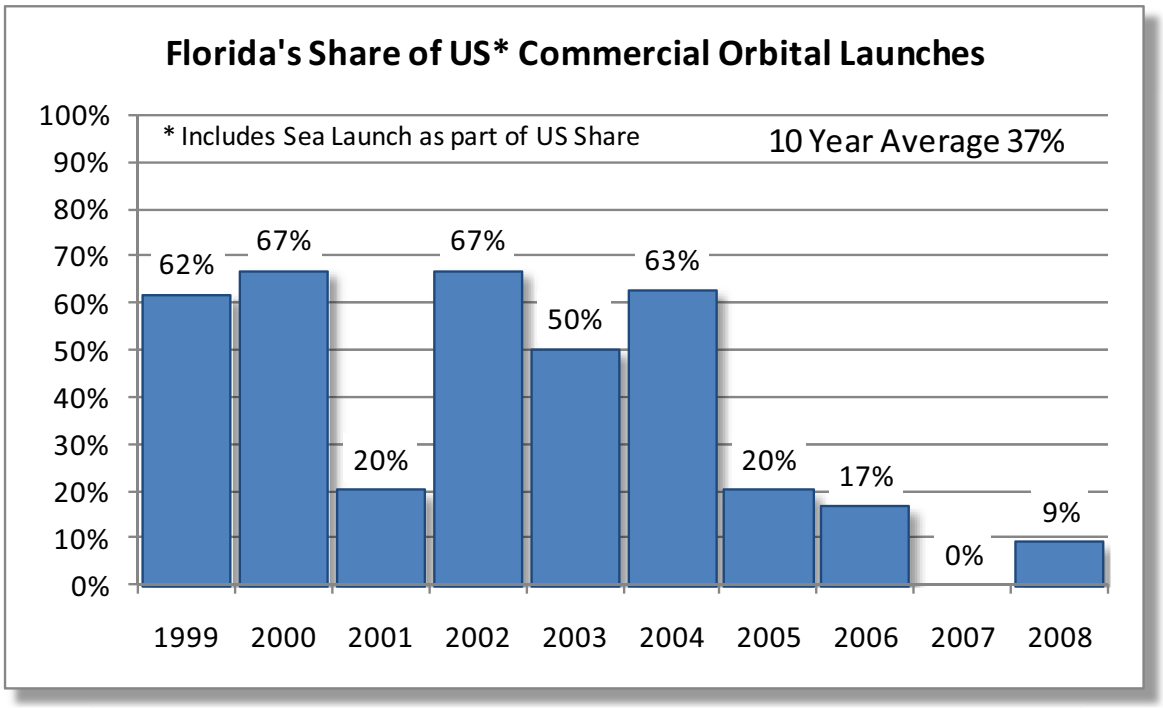


Figure 102: Florida's Share of US Commercial Orbital Launches

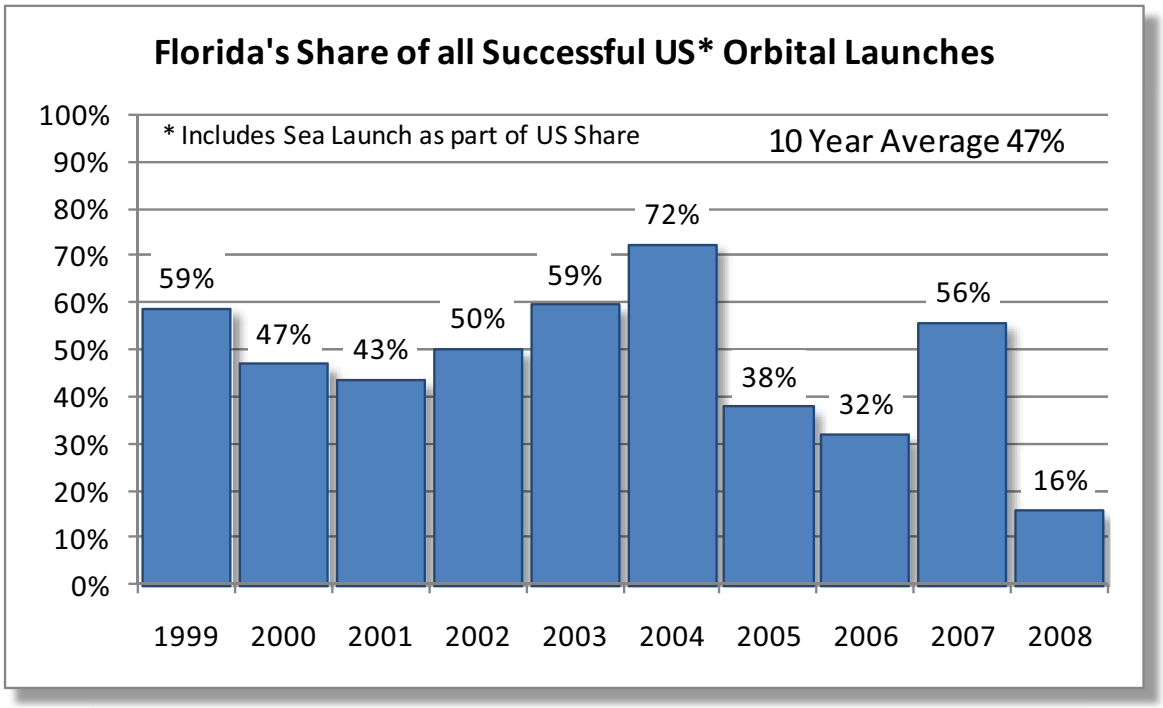


Figure 103: Florida's Share of all Successful US Orbital Launches

FAA-Licensed and Permitted Launch Activities

In 2008, the Federal Aviation Administration's Office of Commercial Space Transportation (FAA/AST) licensed 11 orbital launches valued at approximately $640 million. Ten of the launches were successful and one launch failed. These launches included:

- Five Zenit-3SL launches (for the Sea Launch platform) carrying five commercial payloads to geosynchronous orbit (GSO);
- Two Delta II launches of remote sensing payloads to low Earth orbit (LEO);
- Two Falcon 1 launches of demonstration payloads to LEO, one of which failed;
- One Atlas V launch of a commercial payload to GSO; and
- One FAA-licensed Pegasus XL launch of a government payload to LEO.

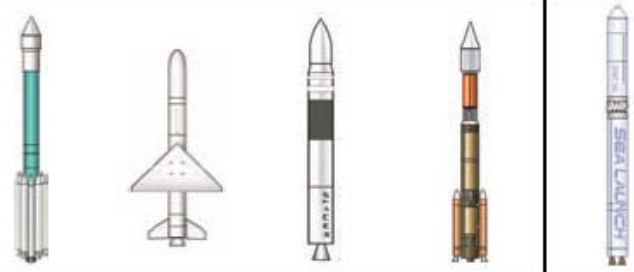
	United States				Multinational
					
Vehicle	**Delta II**	**Pegasus XL**	**Falcon 1**	Atlas V	**Zenit-3SL**
2008 Total Launches	5	2	2	2	5
2008 Licensed Launches	2	1	2	1	5
Launch Reliability (2008)	5/5 (100%)	2/2 (100%)	1/2 (50%)	2/2 (100%)	5/5 (100%)
Launch Reliability (Last 10 Years)	62/62 (100%)	13/13 (100%)	1/4 (25%)	14/14 (100%)	28/30 (93%)
LEO kg (lbs)	6,100 (13,440)	443 (977)	454 (1,000)	20,520 (45,240)	15,246 (33,541)
GTO kg (lbs)	2,170 (4,790)	--	--	8,670 (19,110)	6,100 (13,440)

Figure 104: FAA-Licensed Vehicles Launched in 2008 (Ref [17])

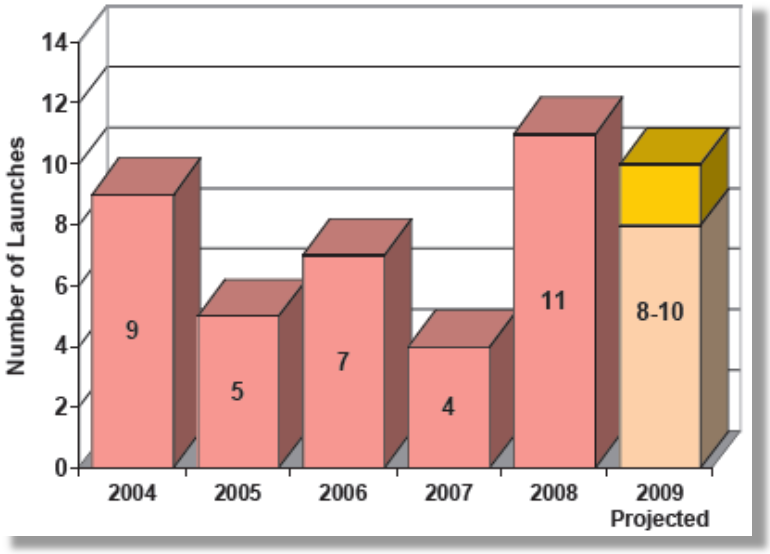


Figure 105: FAA-Licensed Commercial Orbital Launches (Ref [17])

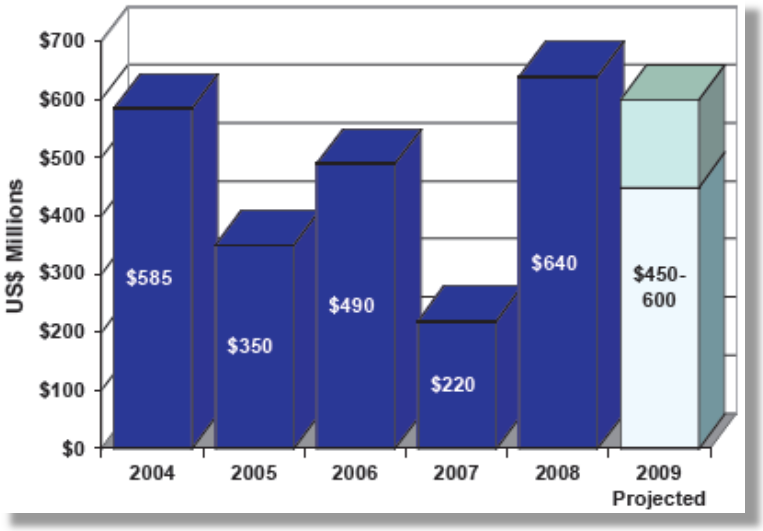


Figure 106: FAA-Licensed Commercial Orbital Launch Revenues (Ref [17])

Note: Five flights under FAA experimental permits were conducted in 2008, compared to nine in 2007

<u>Non-Commercial Launches</u>

Over two thirds of the US launches for the ten year period between 1999 and 2008 were non-commercial launches. Examples of Non-Commercial include:

- Space Shuttle Launches
- National Reconnaissance Office (NRO) Satellites
- Department of Defense (DoD) Satellites

- NASA Satellites (Earth Observation, Interplanetary Missions)
- National Oceanic and Atmospheric Administration (NOAA) Satellites
- Other Government Agency Satellites

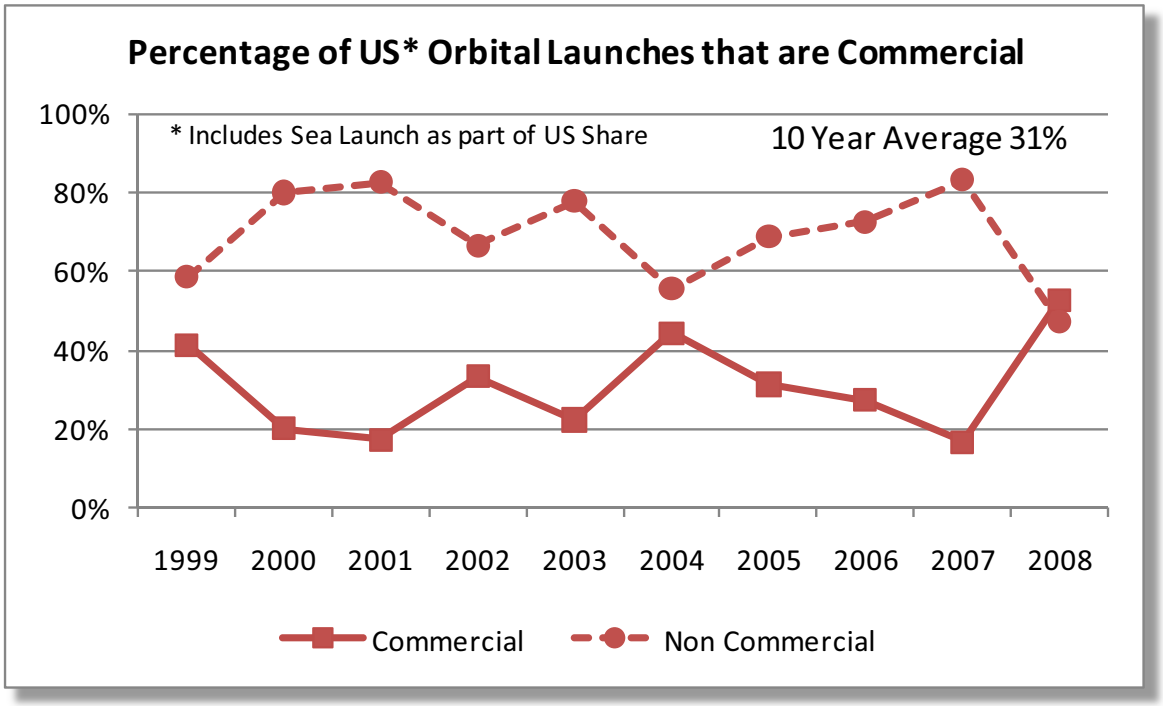


Figure 107: Percentage of US Orbital Launches that are Commercial

D.2.d FLORIDA MARKET OVERVIEW

As the space market transforms and evolves, Florida is postured to achieve stakeholder dominance in the space arena. Florida offers many competitive advantages to ensure the State is at the forefront of the national and global space markets, such as the capability to meet a wide range of requirements consisting of horizontal and vertical launch complexes, geographical advantages, facilities, infrastructure, instrumentation, workforce, and legislative incentives. While Florida continues to promote the existing aerospace markets, strategic measures are being taken to capture new and emerging space markets. The State is also working to alleviate the perceived hurdles typically associated with aerospace programs hosted on government property within the State. All of these efforts have great potential as the space markets continue to demonstrate resilience during worldwide economic turmoil. Remaining competitive is imperative as other states (and nations) continue to mature competing resources. Florida is the place for space and will remain so for the foreseeable future.

Cape Canaveral Air Force Station, FL

At Cape Canaveral Air Force Station (CCAFS) presently only launch complexes SLC-17, SLC-37, SLC-41 and SLC-47 are active and capable of immediately supporting space launch missions. In 2007, Space Florida assisted SpaceX in obtaining their 45 SW real property license for SLC-40 to launch their Falcon 9 launch vehicle in 2009. Space Florida provided funding for SpaceX's Horizontal Launch Facility at SLC-40. Space Florida is coordinating with the 45th Space Wing to utilize the SLC-36 and SLC-46 launch sites as part of Spaceport Canaveral. Through an agreement with the 45th Space Wing, Space Florida can utilize SLC-47 to support Super Loki and University Rocket Programs.

Economic Impact Analysis of Patrick Air Force Base and CCAFS in Florida During the 2008 Fiscal Year

The Economic Impact Region (EIR) consists of Brevard County, Florida, where the majority of economic activity generated by Patrick AFB and CCAFS occurs. The estimated local economic impact of Patrick AFB and CCAFS during Fiscal Year 2008 was nearly $1.07 billion. This amount represents wages and salaries for all military and civilian employees, the estimated dollar value of the indirect jobs created, and local contracts and construction. The wing population of military members, military dependents, civilian employees and contractors is approximately 13,000 (Ref [19]).

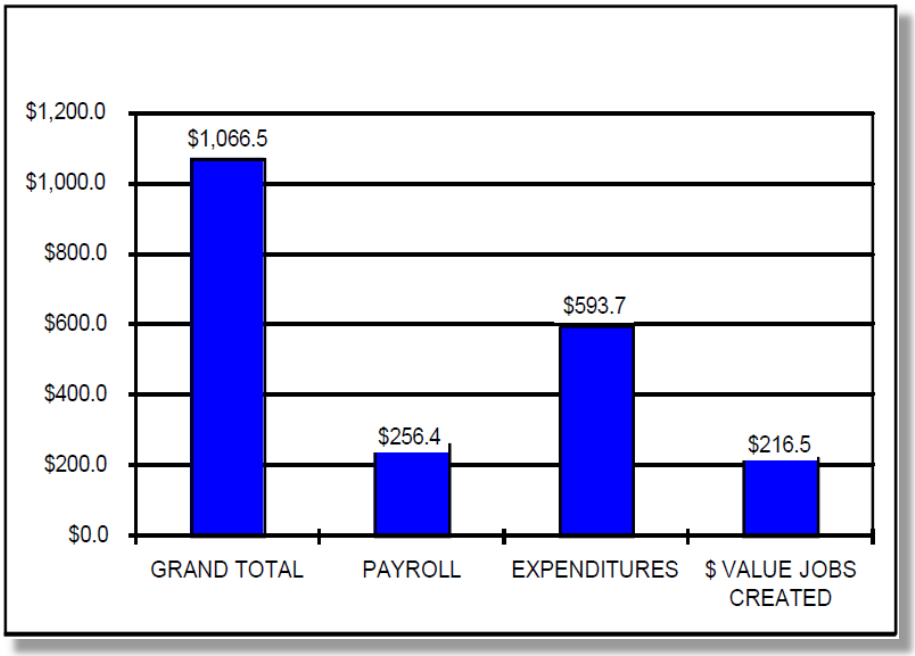


Figure 108: Patrick AFB and CCAFS Total Annual Economic Impact ($M) in Florida (Ref [19])

Kennedy Space Center, FL

At the Kennedy Space Center (KSC), NASA is operating the Shuttle Program and portions of the Constellation Program in parallel. Launch Complex 39A (LC-39A) will continue to support Shuttle launches through 2010, and then be deactivated. After LC-39A deactivation, the complex will be modified and reconfigured to support the Ares V launch vehicle. NASA has started converting the LC-39B complex to support the Ares I test launches which are scheduled for mid to late 2009. Space Florida holds land use agreements with NASA/KSC and owns the Space Life Science Lab (SLSL) and the Reusable Launch Vehicle (RLV) Hanger. The RLV Hangar is expected to become available for commercial space operations. Space Florida will continue to coordinate with NASA/KSC to determine if any excess facilities may become available for commercial use in support of the Space Florida Spaceport.

The current long term goal of NASA's vision for future space exploration is a return to the moon, where a sustainable long-term human presence will be built. As the space shuttle approaches retirement and the International Space Station (ISS) nears completion, NASA is building the next fleet of launch vehicles to bring astronauts back to the moon, and possibly to Mars and beyond as outlined in NASA's Constellation Program.

The Constellation Program was developed through the Exploration Systems Architecture Study (ESAS), which determined how NASA would pursue the goals laid out in the Vision for Space Exploration and the NASA Authorization Act of 2005. As part of the Constellation Program, NASA plans to develop new

spacecraft and two new launch vehicles to replace the Space Shuttle. Currently NASA is in the process of designing the two launch vehicles, the Ares I and Ares V, both of which are based on heritage shuttle hardware. Ares I is a crew launch vehicle and its sole function is to launch astronauts into orbit. Ares V is a much larger vehicle and will be designed to launch large amounts of cargo and other hardware and will have a much heavier lift capacity than the Ares I. In addition to these two launch vehicles, NASA is designing a new set of spacecraft for use during the Constellation Program. These new spacecraft include the Orion crew capsule, the Earth Departure Stage and the Altair lunar lander (Ref [53]).

The first test launch of the Ares I launch system (Ares I-X) occurred successfully on October 28, 2009, with the first manned mission planning to occur in 2014. The Ares V launch system is scheduled to come online later, with the first launch planned for 2018. Based on the latest publicly published set of milestones that were published in February 2009, the following Constellation Program mission plans are assumed. The Ares I launch system is being developed in several phases with three unmanned test flights occurring between 2009 and 2014. Following two manned test flights between 2014 and 2015 the Ares I launch vehicle with the Orion crew capsule will begin operational service supporting two crew rotations on the ISS annually until the Ares V launch vehicle is ready to support lunar missions (Ref [54])

Augustine Commission

There is uncertainty over the end date for the space shuttle missions to the ISS and the end date of the ISS due to Presidential budget cutbacks. The President set up the Augustine Commission to review the options for future U.S. manned space flight operations. This panel assessed NASA's current plan to retire the shuttle in 2010, finish the space station in 2015, return to the moon by the early 2020s, and determined it is not feasible without a significant restoration of funding.

More than $3 billion was deleted from NASA's long-range budget projections by the Office of Management and Budget last spring, before the Augustine Commission was formed. This money is needed for development of the Ares 5 heavy lifter. NASA needs at least an additional $50 billion through 2020 to implement the Constellation program (manned flights to the Moon, Mars and beyond) as currently planned. This scenario assumes the Space Shuttle is retired in 2010 and that the ISS is deorbited in early 2016. No one on the Augustine Commission was in favor of this scenario.

Should the ISS be deorbited in 2016, the new Orion/Ares 1 system would have no destination until the Ares 5 heavy lifter is ready and moon flights begin after 2021. Even if this did happen on schedule, an additional $3 billion a year would not cover ISS operations past early 2016. NASA's international partners in the ISS (Russia, Japan, Canada and the European Space Agency) now want to extend the ISS operations at least through 2020.

The Augustine Commission members agreed with the extension of use of the ISS. If the President agrees with this approach, development of the Ares 1 rocket may be suspended because the money needed for

the booster's development would then be used to finance the continued ISS operations. Therefore, the Ares 1 could not be developed until the end of the ISS's life. To alleviate this delay, the Augustine Commission recommends development of commercial rockets and capsules to ferry astronauts to and from low-Earth orbit. This is a major departure from past practice at NASA.

The Augustine Commission developed the following alternatives for the Human Spaceflight Program:

- Human exploration beyond low-Earth orbit is not viable under the FY 2010 budget guideline.
- Meaningful human exploration is possible under a less constrained budget, ramping to approximately $3 billion per year above the FY 2010 guidance in total resources.
- Funding at the increased level would allow either an exploration program to explore "Moon First" or one that follows a "Flexible Path" of exploration. Either could produce results in a reasonable timeframe.

The Augustine Commission also found that under current conditions the gap in US ability to launch astronauts into space will stretch to at least seven years. The only significant way they found to close the gap is to extend the life of the Shuttle Program and the ISS. The return on investment to both the US and our international partners would be significantly enhanced by an extension of ISS life. Not to extend the Shuttle Program and the life of the ISS operation would significantly impair US ability to develop and lead future international spaceflight partnerships.

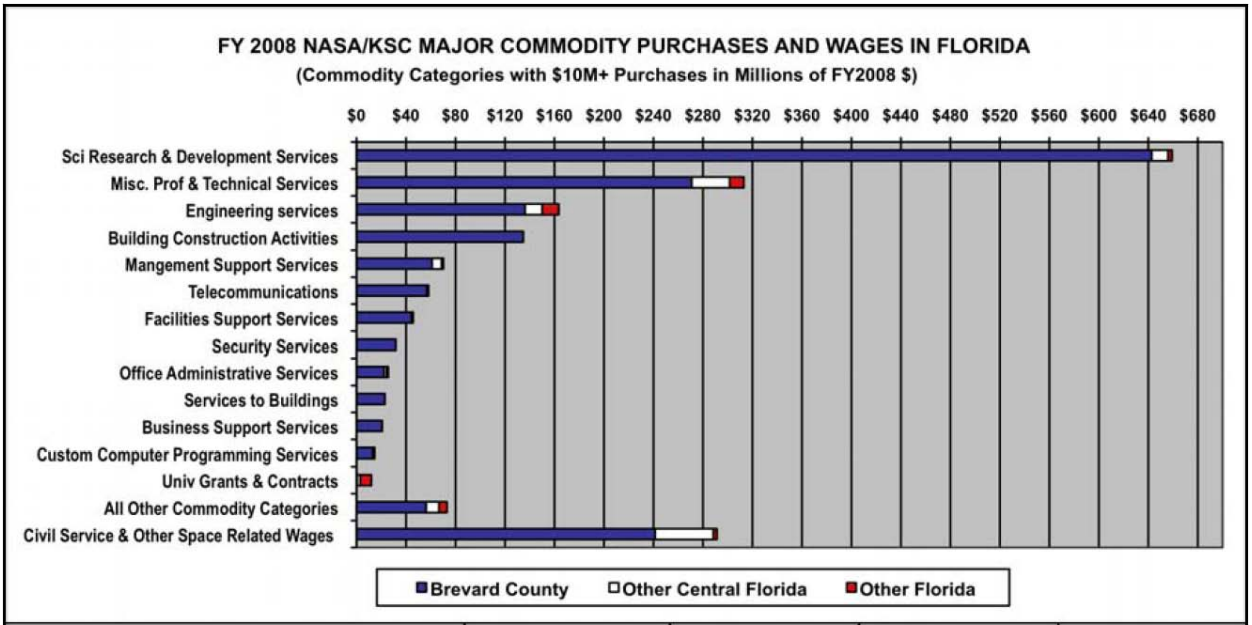
The Augustine Commission still agreed that Mars is the ultimate objective for human spaceflight in the foreseeable future. No budgets or timetables were suggested or recommended as the panel concluded that manned flights to Mars are beyond the scope of current planning budgets. It is unknown when the Obama administration might act on the options. The panel's goal of the review was to assess scenarios before the next budget cycle in Fall 2009 (Ref [71]).

Projections of Job Losses Following the Shuttle Program

While it is difficult to get precise estimates on projected number of jobs that will be lost following the completion of the shuttle program, one thing everyone can agree upon is that some jobs will be lost. In July 2009, Florida Today cited an article citing the results of an unreleased local government study what estimates as many as 6,000 to 7,000 jobs at KSC will be lost after 2010. According to the article, NASA's latest public estimates at the time placed job loss at between 3,000 and 4,000 (Ref [83]).

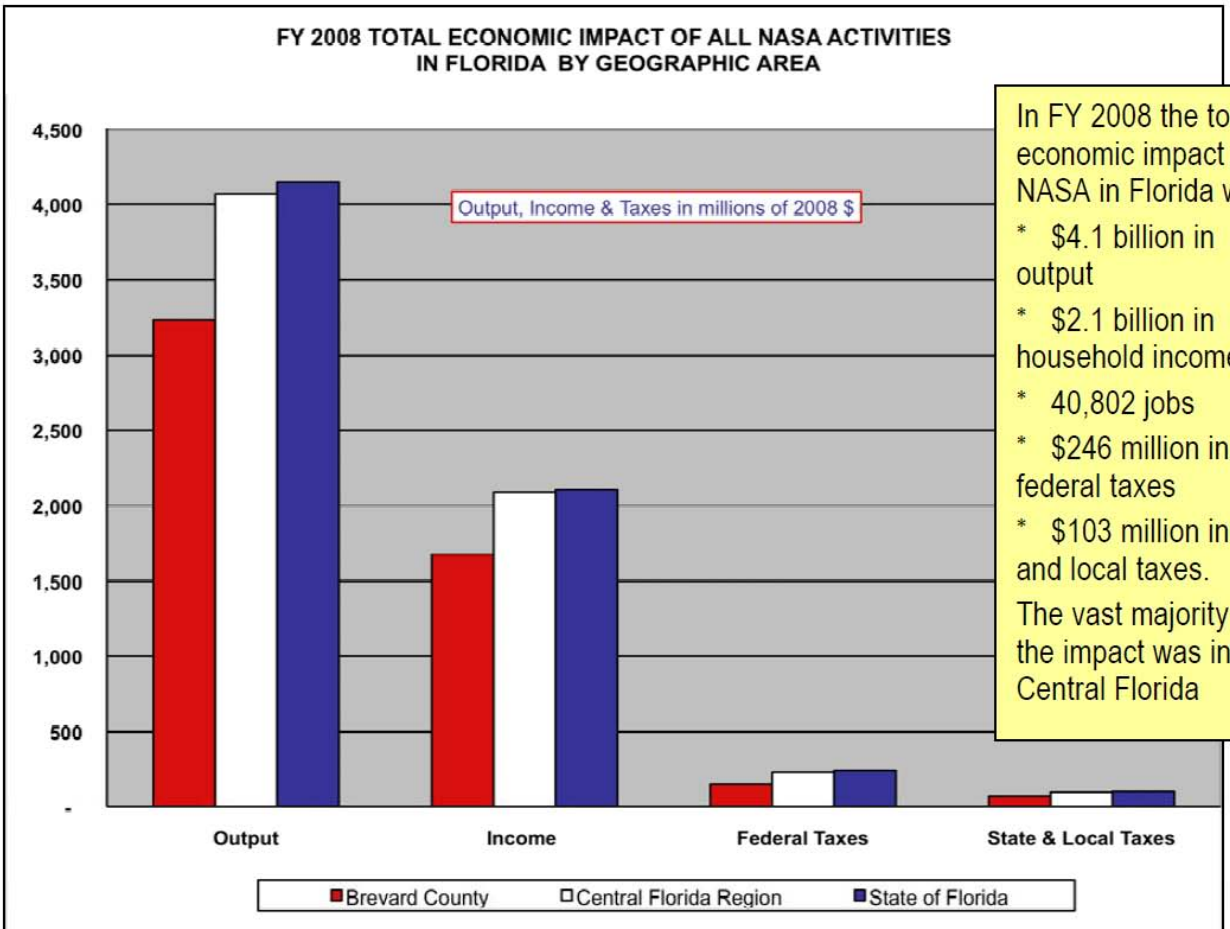
Economic Impact Analysis of NASA in Florida during the 2008 Fiscal Year

After experiencing a slight decline in FY 2007, the monetary injections by KSC and other NASA Centers into Florida's economy in FY 2008 showed substantial growth (6%) over that of the previous year. Based on the results of this economic analysis, it is clear that the KSC continues to be the major economic anchor for Brevard County and the surrounding Central Florida Region.



COMMODITY NAME	Brevard County	Other Central Florida	Other Florida	Florida Total
Sci Research & Development Services	$643	$13	$3	$659
Misc. Prof & Technical Services	$271	$31	$11	$313
Engineering services	$136	$14	$13	$163
Building Construction Activities	$135	$0	$0	$135
Mangement Support Services	$61	$8	$1	$70
Telecommunications	$57	$0	$0	$57
Facilities Support Services	$44	$0	$0	$44
Security Services	$32	$0	$0	$32
Office Administrative Services	$22	$2	$0	$25
Services to Buildings	$23	$0	$0	$23
Business Support Services	$21	$0	$0	$21
Custom Computer Programming Services	$13	$0	$0	$13
Univ Grants & Contracts	$0	$3	$9	$12
All Other Commodity Categories	$56	$10	$6	$73
Civil Service & Other Space Related Wages	$241	$47	$3	$291
Total Commodity Spending	$1,756	$128	$48	$1,932

Figure 109: NASA/KSC Major Commodity Purchases and Wages in FL FY08 (Ref [20])



In FY 2008 the total economic impact of NASA in Florida was:

* $4.1 billion in output
* $2.1 billion in household income
* 40,802 jobs
* $246 million in federal taxes
* $103 million in state and local taxes.

The vast majority of the impact was in Central Florida

Area of Economic Impact	(Millions of 2008$)			
	Output	Income	Federal Taxes	State & Local Taxes
Brevard County	3,238	1,676	153	71
Central Florida Region	4,069	2,085	234	98
State of Florida	4,150	2,104	246	103

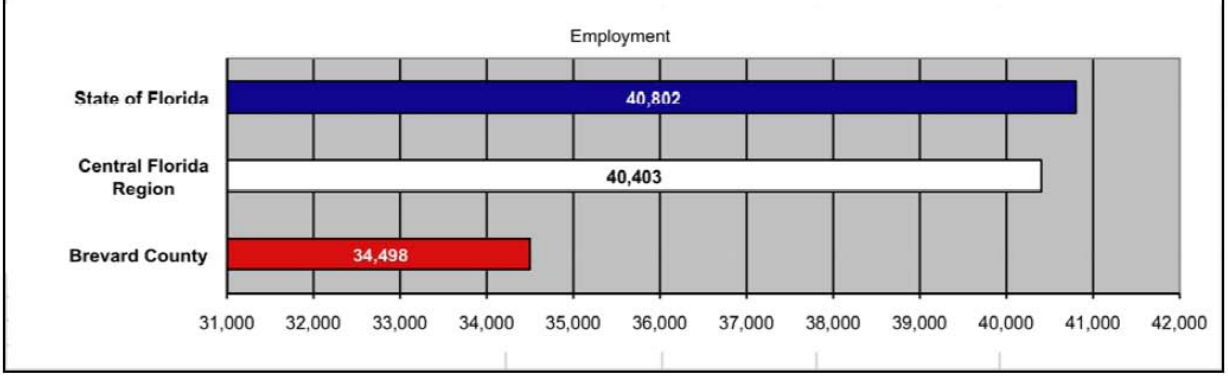


Figure 110: Total Economic Impact of All NASA Activities in FL by Geographical Area FY08 (Ref [20])

KSC and NASA Centers' expenditures in support of space program activities in Florida were $1.93 billion and managed 1,417 active contracts in Florida in FY 2008. 92% of KSC/NASA spending (including civil service wages) was concentrated on-site at KSC. Total KSC/NASA direct spending was $1.82 billion in Brevard County, $83 million in other Central Florida counties, and $45 million in other Florida counties.

Commodity purchases by KSC and NASA Centers in Florida totaled $1.932 billion in FY 2008. Over 77% of these purchases were concentrated in four commodity categories, the top of which was the $659 million for Scientific Research & Development Services (See Figure 110).

The space and aeronautics industry is not only an important employer in Florida, but also a significant customer for other industries such as electronics, materials, engineering, research, and business services. Moreover, employees in this industry, because of their above-average wages, are important customers for Florida's retail and service industries. It is estimated that every dollar earned in the space and aeronautics industry in Florida generates $2.83 in earnings for other sectors of the economy (Ref [21]).

D.2.e SPACE TOURISM MARKET FORECASTS

Space Tourism is an emerging market that is focused on bringing access to space (both suborbital and orbital) to paying participants. Historically, only government sponsored astronauts or international equivalents were able to participate in human space flight. This trend was changed in 2001 when Dennis Tito became the first "fee-paying" space tourist by paying $20 Million US to ride on a Russian Soyuz launch vehicle for a seven day trip to the International Space Station. The forecasts for both suborbital and orbital space tourism look promising and it is important to understand the future market so that Florida can position itself to be a major part of the commercial space tourism.

D.2.e.1 Suborbital Space Tourism

When most people think of traditional space flight they think of a rocket taking a payload or passengers into orbit around the earth. Suborbital space flight is different in that it is a ballistic trajectory that simply goes up to the boundary of space and then immediately comes back down to earth without traveling very far along the surface of the earth. Typically the goal of Suborbital Space Tourism is to take paying passengers up above an altitude of 100 km (62 miles), which is the internationally recognized boundary of space known as the Karman line, and then promptly return them back to earth. During this suborbital flight the passengers will experience a few minutes of weightlessness and be able to see the curvature of the earth along with the blackness of space.

While this market has taken longer to mature than expected it is still making steady progress. In 2004 Scaled Composites won the $10 Million dollar Ansari X PRIZE that was offered to the first non-government organization to launch a reusable manned spacecraft into space twice within two weeks, successfully launching its SpaceShipOne Reusable Launch Vehicle (RLV) from the White Knight carried

aircraft twice within two weeks. Since 2004 no other private RLV has been successfully launched, although the suborbital space tourism industry has continued to move forward.

Following the success of the SpaceShipOne RLV, Scaled Composites began developing its SpaceShipTwo and White Knight Two launch RLV launch system. Other competitors in this market include Rocketplane Global, Inc who is developing the Rocketplane XP RLV, and XCOR who is developing the Lynx RLV. Out of the variety of companies pursuing suborbital space tourism, currently Virgin Galactic is the closest to being operational and will be using the SpaceShipTwo and White Knight Two launch system being developed by Scaled Composites. As of July 2009 Virgin Galactic had received approximately 300 reservations with deposits ranging between $20k and $200k (Ref [62]).

The first commercial flights are planned to operate from Spaceport America in New Mexico with non-US flights likely to be from Spaceport Sweden near Kiruna. Presently there are three FAA licensed spaceports in the US that can support suborbital RLV flights. These spaceports are (1) Mojave Air and Space Port in California, (2) Spaceport America in New Mexico, and (3) Oklahoma Spaceport in Oklahoma. Cecil Field Spaceport in Jacksonville, Florida is currently applying for a FAA launch site operator's license to support suborbital RLV missions.

In 2002 Futron released a study titled "Space Tourism Market Study – Suborbital Space Travel". The 2002 study forecasted that suborbital launch services would begin in 2006 with an annual passenger rate starting around 500 passengers/year and increasing to nearly 13,000 passengers/year by 2020 (Ref [34]).

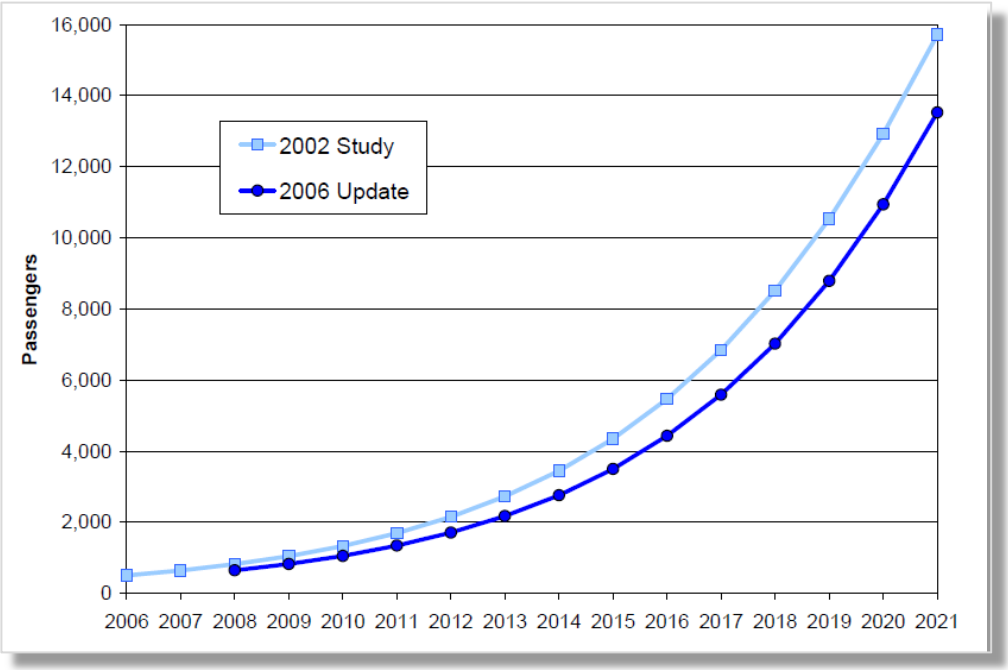


Figure 111: Passenger Demand Forecast for Suborbital Space Tourism (Ref [35])

In 2006, when the forecasted suborbital services failed to become available, Futron released an update to the previous forecasts in a study titled "Suborbital Space Tourism Demand Revisited". In the updated study, Futron adjusted the forecast start date for passenger serviced to 2008. (Ref [35]) The availability of services for suborbital space tourism have progressed much slower than many in the industry predicted.

At this time it may still be a few years before commercial suborbital space tourism services are available to the public.

D.2.e.2 Orbital Space Tourism

The launch of Soyuz TM-32 on April 28, 2001 ushered in a new era of space travel and orbital space tourism. Along with two Russian cosmonauts, the capsule contained Dennis Tito, the first "space tourist". While non-professional astronauts and cosmonauts were nothing new to space travel, Tito was the first private citizen to purchase a seat on Soyuz and live aboard the ISS as a tourist (Ref [63]). Since then, Space Adventures, the company that marketed the trip, has arranged six additional "packages" for tourists, the most recent returning in October 2009. All seven paid between $20m and $35m each for training, launch and ISS stay (Ref [64]).

Currently, options for orbital tourism are limited, and thus the market is limited as well. Launch opportunity is only provided via the Soyuz rocket, and the ISS is the only destination. Orbital space tourist training is currently only provided in Star City, Russia, and launches from Baikonour Cosmodrome in Kazakhstan. The required 6-months of training for a Soyuz flight at the Gargarin Cosmonaut Training facility outside Moscow (See Figure 112) is a deterrent for many potential space tourists. The Soyuz capsule can carry only three people, two of which must be trained cosmonauts, leaving only one seat for a tourist. This effectively limits tourism to hitchhiking on regular ISS supply and crewing missions, which have decreased as construction on the ISS winds down (Ref [23]).

A 2002 study concluded that the market for space tourism could be as large as 60 people annually by 2021, assuming that there is sufficient supply to meet demand. The most substantial restraint on the market for orbital tourism is the high cost. However, among those with means to travel who participated in the study, the inconvenience of training in and launching from Russia was a significant deterrent. Sixty percent of survey respondents were more likely to travel to orbit if training and launch were provided stateside and in a US-made vehicle. It must also be noted that the ISS, designed for scientific purposes, is not an ideal tourist destination. The potential pool of customers increased when destinations other than the ISS were provided (Ref [23]). Indeed, it could be said that the current market for space tourism is being constrained primarily by scarce supply, limited choice and less-than-ideal conditions of travel. Improvement of any of these factors could significantly increase the size of the market. While the study predicted that the cost of orbital insertions would never under any

circumstances drop below $5 Million per person, these disadvantages could undo any market expansion provided by such decreasing costs.

Figure 112: Gagarin Cosmonaut Training Center, Star City, Russia (Ref [65])

Improvement of any of these factors could significantly increase the size of the market. While the study predicted that the cost of orbital insertions would never under any circumstances drop below $5 Million per person, these disadvantages could undo any market expansion provided by such decreasing costs.

Currently, only two privately financed tourist vehicles have been put into orbit. In 2006 Bigelow Aerospace launched Genesis I into orbit, 350 miles above the earth's surface. Genesis is also the first inflatable spacecraft to enter orbit. Its design is based on that of NASAs Transhab, the rights to which Bigelow purchased after congress terminated the program in 2000. A 1/3 scale version of the BA 330, the full-size manned concept vehicle, the 4.4m-long, 2.5m-wide spacecraft collapses along it's long axis to 1.6m wide, making launch easier and cheaper. Once in orbit, gas tanks inflate and pressurize the Kevlar and rubber bladder to full size. As such, it does not satisfy the goal of putting tourists in space, but rather comprises an efficient and flexible method of housing them in orbit. Multiple Genesis modules could be linked together in a fashion similar to that of the ISS, permitting expansion of the module into an entire space station (or space hotel). Genesis I is among the least expensive orbital vehicle launches ever performed (Ref [66]).

Genesis I was followed by Genesis II in 2008, similar in design to its predecessor but included a number of performance enhancing features. Bigelow included a number of marketable programs to promote the station; A "Space Bingo" game, in which numbered balls float in a zero-gravity environment and are plucked from the air by fans, allows terrestrials to play an interactive bingo game on the company's website, and a "Fly your Stuff" program under which individuals can send lightweight mementos into space. These mementos include photographs and advertisements that float aimlessly in the interior of

the station, and can be viewed on the company's website via some of the 22 cameras located on the station. Also on board are a NASA GeneBox experiment and a Bigelow Life Sciences experiment in which insect colonies are propagated (Ref [66]). All of these programs are aimed at increasing public interest in the project, advocating the safety of the capsule, and commercializing future launches.

Figure 113: Launch of Genesis I from Russia, and Artist's Rendering of Genesis II (Ref [66])

Each of the Genesis modules were fitted in the payload bay of a Dnepr rocket, a commercially-modified Soviet SS-18 ICBM, and launched from the ISC Kosmotras Space and Missile Complex at the Dombarovsky Cosmodrome near Orsk, Russia. The SS-18 was the heaviest lift ICBM produced during the Cold War, and it's decommissioning after the START I agreement made it both effective and available for commercial orbital insertions. Its long-term military deployment ensured high reliability and serviceability, and included preexisting launch infrastructure (Ref [67]). While launching Genesis from Dombarovsky made sense from an economic standpoint, legalities of ITAR took nearly a year to clear the way for transit of the vehicle. ITAR, known as the International Traffic in Arms Regulations, restricts the exportation certain space related technologies articles and service. As Bigelow's corporate counsel, Mike Gold stated, "It's significantly easier from a legal perspective to send a spacecraft into orbit than it is to send it to a foreign country". Such legal hurdles will continue to impede private companies launching from foreign soil, providing significant opportunities for providing the capability domestically (Ref [68]).

There is market demand and the potential for Florida to be a leader in orbital space tourism.

D.2.f NASA COMMERCIAL CREW & CARGO PROGRAM

As NASA's Space Shuttle Program comes to its end, the US will have a multi-year gap in its ability to domestically resupply the International Space Station (ISS). Currently, all US cargo and personnel are transported to the ISS on the Space Shuttle, or seats are purchased on Russian (Soyuz and Progress) or European Space Agency launch vehicles. Since the Space Shuttle program is slated for termination 2010, long before any NASA spacecraft will be available to replace, NASA will be left entirely dependent on foreign powers for ISS crew exchange and cargo resupply.

To help reduce the impact of this access gap and stimulate commercial spaceflight, NASA developed a special program aimed at eliminating this gap all together. NASA's Commercial Crew and Cargo Program (C3PO) is investing financial and technical resources to stimulate efforts within the private sector to develop and demonstrate safe, reliable, and cost effective space transportation capabilities. This program manages the Commercial Orbital Transportation Services (COTS) partnership agreements with US industry totaling $500M for commercial cargo transportation demonstrations and is investing $50M towards commercial crew development initiatives (Ref [55]). C3PO is responsible for challenging private industry to establish capabilities and services that can open new space markets, support the crew and cargo transportation needs of the ISS, and provide future services for exploration NASA plans to competitively purchase these services as they become available. NASA's C3PO is applying Recovery Act funds to stimulate efforts within the private sector to develop and demonstrate human spaceflight capabilities. These efforts are intended to foster entrepreneurial activity leading to job growth in engineering, analysis, design, and research, and to economic growth as capabilities for new markets are created (Ref [61]).

This is more challenging than existent commercial space transportation because it requires precision orbit insertion, rendezvous and possibly docking with another spacecraft. The private spaceflight companies are competing in four specific service areas:

- Capability level A: External unpressurized cargo delivery and disposal
- Capability level B: Internal pressurized cargo delivery and disposal
- Capability level C: Internal pressurized cargo delivery, return and recovery
- Capability level D: Crew Transportation

While "filling the gap" remains the first priority of the COTS program and the aggressive deadlines included in it, the program has a more far-reaching potential. It represents a fundamental shift in NASA policy, away from developer and toward consumer of technology. Recognizing that the high cost of the STS program could easily be duplicated in future NASA efforts to develop vehicles in-house, NASA decided to outsource development to private sector providers in a competitive free market. This provides two steps of cost reductions for NASA: First, the arrangement allows private investors to absorb a portion of initial capital costs, and second, the resulting technology can be utilized more widely in non-government markets, thus distributing development costs more efficiently. The $500M of NASA

funds that are being utilized to fund the COTS program will cost less than a single Space Shuttle launch (Ref [55]).

As the retirement of the Space Shuttle approaches, two companies remain in the COTS program; Orbital Sciences Corporation (OSC) and Space Exploration Technologies (SpaceX). Both companies will receive $1.6B in return for the delivery of 20 metric tons of cargo to the ISS until its slated deorbiting in 2015. Additional delivery contracts pending an extension of the service life of the ISS may be awarded for a cumulative total contract cost of $3.1B (Ref [56]).

Under the COTS program Orbital Sciences is developing its Cygnus orbital vehicle and Taurus II launch vehicle slated for their first demonstration flight in late 2010. OSC has been developing satellites and launch vehicles since 1982 and its Space Systems Group has successfully delivered over 115 spacecraft to both government agencies and commercial clients (Ref [57]). The technology in the Cygnus vehicle has been derived from many of these previous spacecraft, and the engines and fuel tanks of the Taurus II will be provided by subcontractors Aerojet and Yuzhnoye (Ref [58]). Under its contract, OSC will deliver its cargo over 8 missions, providing nearly a quarter of the total cargo to be delivered to the ISS until 2015. Cygnus will be initially launched from pad 0A at the Mid-Atlantic Regional Spaceport in Wallops, Virginia (Ref [59]).

SpaceX, founded in 2002, is developing the Dragon orbital vehicle and Falcon 9 launch vehicle under NASA's COTS program. The maiden flight of the Falcon 9 is scheduled to be launched from SLC-40 at Cape Canaveral Air Force Station in late 2009. The Dragon is a reusable orbiter capable of providing both crew and cargo transport services to and from the ISS, and the Falcon 9 is a multi-stage reusable LOX-powered launch vehicle. SpaceX had been developing both the Falcon 9 launch vehicle and Dragon orbiter and engines in-house, so the development of the Dragon/Falcon vehicle has been more specifically targeted at ISS resupply missions, both manned and unmanned. The Dragon/Falcon 9 will deliver its cargo over 12 missions until 2015 (Ref [60]).

Florida is currently hosting the launch complex for SpaceX, one of the two COTS award winners, and providing extra space launch capabilities in Florida to support both commercial cargo and potentially crewed missions in the near future.

D.3 PUBLIC WORKSHOP

To gather input to the Space Florida Spaceport Master Plan from key stakeholders as well as from interested citizens, Space Florida convened a public workshop at Port Canaveral early in October 2009. The workshop was planned and conducted in order to provide participants with information regarding the purpose and content of the Spaceport Master Plan, as well as to obtain information and ideas from nearly all of those who participated in the workshop.

The participants at the workshop included key FDOT officials, from District 5 as well as from the FDOT Aviation Office in Tallahassee. Representatives of the Jacksonville Aviation Authority (JAA) presented display materials and provided information regarding the planned Cecil Field Spaceport in Duval County. Also participating in the workshop were representatives of the Canaveral Port Authority, the Space Coast Transportation Planning Organization (TPO), NASA, the US Air Force 45th Wing, and the Space Foundation, as well as representatives of the aerospace industry.

In addition to information regarding development of the Spaceport Master Plan itself, Space Florida officials also presented materials regarding Exploration Park, along with information about other Space Florida initiatives. Consultants to Space Florida were present at the workshop, in order to compile information and ideas from stakeholders on a firsthand basis.

Feedback sheets were provided to all participants at the public workshop. In addition, opportunities were provided throughout the workshop for informal give and take discussions of issues of critical importance to the development of space infrastructure and transportation facilities in Florida. Representatives of the Space Coast TPO provided guidance as well as information regarding the development of regional multimodal transportation plans, capital improvement budgets, and specific transportation facilities, as well as information and perspectives regarding the importance of the space transportation industry to the overall development of Florida and the Space Coast area.

Information regarding the status of planning for port facilities was provided by a representative of Port Canaveral. NASA and USAF officials provided information on the condition and utilization of existing spaceport infrastructure at the Kennedy Space Center and the Cape Canaveral Air Force Station, as well as how potential changes in the overall mission of NASA and the USAF could impact the short term and long term need for new or improved transportation facilities at KSC and the CCAFS. Environmental issues were also discussed. NASA officials presented extensive information at the workshop regarding plans for improvements and modifications to the Shuttle Landing Facility.

Some workshop participants suggested the mothballing of underutilized existing facilities for which no short term use or need has yet been identified, including railroad facilities and certain highway facilities. It was observed that if these facilities were ever to be completely abandoned or dismantled, then it

could be very difficult to rebuild similar facilities if they were ever needed again in the future, given that much of the undeveloped land in the area is environmentally sensitive.

Regulatory and oversight issues were also discussed at the workshop, including issues related to the FAA Office of Commercial Space Transportation, DoD mission requirements and the management of the Eastern Range.

The perspectives provided by stakeholders at the public workshop have been used as a guide for the development of the Space Florida Spaceport Master Plan, to ensure that they will be used as tools for the effective future development of Florida's space transportation infrastructure.

SECTION E: CAPACITY ANALYSIS OF SPACEPORT INFRASTRUCTURE

HOW DO EXISTING CAPABILITIES SUPPORT THE EXPECTED MARKET

As previously identified, the Federal Aviation Authority/Office of Commercial Space Transportation (FAA/AST) recognizes three spaceports in the Cape Canaveral area, Cape Canaveral Air Force Station (CCAFS), Kennedy Space Center (KSC) and Space Florida Spaceport. The Space Florida Spaceport is proposed, while CCAFS and KSC are existing spaceports. The FAA/AST also recognizes one proposed emerging spaceport in northeast Florida at the former naval air facility, Cecil Field. Detailed discussions on these spaceports are available in Section C.

The FDOT spaceport designation of Cape Canaveral includes all space related activity that occurs in the Merritt Island and Cape Canaveral area. Cape Canaveral Spaceport Hub is located in Cape Canaveral, Florida along the east coast of Florida and the Atlantic seaboard.

In Section C of this plan there is a review of the hub including surrounding highways, railroads, waterways, and deep water seaport. This following capacity analysis section will focus on the Florida's capability to handle commercial, civilian, and military payloads by examining Florida's existing capacity to support space transportation. Topics covered include Florida's launch vehicle options, how many missions that launch pads can support, how many launch vehicles that the vehicle processing buildings can support, how many satellites and payloads that the payload processing facilities can support, what affect the range has on the capability to launch missions from Florida, and forecasted capacity for suborbital/orbital space tourism.

In Section D.2 Market Analysis, an overview of the market for space exploration is examined from a global and national standpoint. Identifying competing spaceports capabilities and as the market analysis aligns with the capacity analysis overview given in this section, some distinctions can made regarding the market in Florida. The following will provide a review of capacity for vehicle launches and payload processing in Florida.

The following figure is an overview of the Spaceport's Core Business Process. This demonstrates how payload processing and launch support activities fit into the overall chain of activities conducted to support spaceport launches.

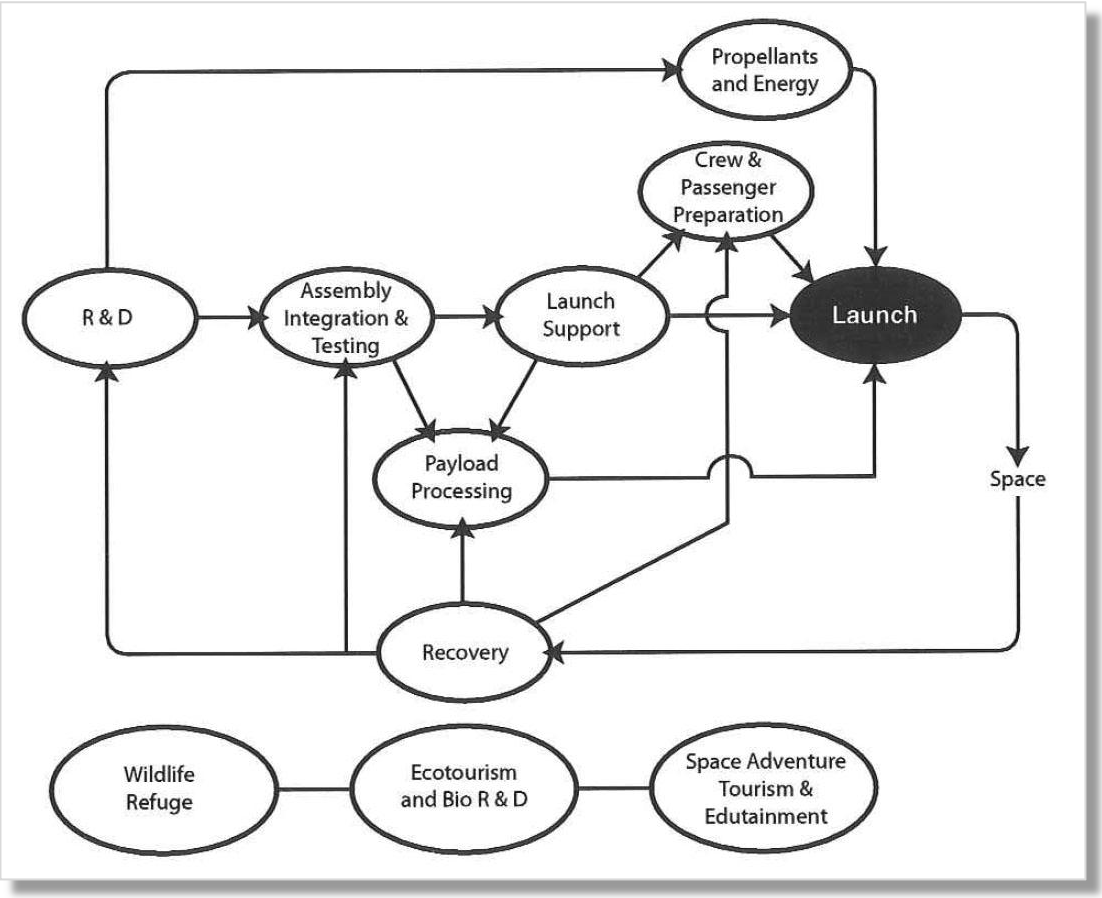


Figure 114: Spaceport's Core Business Process (Ref [7])

E.1 VEHICLE LAUNCHES / PROCESSING

There are currently only two active Spaceports in Florida and both of those are federal Spaceports located in FDOT District 5; the Kennedy Space Center and Cape Canaveral Air Force Station. Currently, 6 active/in-development launch pads support all launch activities at the Kennedy Space Center and Cape Canaveral Air Force Station. Space Launch Complexes 17B, 37, 39A&B, 40, 41 and 47 are active. Space Florida intends to obtain a license from the United States Air Force and FAA/AST to operate the currently inactive SLC-36 and SLC-46. Launch facilities at Cecil Field are yet to be activated pending licensing by the FAA/AST.

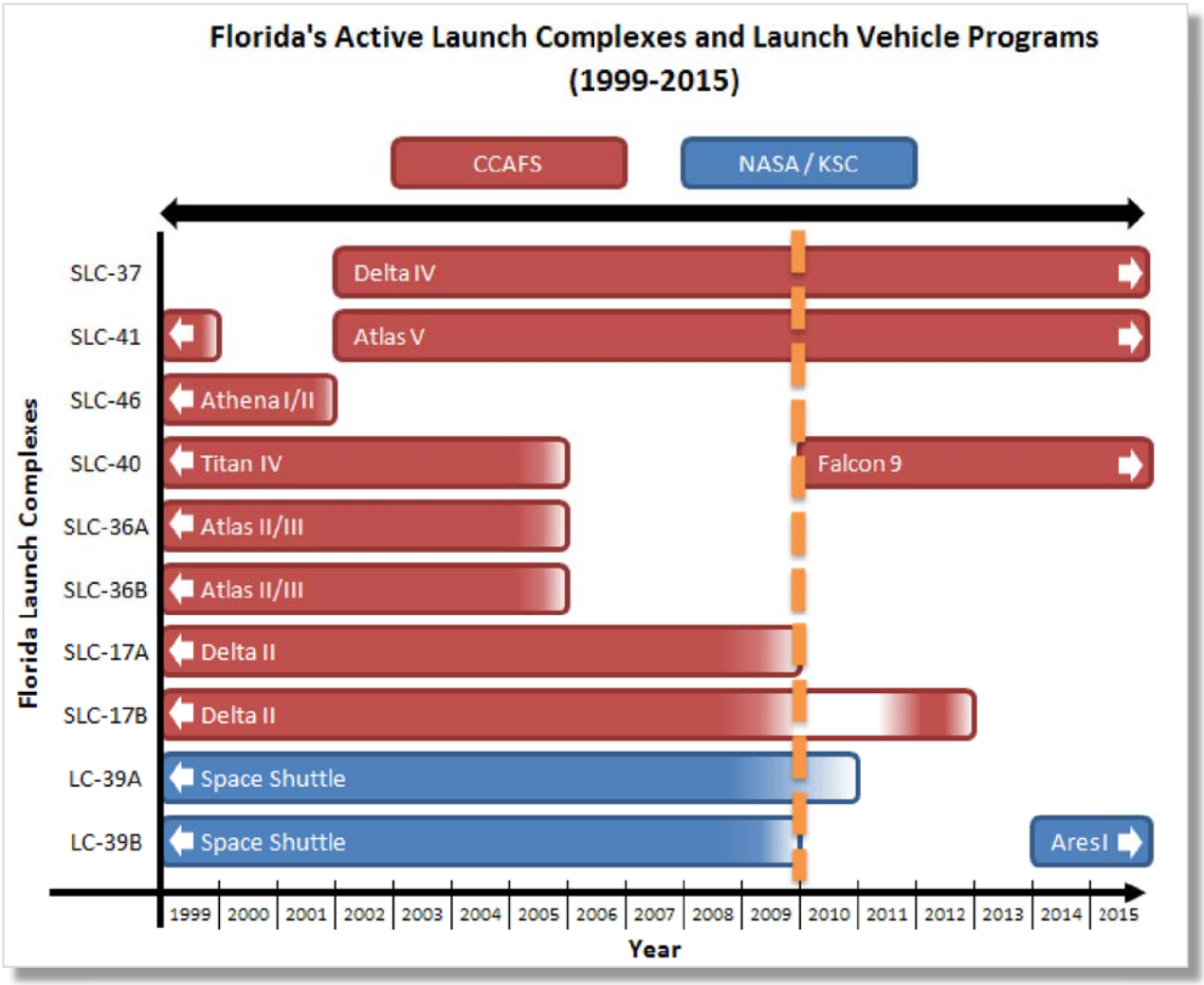


Figure 115: Florida's Active Orbital Launch Complexes and Launch Vehicle Programs

Following the retirement of the Space Shuttle in 2010 and the retirement of the Delta II in 2012 the only active launch vehicle programs in Florida will be the Delta IV, Atlas V, and Falcon 9.

Based on historical data from the last 10 years (1999-2009), launch history for the Delta II, Delta IV, Atlas V and Space Shuttle are shown in the figure above. Although the Atlas II/III, Athena I/II, and Titan IV launch vehicles were also operational within the last 10 years they are not included in this figure since their programs have ended and their facilities have been reused or are inactive. The maximum historical launch rate between 1999 and 2008 for the Delta II, Space Shuttle, Atlas V, and Delta IV launch vehicles is summarized in the following figure. This demonstrates a capacity for launches based on existing infrastructure and operations.

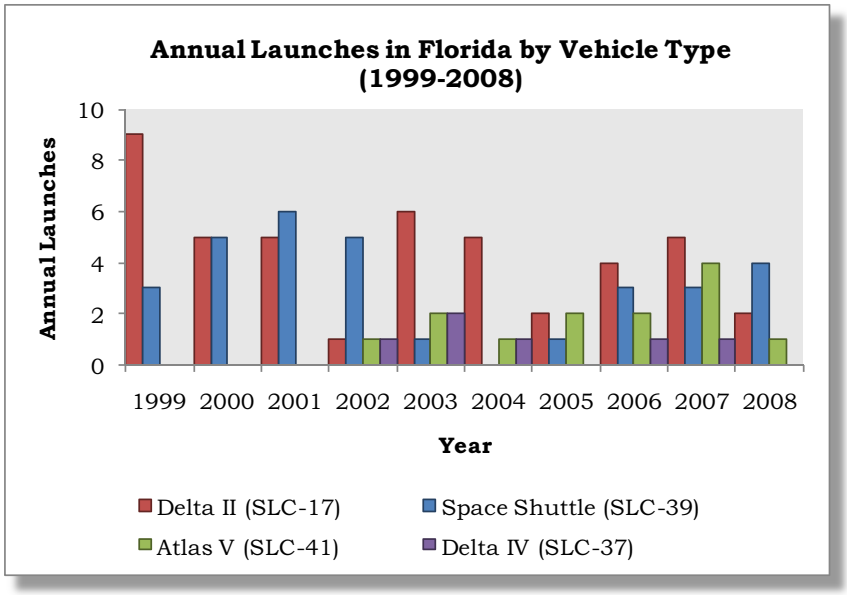


Figure 116: Annual Vehicle Launches

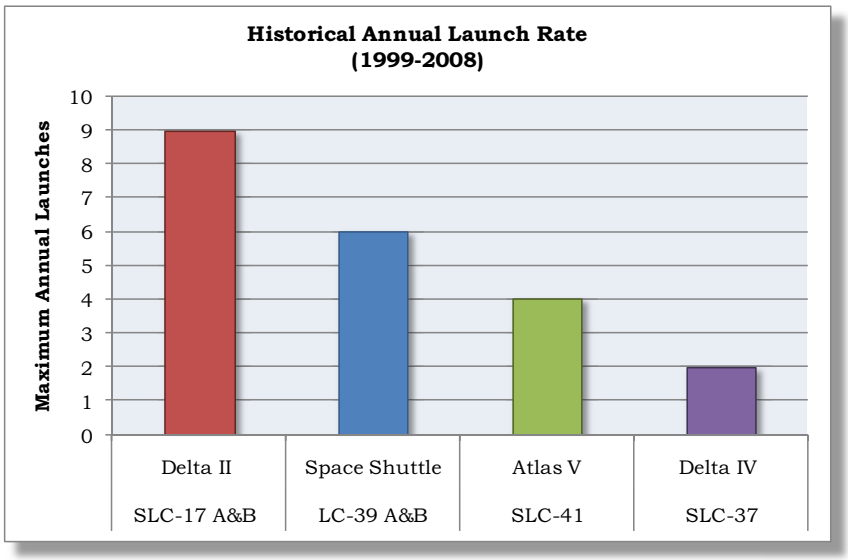


Figure 117: Maximum Annual Launch Vehicle Throughput Capacity

While it is useful to review what the historical capacity of the currently active launch vehicle programs are in Florida, it is worthwhile to note that this information does not provide the full picture of Florida's capability to support projected space launch market in the near future. Both the Delta II program and Space Shuttle Programs are schedule to end within the next few years. The current capacity to support orbital space launch activities from Florida will be greatly diminished following the retirement of both the Delta II and Space Shuttle.

Since both the Delta II and Shuttle programs are set to retire, a more thorough analysis of the launch capacity of the remaining launch vehicles is presented. Another measure of the launch capacity for the Atlas V and Delta IV is their historical turnaround time. The following figure shows the historical ability for the Atlas V and Delta IV to launch another mission following the successful completion of the previous mission.

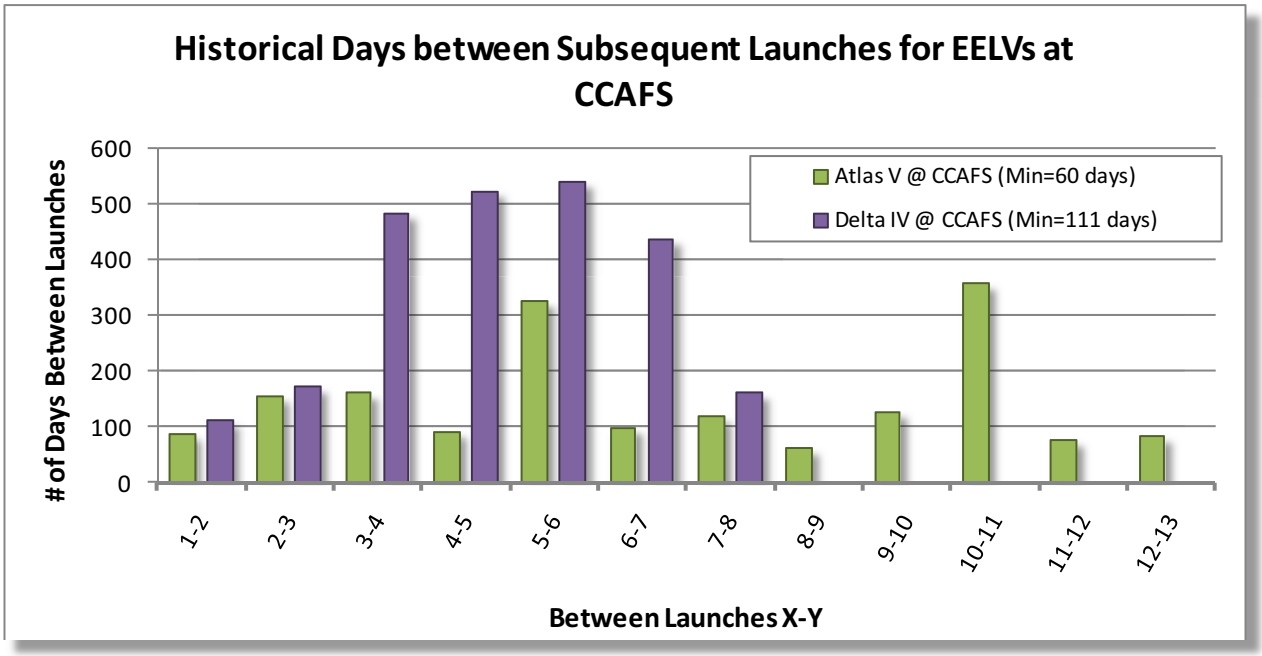


Figure 118: Historical Days between Subsequent Launches of EELVs at CCAFS

Historically the best turnaround times for the Atlas V and Delta IV have been 60 days and 111 days respectively. Based on recent factors, including the creation of United Launch Alliance (ULA), effectively merging capabilities of Atlas V and Delta IV under one entity, the launch capacity of these two vehicles is further complicated. Following the creation of ULA production lines for the Atlas V moved from Denver to Decatur to be collocated with Delta IV booster production which has the potential to reduce supply output of boosters. With current conditions, following the creation of ULA, the launch rate/processing flow is about 120 days for both vehicles and can be expedited to 90 days. With additional manning and a substantial increase in funding it may be possible for both vehicles to reduce this to 45 days.

Table 12: Annual Launch Rate Potential for Eastern Range

Launch Vehicle	Current	Expedited	Potential*
Atlas V	3	4	8
Delta IV	3	4	8
Falcon 9	4**	6	9-12
Total	10	14	25+

*Requires Substantial Changes to Current Infrastructure/Processes ** Based on Launch Manifest as of November 2009

E.1.a DELTA II RETIREMENT

Following the August 17, 2009 launch of the Delta II from SLC-17A at CCAFS, pad A was deactivated and presently only SLC-17B is active. The current plans for the Delta II include its eventual retirement in 2012 following one final planned mission. The historical trend of the Delta II is that is has had a significantly higher annual launch rate from CCAFS when compared to the other currently active launch vehicles. Over the next few years only five additional launches of the Delta II are planned; one from CCAFS and four from Vandenberg Air Force Base (Ref [84]). The Delta II has had a long and very successful career with less than a 2 percent failure rate since 1989.

Following the retirement of the Delta II launch vehicle in 2012 there will be a gap in the US ability to launch medium class payloads for commercial, DoD, NASA, and other missions. The Falcon 9 and Taurus II programs (both in development) may be able to support this market.

E.1.b SHUTTLE RETIREMENT

Current plans by NASA indicate the Space Shuttles will be retired from service in 2010, after nearly 30 years of service and 134 launches. Atlantis will be the first of NASA's three remaining operational space shuttles to be retired as the program winds down. A new spacecraft is being developed to fill the void left by the Shuttle's retirement and will be utilized to not only transport passengers and cargo to the International Space Station (ISS) but to also travel beyond Earth's orbit to the Moon and eventually Mars.

This next generation of US manned space travel is NASA's Project Constellation. The concept vehicle has evolved into the Orion spacecraft to be launched aboard the Ares I launch vehicle. The earliest targeted manned launch is in 2014. All crews and cargo traveling to and from the International Space Station during the intervening period will need to do so by either an existing Russian spacecraft or possibly a new American commercial spacecraft. Following the retirement of the Space Shuttle in 2010 there will be a gap in the capacity to domestically provide support the ISS.

Following the retirement of the Space Shuttle there will be a gap in the US manned spaceflight capability.

NASA recognized the need for mitigating measures to ease the transition from the current shuttle program to Project Constellation and develop the capability to affordably support the ISS. Development of the Commercial Orbital Transportation Services (COTS) program is intended to provide alternatives

for the transition and beyond. To initiate the program NASA has allocated $500 Million in funding for the development of launch vehicles to commercial providers. Following the successful development of launch vehicles and spacecraft by SpaceX and Orbital Sciences, the COTS program competition winners, cargo access to the ISS will be available.

There will be insufficient domestic capability to support crew access to the ISS. This lack of capability may exist until NASA's Ares I and Orion are operational.

E.1.c ACTIVATION OF FALCON 9 (SPACEX)

In 2008 SpaceX began construction at SLC-40 on its ground facilities in support of the Falcon 9 launch vehicle. The Falcon 9 launch vehicle was developed in support of NASA's COTS program to provide commercial capability to resupply the Space Station economically. The first launch of the Falcon 9 is expected to occur in early 2010.

When fully operational the Falcon 9 will be able to support both ISS resupply and commercial access to space.

E.1.d LICENSURE OF CECIL FIELD

Cecil Field is capable of supporting two of the several types of the horizontal suborbital reusable launch vehicles (RLVs), known as Concept X and Concept Z. Annual projected capacity to support launches of RLV's from Cecil Field Spaceport are listed in the following table. To reduce commercial and private airspace concerns during RLV operations, launches are expected to occur on Wednesday's and Saturday's prior to 10AM.

Table 13: Maximum Number of Launches for Concept X and Concept Z (Ref [18])

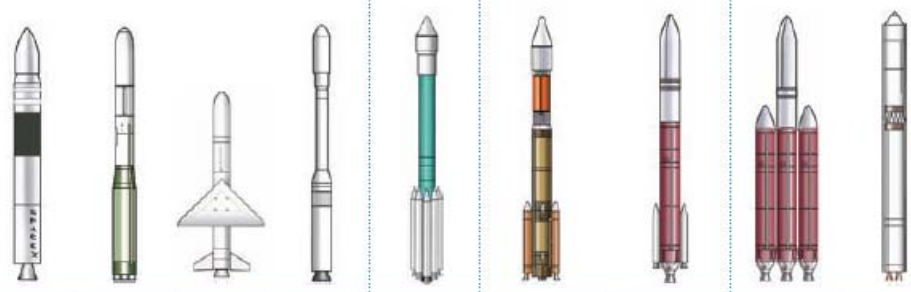
	2009	2010	2011	2012	2013
Maximum Number of Launches - Concept X	~~12~~	12	24	48	48
Maximum Number of Launches - Concept Z	~~2~~	2	3	4	4

Based on initial passenger demand forecasts and Cecil Field's expected market share Cecil Field Spaceport only has enough capacity to support a small portion (less than 10%) of the initial suborbital space tourism market.

E.2 PAYLOAD PROCESSING

A payload is cargo or goods being delivered or transported. As it relates to Spaceports, payloads are items carried by launch vehicles, be it supplies for the space station or high value assets, such as satellites. The following table summarizes payload categorization by mass class and correspondingly which launch pads and launch vehicles are equipped to handle the payload.

Table 14: Currently Available Expendable Launch Vehicles & Payload Performance (Ref [4])

	SMALL				MEDIUM	INTERMEDIATE		HEAVY	
									
Vehicle	Falcon 1	Minotaur	Pegasus XL	Taurus XL	Delta II	Atlas V	Delta IV	Delta IV Heavy	Zenit-3SL
Company	SpaceX	Orbital Sciences	Orbital Sciences	Orbital Sciences	ULA	ULA	ULA	ULA	Sea Launch
First Launch	2008	2000	1990	1994	1990	2002	2002	2004	1999
Stages	2	4	3	4	3	2	2	2	3
Payload Performance (LEO)	420 kg (925 lb)	640 kg (1,410 lb)	440 kg (970 lb)	1,590 kg (3,505 lb)	6,100 kg (13,440 lb)	12,500 kg (27,560 lb) (Atlas V 402) 20,520 kg (45,240 lb) (Atlas V 552)	9,150 kg(20,170 lb)(Delta IV M) 13,360 kg (29,440 lb) (Delta IV M+ (5,4))	22,560 kg (49,740 lb)	N/A
Payload Performance (LEO polor)	420 kg (925 lb)	640 kg (1,410 lb)	190 kg (420 lb) (SSO)	860 kg (2,000 lb) (SSO)	3,600 kg (7,930 lb)	7,095 kg (15,640 lb) (Atlas V 402) 14,095 kg (31,075 lb) (Atlas V 552)	7,510 kg (16,550 lb) (Delta IV M) 11,300 kg (24,920 lb) (Delta IV M+ (5,4))	22,560 kg (49,740 lb)	N/A
Payload Performance (GTO)	N/A	N/A	N/A	430 kg (950 lb)	2,170 kg (4,790 lb)	4,950 kg (10,910 lb) (Atlas V 401) 8,670 kg (19,120 lb) (Atlas V 551)	4,300 kg (9,480 lb) (Delta IV M) 7,020 kg (15,470 lb) (Delta IV M+ (5,4))	12,980 kg (28,620 lb)	6,100 kg (13,500 lb)
Launch Sites	RTS, CCAFS	VAFB, Wallops	VAFB, Wallops, CCAFS	VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS, VAFB	CCAFS, VAFB	Pacific Ocean

The Falcon 9, in development, is not included in the preceding table. The single core variation of the Falcon 9 is expected to lift up to 10,450 kg (23,050lb) to LEO and 4,540 kg (10,000 lb) to GTO. A distinction between commercial and non-commercial payload launches is made. Examples of non-commercial payloads include; NRO Satellites, DoD Satellites, NOAA and NASA Satellites and other government agency satellites. Commercial payloads generally consist of communications related items and earth imaging satellites.

It is notable that in 2008 more than one third of all successful orbital US launches carried commercial payloads while the remaining launches transported NASA and DoD missions. Also notable is a near-term trend for heavier geosynchronous orbit (GSO) telecommunications satellites followed by a decline, referenced in Section D.2.b. When comparing launch forecasts and payload forecasts from Section D.2.b caution should be used since many projected small payloads will be grouped aboard a single launch vehicle.

Payload Processing Options

The Payload User Guides for the Atlas V, Delta IV, and Falcon 9 each identify potential facilities for use when processing payloads for their vehicles. The following figure is a summary of the facilities that are potentially available. Identified active facilities at Kennedy Space Center include the Payload Hazardous Servicing Facility (PHSF). Other KSC facilities identified are no longer available to support EELV payloads. Identified Facilities at Cape Canaveral Air Force Station include: the Defense Satellite Communication Systems Processing Facility (DPF), the Shuttle Payload Integration Facility (SPIF), and the Payload Processing in the Falcon 9 Hangar. Identified Astrotech Facilities in Titusville include a Payload Processing Facility (PPF), a Hazardous Processing Facility (HPF), a Spacecraft Processing Facility (SPF), and a Spacecraft Support Facility (SSF).

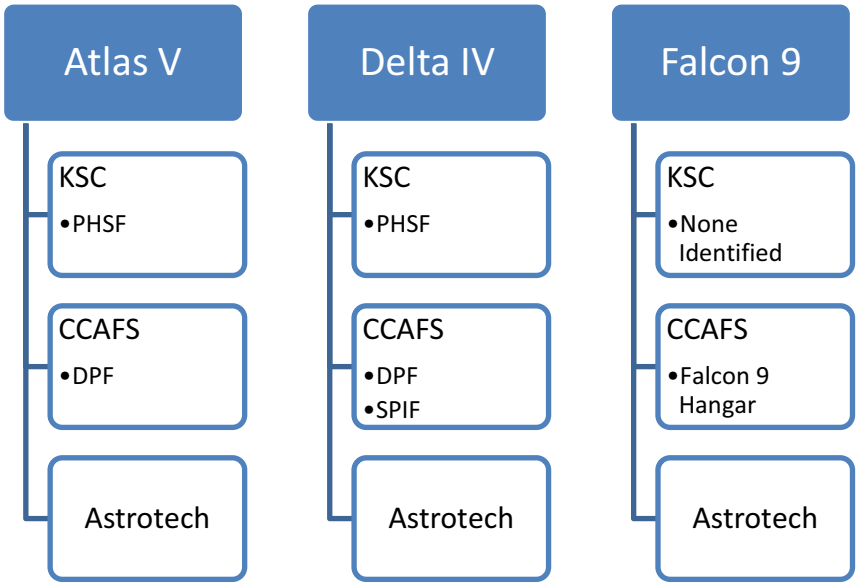


Figure 119: Payload Processing Options for Eastern Range (Ref [31], [32], and [33])

Commercial Payloads

Astrotech, located in Titusville, Florida, supports commercial payload processing for KSC and CCAFS. They own 62 acres of land with 140,000 square feet of space utilized for payload processing, hazardous processing, spacecraft processing, payload storage, warehouse storage as well as customer offices. Since beginning operation Astrotech has processed of more than 230 government and commercial spacecrafts.

The following figure shows the annual throughput of payload processing handled by Astrotech since 1989. A maximum of 14 payloads per year were processed at their facility in 1996 and 1998 (highlighted in orange in the following figure). Payloads for various launch programs including Atlas V, Delta II, Delta IV and Space Shuttle have been processed at the Astrotech Facility.

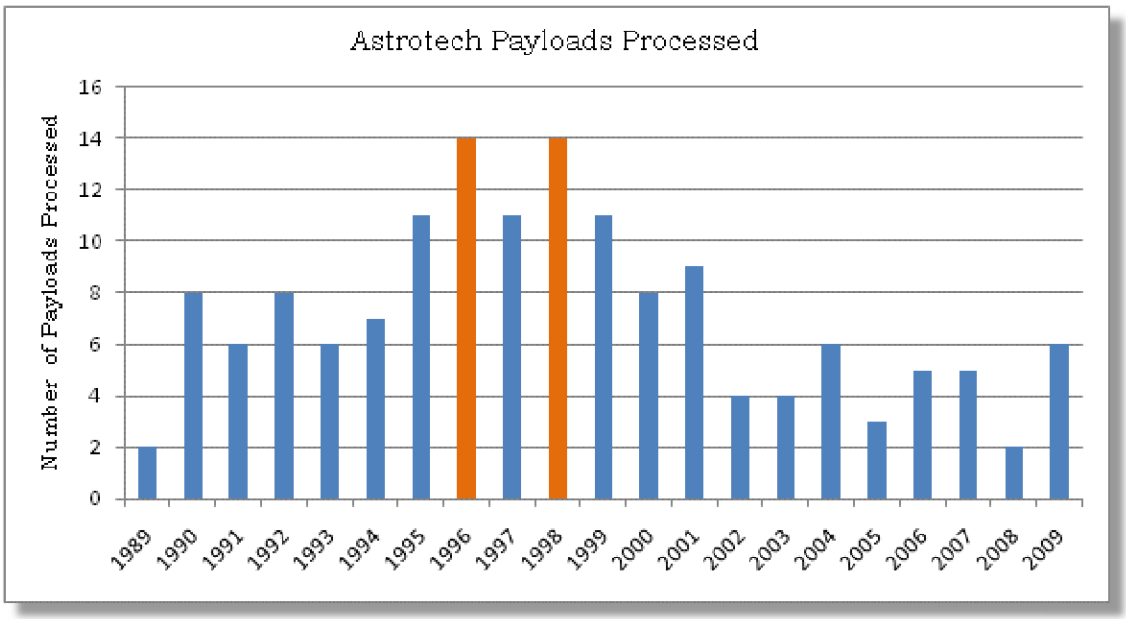


Figure 120: Astrotech Payloads Processed Annually

Florida's worldwide share of global commercial orbital launches, based on data from the last 10 years, is approximately 12% as shown in Figure 101 of Section D.2.b. Assuming that Florida continues to support 12% of the global commercial market, Florida's projected market share will be about three commercial launches annually over the next ten years. Since Astrotech has sufficient capacity to process up to 14 payloads annually they are equipped to meet this demand with excess capacity in the event that the market expands beyond this projection.

Exiting capabilities for processing commercial and non-commercial payloads are adequate for the market forecast.

E.3 EASTERN RANGE

The Eastern Range (ER) is located at Cape Canaveral Air Force Station in Florida and is used to support space launch missions launched in an easterly direction. Orbital launches from the Eastern Range are limited to the azimuths between 37 and 114 degrees. The types of orbital missions that are currently flown from the Eastern Range include the Space Shuttle, Atlas V, Delta II, Delta V, and Navy Trident II. Future missions will include the Falcon 9, Ares I, and Ares V. The Morrell Operations Center (MOC) provides flight safety, weather, scheduling, and instrumentation target designation for each launch vehicle launched from the range.

The capacity of the Eastern Range has been analyzed in three ways. The first is their overall ability to support a larger number of missions, the second are the launch azimuth limitations, and the third is its ability to quickly respond to a new program that has selected to launch from the Eastern Range.

E.3.a EASTERN RANGE OVERALL LAUNCH CAPACITY

The Eastern Range has supported over 3,300 spacelift missions over the past 50 years, and many of them have been commercial payloads. By the end of September 2009, the Eastern Range supported 16 major launch operations in a nine-month period. In the mid 90s, there were over 35 launches a year from the Cape. Historically, the range can reconfigure from one launch vehicle to another in less than 48 hours. In December 2007 when NASA's STS-122 space shuttle mission was scrubbed, the range successfully reconfigured for Atlas V launch of an NRO payload in less than 36 hours (Ref [85]). As a result, the theoretical throughput of the Eastern Range is well over 50 launches per year. While many perceive a capacity limitation to launches from the Eastern Range, the real capacity limitation comes from the launch vehicles, not the Range. For example, in the mid 1990s, there were 3 different launch systems operating at the Cape, each with 2 launch pads. Today, there are currently only 2 operational launches systems each with a single pad with missions scheduled in the near term (SLC -37 & 41). SLC-17 has a mission scheduled in 2012 and SLC-40 is currently under construction with a launch scheduled for late 2009 / early 2010.

> There are presently no capacity limitations for the Eastern Range to support launch operations in the foreseeable future.

E.3.b EASTERN RANGE LAUNCH AZIMUTHS

Different satellites have different orbital requirements. While a large number of satellites can reach their desired orbit from the Eastern Range, certain satellites are designed to operate in orbits unattainable from the Eastern Range and must be launched from other locations.

As an example between 1990 and 2006 nearly half of all NASA sponsored satellites launched on Expendable Launch Vehicles where launched from the Eastern Range (Ref [69]).

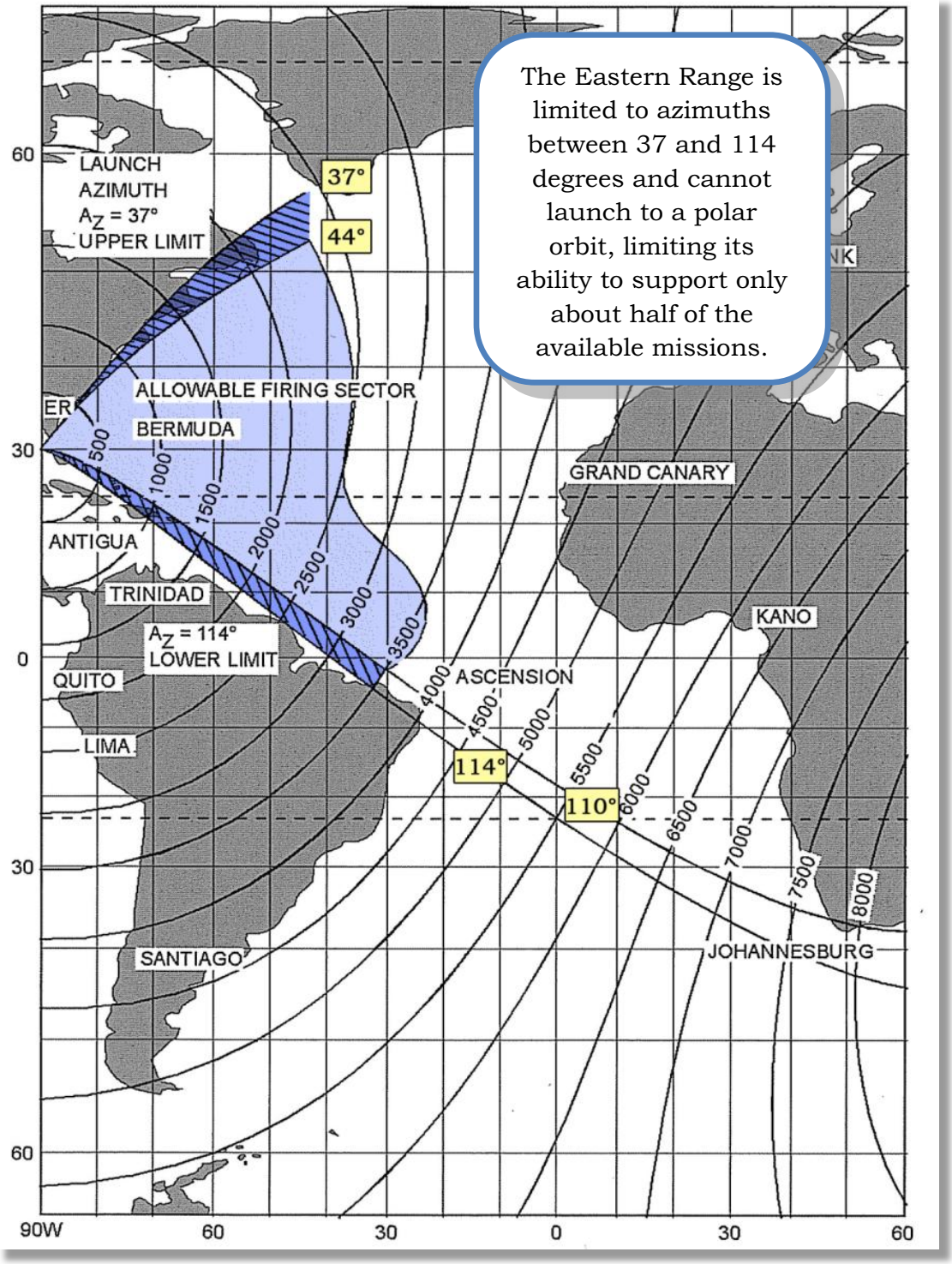


Figure 121: Eastern Range Launch Azimuths

E.3.c EASTERN RANGE SUPPORT FOR NEW PROGRAMS

Over the past few years, the 45th Space Wing has streamlined processes and made significant organizational changes to increase flexibility and support for all operations at Cape Canaveral Air Force Station. The Wing has held multiple events to streamline processes and improve transparency in Safety processes, Range Scheduling, and Facility Allocation. Moreover, the licensing of SLC-40 to Space-X and the announced intent to license SLC-36 and SLC-46 to Space Florida communicate clearly that the Eastern Range is committed to supporting new programs to the extent that it is authorized to do so.

In order to fulfill its commitment to attracting and expanding the next generation of space industry businesses, Space Florida is working with the USAF to identify and improve any existing physical, operational or administrative restrictions that may exist.

Through its Customer Assistance Service Program for the Eastern Range (CASPER), Space Florida provides a single point of contact for navigating the launch process from Florida's Space Coast quickly and efficiently. This reduces the need for commercial launch customers to have the specialists or budgets that would otherwise be needed to meet federal range requirements in a fiscally responsible manner. CASPER has received strong user support.

To reduce the overall time for a new customer to initiate their program in Florida, Space Florida has been focused on securing access to previously disturbed launch sites that can be developed for future commercial launch operations. By working with the Air Force and obtaining the proper and generic licensing for the launch site prior to having a specific launch operator, Space Florida is able to provide future launch operators with schedule and cost structure options in Florida that are more competitive than other locations.

Space Florida's strategic spaceport operations, legislative and business development plans are designed to establish Florida as the clear choice for international commercial space launch services in the world's commercial launch services marketplace.

Working together Space Florida and the Eastern Range are providing tools, services, and infrastructure to support new programs and help them navigate the requirements of the Eastern Range that will ultimately reduce program schedule and cost.

SECTION F: PLANS TO MODERNIZE AND EXPAND FACILITIES

WHAT WE CAN DO

F.1 SPACE FLORIDA PLANS FOR EXISTING FACILITIES

In the current global marketplace for Space Launches, many payload customers (both international and domestic) have selected to use foreign launch systems over the current systems available in the US and Florida. The most common reasons for a payload provider to select a foreign launch vehicle are cost and schedule. For the state of Florida to be competitive in the commercial launch industry, options must be available for potential customers. The current options available in Florida are not cost competitive enough to increase the Florida market share of the global space industry. It is imperative that Florida provides a cost competitive option for potential customers. To do this, it is recommended that Space Florida invest in launch and facility infrastructure that will serve as a foundation for Space Florida Spaceport customers. By providing these capabilities, the state of Florida and Space Florida will incentivize and encourage commercial space business development. An evaluation of the Space Florida Spaceport was completed (see Section H in the Appendix) that highlights the advantages of developing a commercial spaceport in Florida.

The integration of commercial space transportation launch and payload facilities construction and processes depends on continued work on the development of State and Federal government policies, statutes, rules and regulations. The architecture, engineering, and construction of launch sites require Space Florida to seamlessly interface with existing civil and defense components at KSC and CCAFS. As a tenant operating within the respective land use plans and according to the current operational requirements and processes, Space Florida's master plan must compliment those of NASA and the 45th Space Wing (45 SW).

Space Florida Plans for Development

- Exploration Park
- Space Florida Spaceport
  - Space Launch Complex 36 (SLC-36)
  - Space Launch Complex 46 (SLC-46)
  - Space Launch Complex 47 (SLC-47)

F.1.a EXPLORATION PARK

NASA's Kennedy Space Center and Space Florida have partnered to enable the development of a mixed-use technology and commerce park known as Exploration Park at Kennedy Space Center. Exploration Park will become home to diverse private sector technology and innovation enterprises, offering opportunities that support NASA's mission, grow and deploy U.S. commercial space capabilities, and respond to national priorities in science and technology.

KSC has established a flexible, long-term area development plan for Exploration Park. The initial phase is soon to be under design/construction by Space Florida and its selected Master Developer, Pizzuti. Up to 315,000 square feet of planned floor space will be available for research and lab facilities, offices, and processing and light manufacturing. In addition, NASA and Space Florida plan to incorporate the existing 100,000 square foot Space Life Sciences Laboratory into the park, broadening the lab's accessibility and use beyond NASA.

Figure 122: Exploration Park - Building A (Rendering)

The Exploration Park development team is targeting several specific industry clusters:

- Aerospace contractors and commercial space services providers supporting U.S. government and private space initiatives
- Bio-technology and Life/Environmental Sciences
- Clean energy research, development, and demonstration
- Advanced technology for automation, robotics, and micro-electronics
- Spacecraft fabrication, assembly, component manufacturing

Exploration Park is ideally located on KSC grounds in close proximity to launch, payload processing, and technical labs operated by NASA and by the U.S. Air Force on neighboring Cape Canaveral Air Force Station. It offers easy and reliable 24/7 access for clients, workers, and visitors because it is located just outside the restricted access portion of KSC. The park is serviced with all necessary utilities and emergency services, and will offer sites ready for development and/or leases within dedicated or multi-tenant facilities.

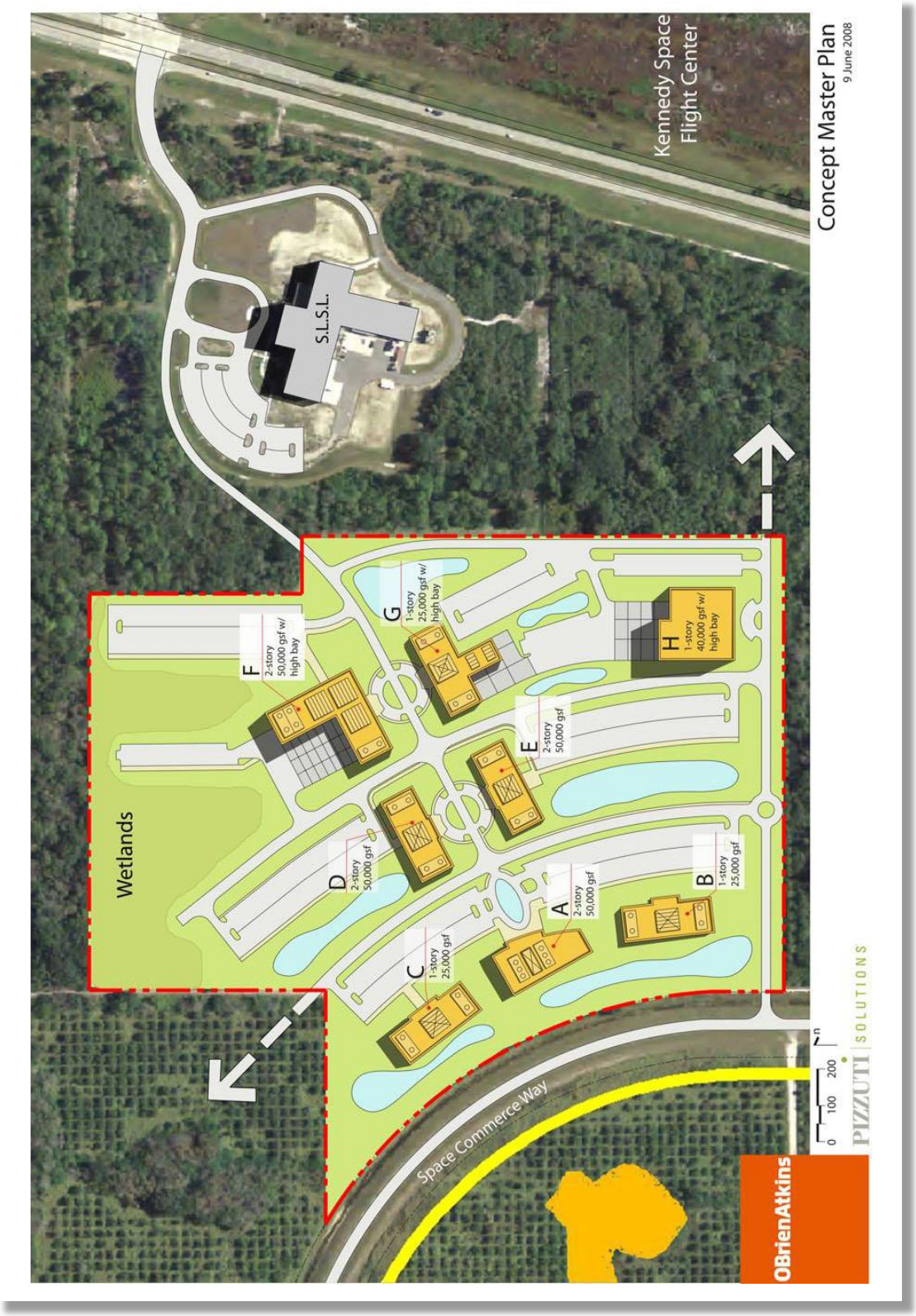


Figure 123: Exploration Park Concept Master Plan (Pizzuti – Ref [46])

F.1.b SPACE FLORIDA SPACEPORT DEVELOPMENT

Space Florida recommends the development of the Space Florida Spaceport, consisting of SLC-36, SLC-46, and SLC-47. By modernizing and continuing to develop these sites, the state of Florida will make available launch sites for use by commercial launch operators. The Space Florida Spaceport will provide the commercial capability to support both orbital and suborbital missions as well as launch vehicles fueled by either liquid or solid propellants.

Future expansion of the Space Florida Spaceport and Florida Spaceport System can provide further modernization and expansion capable of supporting suborbital and orbital Reusable Launch Vehicles.

Table 15: Launch Vehicle Types Supported at Space Florida Spaceport

	SLC-36	SLC-46	SLC-47
Orbital Liquid Propellant Launch Vehicles (LOX/RP-1)	✓	--	--
Orbital Solid Propellant Launch Vehicles (e.g., Castor 120 based)	--	✓	--
Suborbital Launch Vehicles (Super Loki / University Rockets)	--	--	✓

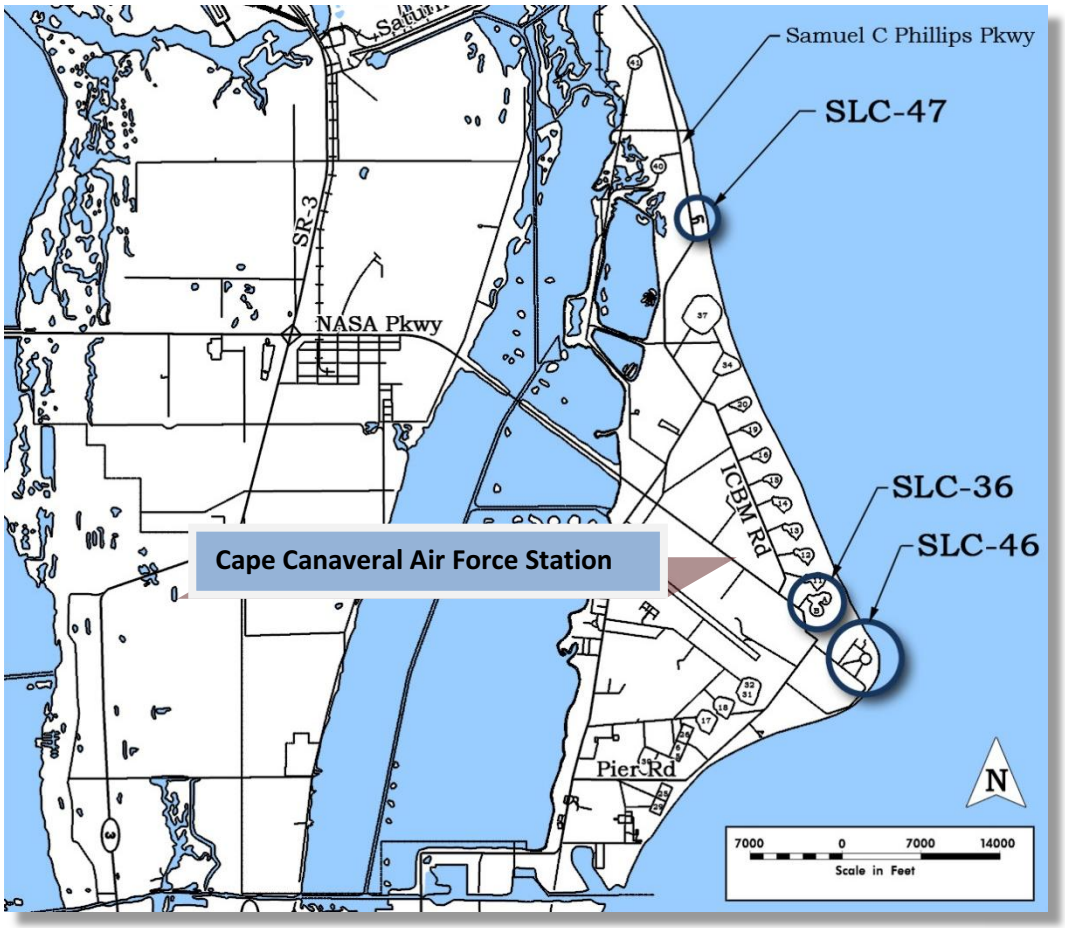


Figure 124: Location of Space Florida Spaceport Launch Complexes

F.1.c SPACE LAUNCH COMPLEX 36 (SLC-36)

Figure 125: SLC-36 Recommended Development Phases

The development of SLC-36, as shown in Figure 125 and Figure 126, is proposed to occur in four phases:

Phase 0 – Planning and Licensing

Space Florida is in the process of obtaining both the Air Force Real Property License and FAA Launch Site Operators License. Once both of these licenses have been obtained construction can begin on the site. Concept development for the entire launch facility is complete and a topographical survey will be conducted in the near future. Space Florida will continue to maintain the SLC-36 property and will use the property for temporary storage of assets that will eventually be incorporated in the operational infrastructure.

Phase 1 – Launch Complex Construction

The initial construction projects will include new paving, new security fence, reconditioning of existing buildings, upgrade of utility terminations, and construction design work to the PER (Preliminary Engineering Review) level. These projects have been selected because they are independent of any particular launch operator or a vehicle-specific requirement.

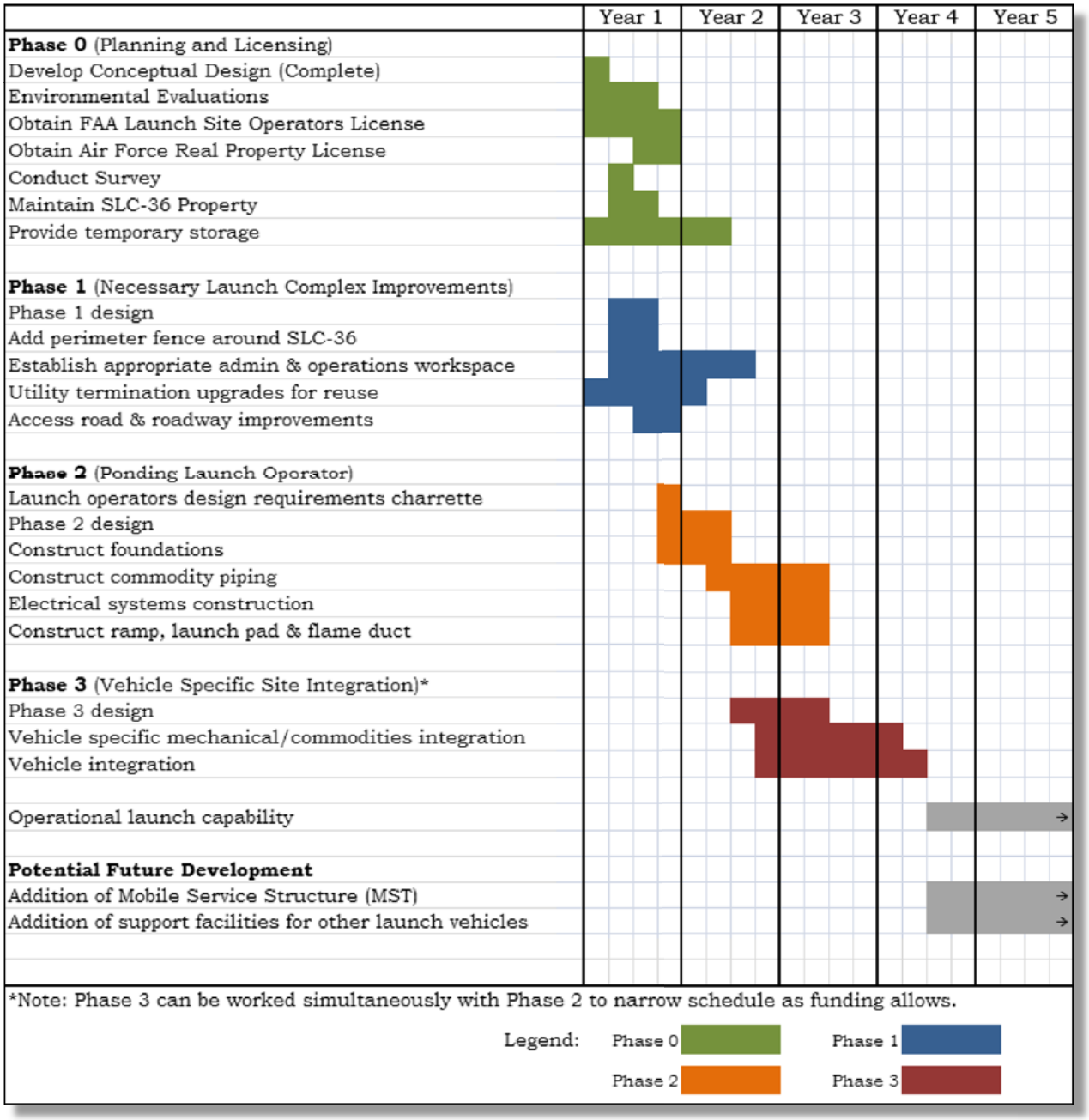


Figure 126: SLC-36 – 5-year Plan

Phase 2 – Initial Infrastructure Development

Before Phase 2 can begin a vehicle operator or payload customer must be identified. A launch operator "design requirements charrette" will be completed to identify requirements for designing the infrastructure. Initial infrastructure will be designed and constructed during this phase.

Phase 3 – Vehicle Specific Site Integration

Once a specific launch vehicle operator has committed to using SLC-36 Phase 3 will begin. This phase can be coordinated in parallel to Phase 2. In Phase 3, vehicle-specific equipment is installed and integrated with the existing pad infrastructure.

Future Development

As the development of SLC-36 continues, the potential exists for expansion of the capabilities at the launch site. For example, adding a Mobile Service Structure, support facilities for other launch vehicles, and a second pad.

F.1.d SPACE LAUNCH COMPLEX 46 (SLC-46)

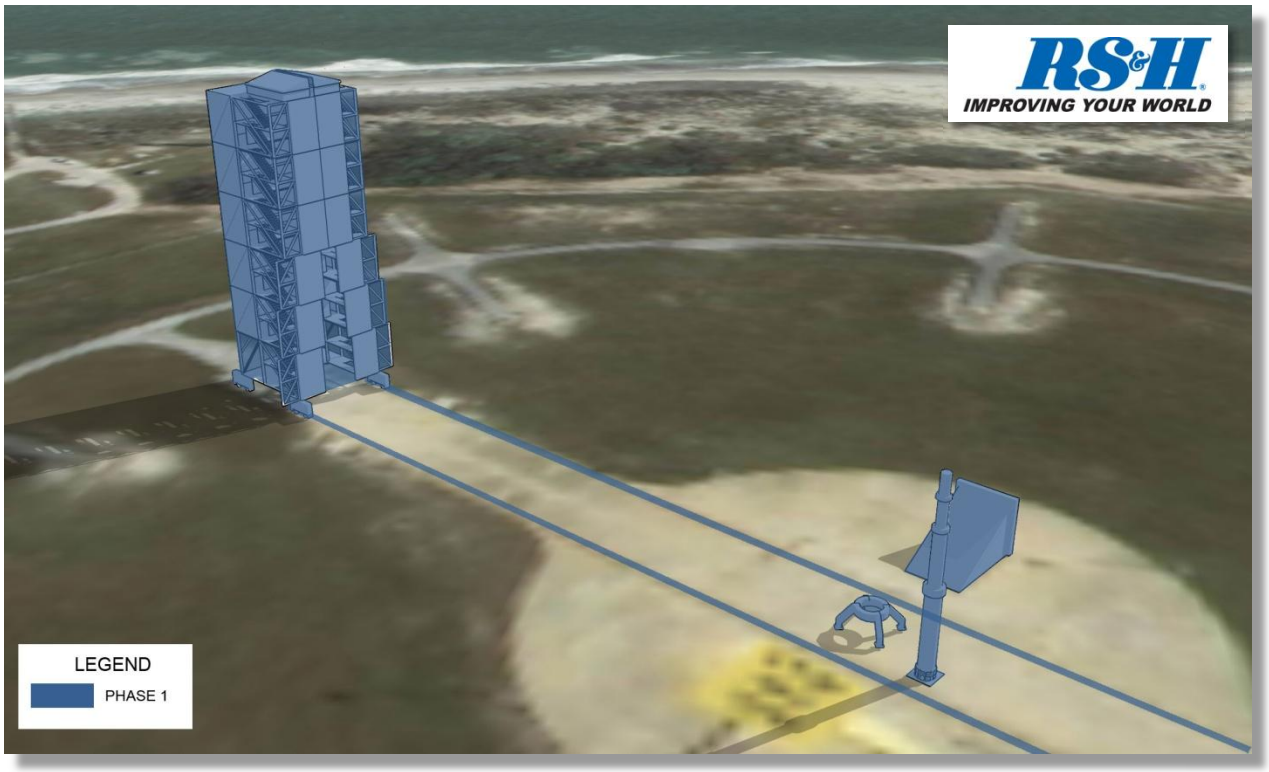


Figure 127: SLC-46 Recommended Development Phases

Market conditions are creating renewed interest in launching from Complex 46. For example, a major launch services provider has submitted a Program Introduction to the 45 SW specifically requesting access to Complex 46 for a small launch vehicle similar to those previously launched from this facility. This request has been favorably received by the 45 SW.

The development of SLC-46, as shown in Figure 127 and Figure 128, is proposed to occur in 2 phases:

Phase 0 – Planning and Licensing

Space Florida is in the process of developing an explosive site plan and working with the Navy to develop a Memorandum of Agreement (MOA) for access to SLC-46. Additionally Space Florida is also in the process of obtaining both the Air Force Real Property License and FAA Launch Site Operator's License. Once both of these documents have been obtained construction can begin on the site.

Phase 1 – Restore Operational Capability

Once a launch service provider has been identified for SLC-46, renovation activities can begin to restore major infrastructure at the site such as the Mobile Access Structure (MAS) and communications and

launch control system. An assessment will be completed to determine if the MAS rail or flame deflector require refurbishment.

Future Development

As the development of this site continues, the potential exists for an expansion of the capabilities at the launch site to support additional space launch programs. In support of any additional future space launch programs modifications to the MAS and integration of vehicle-specific launch mounts and hardware will be required.

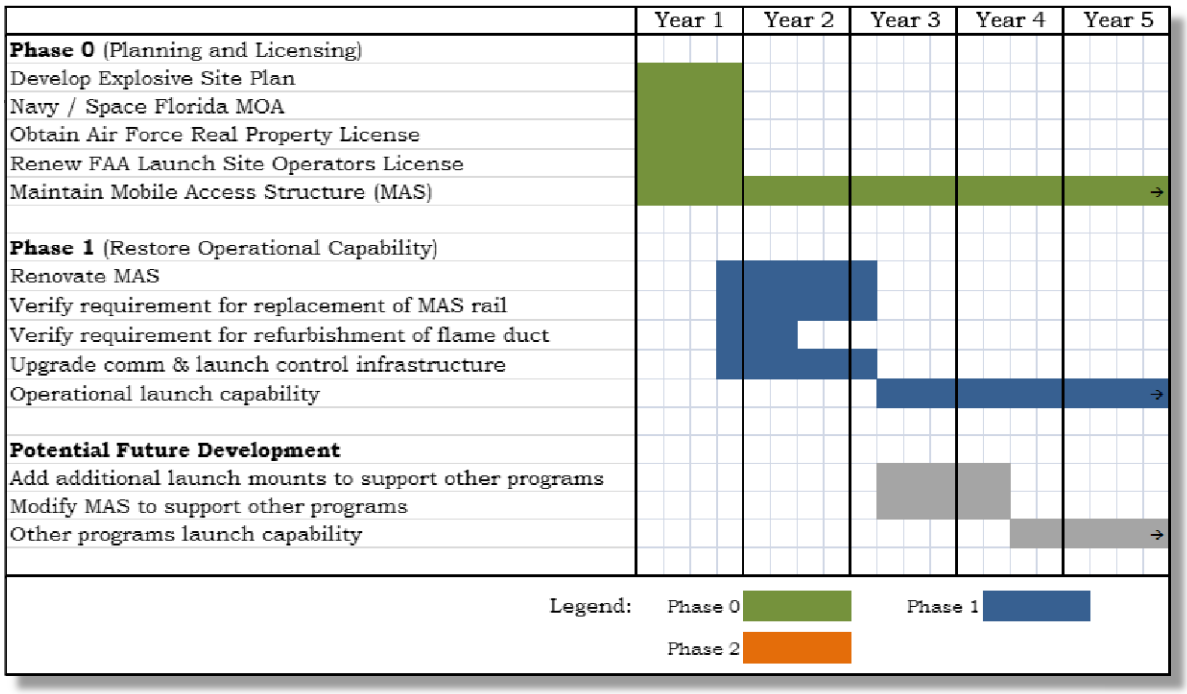


Figure 128: SLC-46 – 5-year Plan

F.1.e SPACE LAUNCH COMPLEX 47 (SLC-47)

SLC-47 is anticipated to continue supporting Super Loki suborbital launch vehicles for education and research. The current five-year plan, as shown in Figure 129, for SLC-47 is to continue operating as normal and to expand the capability to include University sounding rockets. Phase 1 of the development efforts include refurbishing the current launch rail and launch control center. Phase 2 of the development effort includes the integration of University launch programs and adding sounding rocket launch capability to the site.

There are no launch sites within the Space Florida Spaceport that are capable of supporting a solid-propellant launch vehicle larger than an Athena II. As future needs dictate, development of a launch site capable of supporting a solid-propellant launch vehicle larger than an Athena II can be considered at SLC-47. This will require an extensive study to determine conceptual site layouts and environmental impacts and acquisitions of additional land use agreements.

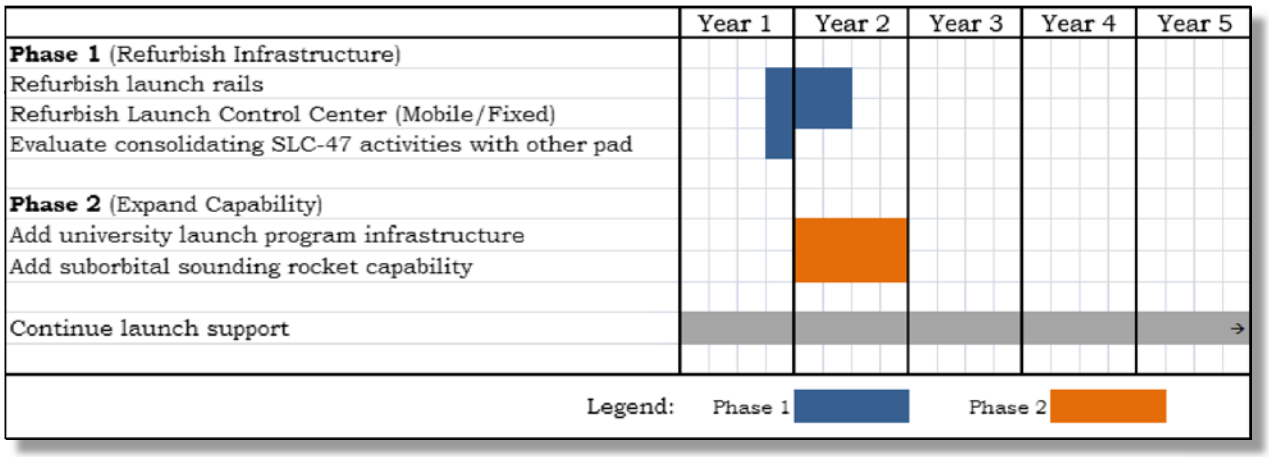


Figure 129: SLC-47 - 5 year Plan

Florida Tech University delivered a rocket motor static test stand under a Space Florida contract awarded in August 2006. The test stand is capable of measuring any thrust level up to 10,000 lbf in the primary direction, can measure solid rocket motors up to 12 inches in diameter and of any length. It is capable of measuring six degrees of freedom, including torque, using high-frequency, state-of-the-art piezoelectric force transducers. The instrumentation suite allows the test stand to be used as either a rocket motor research facility or educational "thrust laboratory." Commercial entities and universities have utilized the test stand to verify experimental rocket motor performance.

Space Florida and Florida Tech are currently researching operational locations around the state for emplacement of the test stand; SLC-47 is an ideal location for this. It is readily transportable and able to be set up and operated in any location with sufficient safe stand-off distances to accommodate the size of the rocket motor.

F.2 NASA KSC PLANS

Kennedy Space Center has an aggressive plan in process for the development of its facilities. Currently KSC is following plans to support the retirement of the space shuttle, and modify existing facilities for use with the Ares I, and Ares V vehicles of the Constellation Program

F.2.a PLANS FOR LAUNCH COMPLEX 39A

Launch Complex 39A will continue to support space shuttle missions until the shuttle program is retired. It will then undergo yet-to-be-determined modifications to accommodate the Ares V vehicle.

F.2.b PLANS FOR LAUNCH COMPLEX 39B

Launch Complex 39B is already in the process of being modified for the Ares I vehicle, and is supporting the launch of the Ares IX test vehicle. This pad has already undergone a major transformation with the addition of the Lightning Protection towers. Further plans are to remove the Fixed Service Structure (FSS) and Rotating Service Structure (RSS) in preparation for the new Mobile Launcher for the Ares I vehicle. There will also be a new emergency egress system for the astronauts, which operates similar to a roller coaster to quickly provide the astronauts with a means to escape the pad in an emergency.

F.2.c PLANS FOR THE VEHICLE ASSEMBLY BUILDING

The Vehicle Assembly Building (VAB) will continue to support vertical vehicle processing with new modifications for the Constellation Program. High bay 3 has been modified for use with the Ares I-X test vehicle, and will be further modified for the Ares I operational vehicle. High Bay 1 will be converted to accommodate the Ares V vehicle processing needs.

F.2.d PLANS FOR LAUNCH CONTROL CENTER FIRING ROOM 1

Firing Room 1 will be modified for Launch Control of the Ares launch vehicles. It will also be used for practicing with new equipment and procedures of the Ares program.

F.2.e PLANS FOR THE SHUTTLE LANDING FACILITY (SLF)

The SLF is a highly capable runway that is 15,000’ long, and 300’ wide. Its primary use is for the shuttle program to support Shuttle landings, and Shuttle Carrier Aircraft landings. The facility also functions as a runway for NASA aircraft and is a destination for air delivered space related components.

In the last few years there have been a variety of pathfinder activities performed at the SLF to verify potential new uses of this asset. Through a number of expanded access demonstrations, NASA has identified alternative government and commercial uses for the SLF beyond the shuttle program.

Expanded Access Demonstrations:

- Zero G flights
- Global Flyer
- USAF C-5
- Indy and NASCAR
- Starfighters
- USCG R&D Center

Through these expanded access demonstrations, facility improvements and general use categories were identified. These uses have been included in the recent Environmental Assessment and are approved. These uses are:

- Spaceflight Development and Operations
  - Suborbital & orbital horizontal launch & landing.
- Spaceflight Program & Mission Support Aviation
  - Parabolic and high altitude/performance flights for training/R&D
  - Cargo flights, mission support aircraft
- Aviation Test Operations
  - FAA Certification Tests
  - Development/demonstration flights of experimental aircraft, new systems development.
  - Military aircraft
  - UAVs
- Airborne Research & Technology Development
  - Weather studies/earth remote sensing (e.g. NOAA aircraft)
  - Sensor development flights (e.g. helicopters/UAVs)
- Incidental, Transient Aircraft Use
- Straight-Line Aerodynamic Tests (high performance vehicles)
- Ground Research & Technology Development
  - Laser Test range applications
  - Ground systems testing & calibration

F.2.f PLANS AT THE SLF RLV HANGAR

Space Florida and NASA are currently in discussions regarding the future of the Reusable Launch Vehicle (RLV) Hangar. Items driving this effort include:

- NASA/KSC has determined for security and safety requirements and reasons, that the user market for the RLV must be restricted to government or NASA approved users of the Shuttle Landing Facility (SLF). Space Florida has determined that the potential user market is very limited and that Kennedy Space Center (KSC) is considered the most likely qualified user.
- Space Florida currently retains the responsibility to fund RLV operations, maintenance, and NASA/KSC support services for the facility. These annual expenses exceed projected tenant revenue with additional revenue opportunities possible but not probable for the foreseeable future.
- NASA/KSC has identified a need for the RLV to support current and future mission aviation needs and contingencies. However, NASA/KSC has also determined that due to security and safety requirements it requires asset ownership of the hanger to support SLF uses supporting agency mission and objectives.

F.3 CCAFS PLANS

Planning for CCAFS facilities begins with an overall land use plan, and narrows down through a number of levels to facility specific plans. The specific facility plans are not available publicly, but the latest land use plan was shown to Space Florida Associates, and Space Florida plans were shared with CCAFS Civil Engineering Staff. The plans and projects listed in this Spaceport Master Plan do not interfere or conflict with the plans of CCAFS.

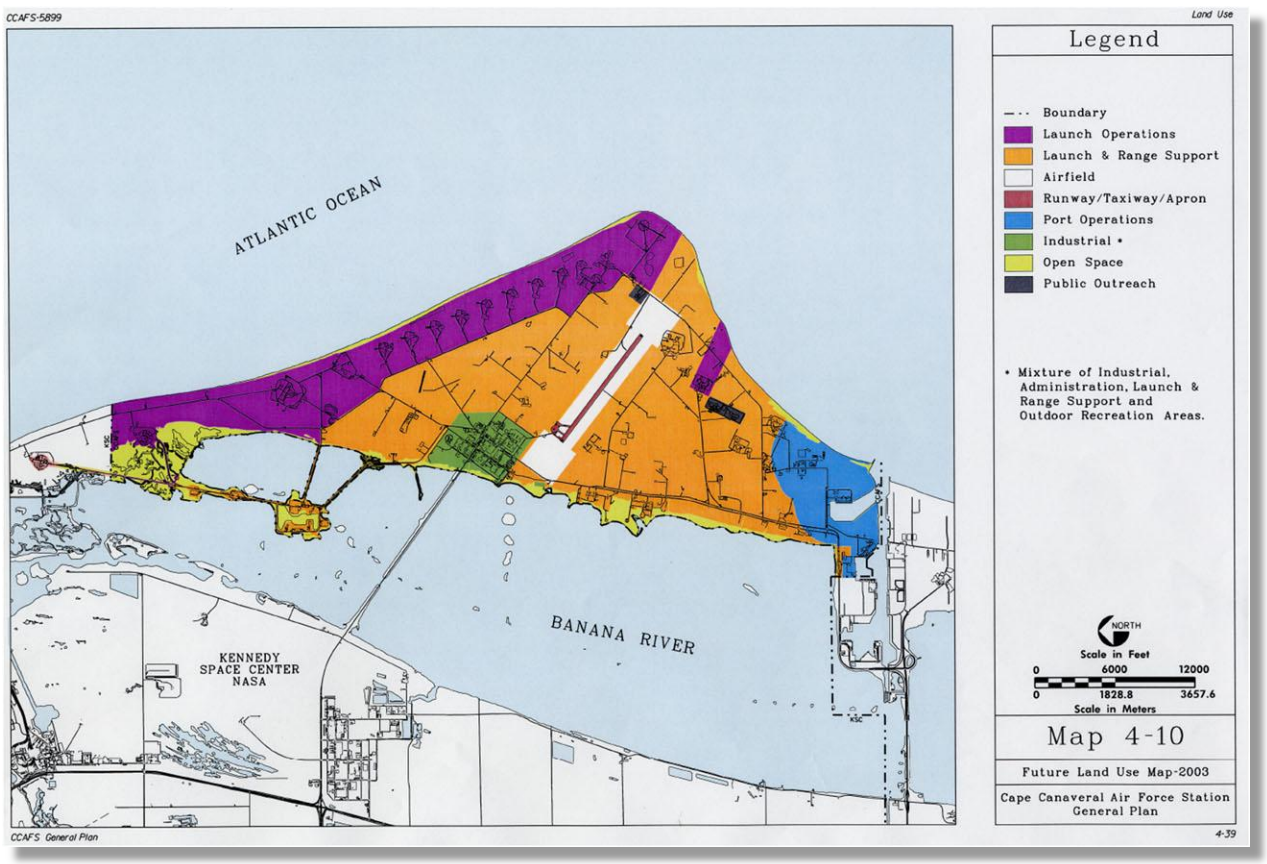


Figure 130: Cape Canaveral Air Force Station General Plan (Ref [1])

There are a number of existing facilities at CCAFS, and as military programs come and go, some of these facilities become available. Programs looking for a facility that matches open existing facilities can benefit from the capital already invested in the facility. There is an established process for how available facilities become dispositioned after their use, and it follows this priority:

1. 45th Space Wing Program Use
2. Other Air Force Program Use
3. DOD Program Use
4. Federal Government Program Use
5. State Government Program Use
6. Civil Use
7. Commercial Use

The best way for a commercial entity to engage CCAFS with regard to facilities is to furnish a list of facility requirements to Space Florida, who will work with CCAFS, and allow their facility, and land use planners to find the right location in which to operate.

F.4 JACKSONVILLE AVIATION AUTHORITY PLANS

With regards to Space transportation, JAA has exciting plans for expansion of infrastructure. JAA has positioned Cecil Field to be the Launch and Landing Site for suborbital Reusable Launch Vehicles, and has a variety of projects to meet the needs of this emerging market. All of these projects are consistent with Cecil Field's Spaceport License Application and will help position Cecil Field to be a competitive spaceport for Suborbital Reusable Launch Vehicles.

F.4.a RLV HANGAR & ASSEMBLY FACILITY

This project is to design and construct a 54,000 square ft hangar with 10,000 sq. ft. of administration space at Cecil Field. This would support RLV operations for storage, integration, and administration. This new space could be leased to a variety of existing aviation customers until a RLV provider comes to Cecil Field. Many RLV companies operate on tight budgets. Being able to lease space is an attractive capability to these operators.

F.4.b RLV TAXIWAY & APRON FACILITY

The new RLV taxiway at Cecil Field will support RLV operations consistent with their Spaceport License. This project will construct a taxiway and apron for use by Reusable Launch Vehicles. The taxiway will be 75 ft wide (75,000 square-yards) and be positioned parallel to Runway 18L/36R, which is the runway to be used for spaceport operations. During times when spaceport operations are not being conducted, the taxiway will be available for use by airplanes operating on the airfield. The RLV Apron will be positioned adjacent to the new RLV assembly facility and serve as a parking area for aircraft transitioning between the hangar and flight environment. The RLV Apron will measure approximately 300 ft in length by 200 ft in width (6,700 sq yards.) and be constructed of concrete.

F.4.c RLV FUELING FACILITY

At Cecil Field Spaceport, no facilities dedicated to RLV fueling operations are currently provided. With the existing facilities, RLVs are loaded with rocket fuel and oxidizing agents on the runway in which the vehicle will use for departure. JAA proposes developing a facility dedicated to RLV fueling operations. The proposed facility will be located approximately 2,000 ft from the proposed assembly facility in order to load Concept X and Concept Z vehicles, while also complying with Inhabited Building Distance (IBD)

criteria for fueled RLVs. The fueling station area will include a taxiway measuring 75 ft in width for transitioning from the apron to the fueling area and a pad for RLV maneuvering. The Spacecraft Fueling Area will measure 400 ft in length by 400 ft in width (160,000 square feet (17,800 square yards)). Both the taxiway and fueling area will be constructed of concrete and require approximately 26,200 square-yards.

F.5 SPACEX PLANS

SpaceX plans to launch the Falcon 9 from Launch Complex 40 at CCAFS. They have submitted the following projects that would help them modernize and expand their facilities at CCAFS in support of NASA's COTS program.

F.5.a FALCON 9 BOOSTER REFURBISHMENT FACILITY

Each Falcon 9 vehicle has a recoverable booster stage with 9 SpaceX Merlin engines. This booster stage has potential to be refurbished, which would save much of the cost of building each vehicle. In order to refurbish a booster of this size a facility approximately 200' x 75' would have to be constructed. A refurbishment facility in Florida will keep the boosters close to their recovery and launch points which will reduce the overall processing time. By helping SpaceX build this facility, the state assures that the booster recovery and refurbishment work stays in Florida.

F.5.b FALCON 9 VEHICLE STORAGE SPACE

The Falcon 9 vehicle needs additional storage space. For comparison, while the Delta IV HIF can store 9 boosters, the current Falcon 9 facility can store only one. Additional space for vehicle storage will allow faster response to new launch requests.

F.5.c FALCON 9 ORDNANCE STORAGE

The Falcon 9 vehicle, like all other rockets at CCAFS, has ordnance on board. Storage for these volatile materials has to be handled properly within strict safety regulations. SpaceX as a commercial company requires storage that is compliant with ATF (Alcohol, Tobacco, and Firearms) Standards. While existing ordnance facilities at CCAFS meet the DoD standards there are variations between ATF and DoD standard that create complications for ordnance storage. SpaceX is working with Space Florida to address this issue.

F.5.d FALCON 9 DRAGON CAPSULE PROCESSING FACILITY

The Dragon Capsule is the spacecraft that will take cargo to the ISS and is planned to eventually ferry astronauts to the ISS. Processing this capsule requires a dedicated processing facility. There will be a number of operations required for processing the Dragon Capsule. Having the processing facility near the launch pad, will keep vehicle integration time low. The state could also ensure processing jobs stay in Florida by helping to build the Capsule Processing Facility.

F.6 UNITED LAUNCH ALLIANCE PLANS

In order to expand the capabilities of their Florida facilities United Launch Alliance (ULA) plans to provide increased capacity for their Atlas V vehicle. This includes an additional Vertical Integration Facility (VIF) and Mobile Launch Platform (MLP).

Launch infrastructure was initially planned at Launch Complex 41 to have 4 VIF bays to meet the high launch rates required in the initial EELV plans. When the contract was awarded to start the Atlas V program only one VIF and MLP was built. This project would double the processing capacity for the Atlas V, and allow more launch flexibility by being able to process two vehicles in parallel.

F.7 POTENTIAL PROJECTS FOR SPACE FLORIDA TO ADVOCATE FOR THIS YEAR

Through the process of developing the Spaceport Master Plan, existing state space transportation infrastructure was assessed, the current market and capacity was analyzed, statewide stakeholders were surveyed and potential projects that will help to modernize and expand Space Transportation in Florida were identified.

Here the candidate projects are listed and Project Identification Sheets are provided. Since the current project list has not been vetted through a prioritization process a brief discussion is provided about the future development of a prioritization and selection process for candidate projects.

F.7.a PROJECT LISTING

Presented here is a list of Candidate Projects (in alphabetical order) that have been identified by Space Florida and their Stakeholders.

Table 16: Candidate Project Listing

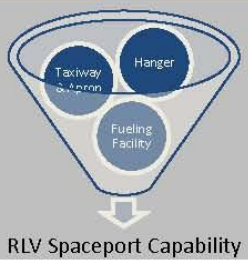
Project Description (in alphabetical order)	Location
Jacksonville Aviation Authority - RLV Fueling Facility	Cecil Field Spaceport
Jacksonville Aviation Authority - RLV Hanger & Assembly Facility	Cecil Field Spaceport
Jacksonville Aviation Authority - RLV Taxiway & Apron Facility	Cecil Field Spaceport
NASA/KSC - Shuttle Landing Facility Improvements	Kennedy Space Center
Space Florida - Space Launch Complex 36 Phase 0 Design and Construction	Space Florida Spaceport
Space Florida - Space Launch Complex 46 Refurbishment	Space Florida Spaceport
Space Florida - Space Life Sciences Exploration Park Transportation Improvements	Kennedy Space Center
Space Florida - Spaceport Master Planning	Statewide
SpaceX - Falcon 9 Vehicle Storage Space	CCAFS
SpaceX - Falcon 9 Dragon Capsule Processing Facility	CCAFS
SpaceX - Falcon 9 Ordnance Storage	CCAFS
SpaceX - Falcon 9 Booster Refurbishment Facility	CCAFS
United Launch Alliance - Vertical Integration Facility and Mobile Launch Platform	CCAFS – SLC-41

These projects are detailed in the “Project Identification Sheets” sheets below.

RLV FUELING FACILITY

Description:

Design and Construct Fueling Facility and Apron for reusable vehicles to meet IBD Criteria of Spaceport License



"The liquid fuel loading area provides a location to load liquid fuels onto the RLVs prior to roll-out to the liquid oxidizer loading area.

Maximum Quantity of Propellants at the Liquid Fuel Loading Area

- At most, the quantity of one full 3,000 gal fuel tanker truck.
- Equivalent to 3,000 gal of fuel (RP-1 or Ethanol).
- Or equivalent up to ~21,000 lbs of liquid fuel."

-Cecil Field Spaceport Application, Chapter 3 – Explosive Site Plan

JACKSONVILLE AVIATION AUTHORITY

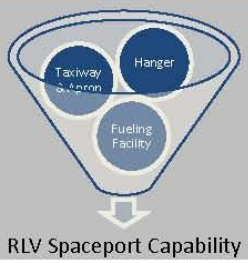
- The fueling facility needs to clearly identify a stay-out zone of 100'
- $1.9 million - estimate
- 18 months - estimate
- RLV missions for space tourism are a viable business case.
- The RLV Fuel Facility can be configured for capacity storage of aviation fuel until an RLV customer is identified.
- This project is eligible for conduit financing, or private financing.

Hangar → Taxiway & Apron → Fueling Facility → RLV Spaceport Capability

RLV HANGAR & ASSEMBLY FACILITY

Description:

Design and construct 54,000 sq. ft. hangar & 10,000 sq. ft. administration space. At Cecil Field Spaceport



- Hangar can be used for Reusable Launch Vehicles, and Launch Operator administration.
- Hangar can be utilized by other aviation businesses until an RLV business comes to Cecil Field.
- Approx $16 Million
- 24 month schedule to completion.
- Project is ready to proceed.
- Viable business case with Estimated Cost Recovery in approximately 10 years.
- This project is eligible for conduit financing, or private financing.

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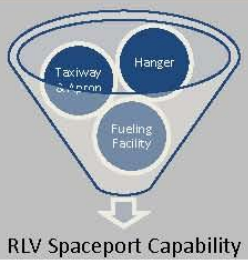
RLV TAXIWAY & APRON FACILITY

Description:

Design and Construct Taxiway and Reusable Launch Vehicle (RLV) Apron at Cecil Field Spaceport.



- Taxiway measuring 75 Ft in width.
- RLV Apron to be 6,700 Sq. Yd

JACKSONVILLE AVIATION AUTHORITY

- Reusable Launch Vehicles require a sufficiently wide taxiway to reach the Apron
- RLVs require sufficient apron size for outdoor operations and temporary storage.
- $500,000 estimate.
- Can be complete in 10 months.
- RLV missions for space tourism are a viable business case.
- The RLV Taxiway is an intermodal connector between spaceport infrastructure and aviation facilities.
- This project is eligible for conduit financing, SIS, or private financing.

Hangar → Taxiway & Apron → Fueling Facility → RLV Spaceport Capability

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KSC SHUTTLE LANDING FACILITY IMPROVEMENTS

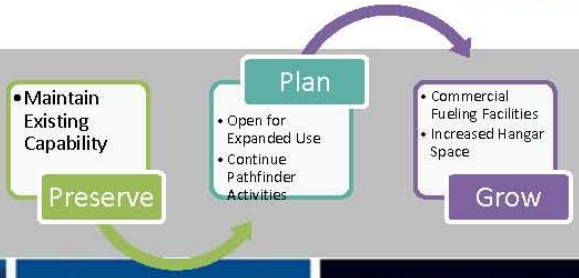
Description

Create incremental improvements to support expanded use of the SLF

Possible Expanded usage of the SLF includes:

- Spaceflight Development and Operations
- Spaceflight Program & Mission Support Aviation
- Aviation Test Operations
- Airborne Research & Technology Development
- Incidental, Transient Aircraft Use
- Straight-Line Aerodynamic Tests
- Ground Research and Development

- Located at Kennedy Space Center
- Allows for greater utilization and maintenance of this National Asset.
- Can be funded through grants and Federal appropriations.
- Implementation over the next 3 years
- $5 million (approx)



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SPACE LAUNCH COMPLEX 36

Description

Develop a liquid fueled vehicle launch complex. Constructed in a phased approach to limit costs and protect assets while providing the state a competitive value.

Phase 1 (Necessary Launch Complex Improvements) → Phase 2 (Improvements Specific to Launch Operator Requirements) → Phase 3 (Vehicle Specific Integration) → Liquid Fueled Launch Vehicle Capability

SPACE FLORIDA

- Located at CCAFS, LC-36
- Provides a dedicated complex for commercial medium class launch vehicles.
- Phased construction can be complete in 2 to 6 years depending on level of funding.
- Return in 10 years allowing for proper level of investment and launch rate.
- Can be funded by the State Transportation Trust Fund, Or Conduit Financing with a launch operator.
- $55 million, est.

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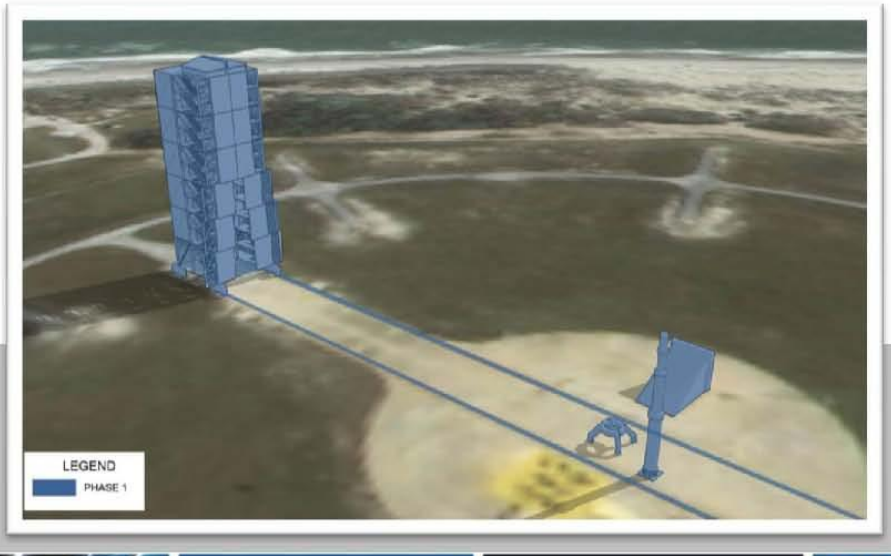
SPACE LAUNCH COMPLEX 46

Phase 1 – Restore Operational Capability

Once a launch service provider has been identified for SLC-46, renovation activities can begin to restore major infrastructure at the site such as the Mobile Access Structure (MAS) and communications and launch control system. An assessment will be completed to determine if the MAS rail or flame deflector require refurbishment.

SPACE FLORIDA

- Provides Solid Fueled Small Vehicle Launch Capability
- $5 Million to Restore Full Capability
- Structure is in good shape.
- Doors, paneling, and facility systems need refurbishment or replacement.
- Rails, wheel trucks, and flame deflector need full assessment.

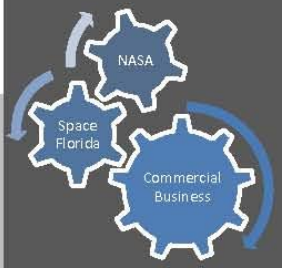


SPACE LIFE SCIENCES EXPLORATION PARK TRANSPORTATION IMPROVEMENTS

Roadway Access to Begin Development

Design and Construct Roadways to connect SLS building with Exploration park and Space Commerce Way.

- Exploration park will provide real estate for science and technology companies that enjoy a close proximity to NASA KSC, CCAFS, and the Space Life Sciences Building.
- Constructor is a partner, and will fund the construction of the buildings.
- Up to 315,000 sf. Of planned research, lab and office space.
- Lease and build-to-suit opportunities
- High-bay and Clean room capability



- $5 million estimate
- 10 months (roads and infrastructure)
- Leases will contribute funds through a special tax district mechanism to cover debt, and fund future expansion.
- Viable business plan requires a minimum of funding. Possibly from SIS, or State Transportation Trust Fund.

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SPACEPORT MASTER PLAN

CONTINUED PLANNING

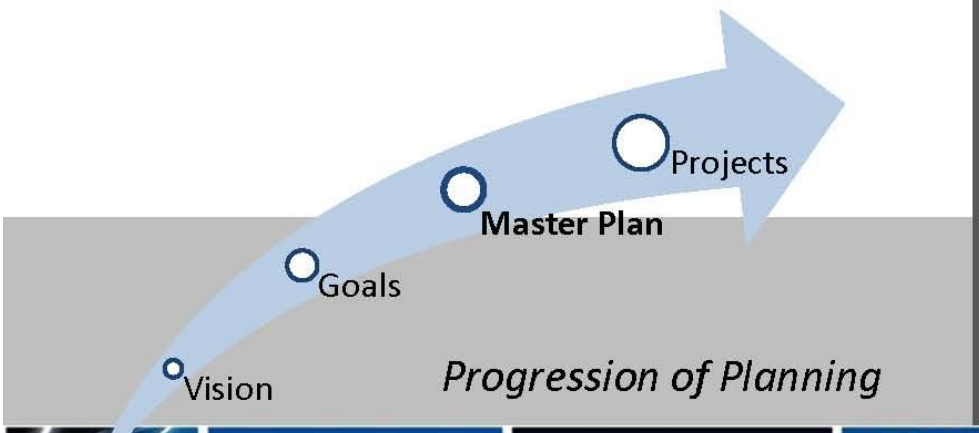
Funding for continuation and maintenance of Planning

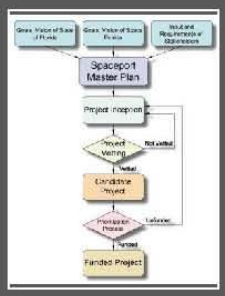
The Spaceport Master Plan is a living document that requires periodic updates to remain current and relevant. Projects need assessment and reevaluation on an annual basis.

The Master Plan is the key mechanism for:

- Communicating with Stakeholders
- Identifying needs
- Project Development and Prioritization
- Bringing the Vision to Reality.

- The return is organizational direction in the form of vetted development projects.
- $300,000 Annually
- Can be funded with SIS funds, State Transportation Trust Funds, or Space Florida Organizational Funding.





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FALCON 9 VEHICLE STORAGE SPACE

Vehicle Storage Space

This facility would provide storage space for the Falcon 9 first and second stage, as well as room for the capsule and some administration.

"The Falcon launch vehicle family is designed to provide breakthrough advances in reliability, cost, flight environment and time to launch. The primary design driver is and will remain reliability, as described in more detail below. We recognize that nothing is more important than getting our customer's spacecraft safely to its intended destination." - SPACEX

SPACEX

- 225' long x 150' wide enclosed building.
- Overhead crane to facilitate moving operations
- $2.6 million, 2 years construction – estimate.

Deliver / Refurbish → **Store** → Process / Integrate → Launch

FALCON 9 DRAGON CAPSULE PROCESSING FACILITY

Description

The Dragon Capsule needs a place for processing in Florida to ready it for missions.

"The Dragon spacecraft is made up of a pressurized capsule and unpressurized trunk used for Earth to LEO transport of pressurized cargo, unpressurized cargo, and/or crew members. Initiated internally by SpaceX in 2005, Dragon will be utilized to fulfill our NASA COTS contract for demonstration of cargo re-supply of the ISS."

-SPACEX

- 50' x 100' facility, with a small area for a clean room.
- $3.3 million, 2 years construction, est.
- This project is eligible for financing through lease-back, bonds.

Deliver / Refurbish → Store → Process / Integrate → Launch

FALCON 9 ORDNANCE STORAGE

Description

SPACEX needs a place to store ordnance for Falcon 9 missions.

"The Falcon launch vehicle family is designed to provide breakthrough advances in reliability, cost, flight environment and time to launch. The primary design driver is and will remain reliability, as described in more detail below. We recognize that nothing is more important than getting our customer's spacecraft safely to its intended destination." - SPACEX

- CCAFS has a long history of safely storing ordnance, boosters and propellants.
- An agreement between CCAFS and SPACEX needs to be negotiated for use of ordnance storage facilities.
- Little to no facility cost$ for reuse of existing facilities. No lead time required for existing facilities.

Deliver / Refurbish → **Store** → Process / Integrate → Launch

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FALCON 9 BOOSTER REFURBISHMENT FACILITY

Description

SPACEX needs a facility for first stage refurbishment.

"The Falcon 9 tank walls and domes are made from aluminum lithium alloy. SpaceX uses an all friction stir welded tank, the highest strength and most reliable welding technique available. Like Falcon 1, the interstage, which connects the upper and lower stage for Falcon 9, is a carbon fiber aluminum core composite structure. The separation system is a larger version of the pneumatic pushers used on Falcon 1.

Nine SpaceX Merlin engines power the Falcon 9 first stage with 125,000 lbs-f sea level thrust per engine for a total thrust on liftoff of just over 1.1 Million lbs-f. After engine start, Falcon is held down until all vehicle systems are verified to be functioning normally before release for liftoff." - SPACEX

SPACEX

- Each Falcon 9 vehicle has a recoverable booster stage with 9 engines.
- Due to the large vehicle investment, it would be beneficial to be able to recover and refurbish the booster stage.
- A booster refurbishment facility would be ideally located between a seaport and the vehicle storage building
- Approximate size 200' x 75' building
- $25 million, 2 years, est.
- This project is eligible for financing.

Deliver / Refurbish → Store → Process / Integrate → Launch

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VERTICAL INTEGRATION FACILITY AND MOBILE LAUNCH PLATFORM

Description

Development of an additional Vertical Integration Facility (VIF) and Mobile Launcher Platform (MLP) to increase launch capacity.

Existing VIF and MLP
- Adequate Capacity to meet EELV assured access to space
- Limited Capacity for Commercial Launches

Additional VIF and MLP
- Increased Capacity for DOD Space Missions
- Increased Flexibility for Commercial Launches

ULA United Launch Alliance

- Infrastructure of LC 41 and Atlas V was created with multiple VIFs and MLPs in mind.
- Expanding this capability leverages existing successful launch infrastructure, and business.
- Allows Vehicle Processing in Parallel.
- This project is eligible for conduit financing
- $340 million est.
- 3 years of construction.

Atlas V in VIF

Mobile Launch Platform

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SPACEPORT MASTER PLAN 2010

F.7.b PROJECT PRIORITIZATION AND SELECTION

The current projects identified in this Spaceport Master Plan have not been filtered through an official prioritization and selection process. Development of prioritization process will require a substantial time investment from stakeholders, users, other state agencies, and the public. it is recommended that a process be developed to evaluate projects identified in future iterations of the Master Plan or for high priority projects that are identified needing expedited consideration for funding. The following approach for filtering projects has been developed as a concept to be further expanded and implemented.

Once potential projects have been identified, it will be necessary to vet and prioritize the projects for advocacy or potential receipt of state funding. Future candidate projects should go through a project prioritization and selection process prior to advocating for funding through the Spaceport Master Plan similar to the flow chart shown in Figure 131.

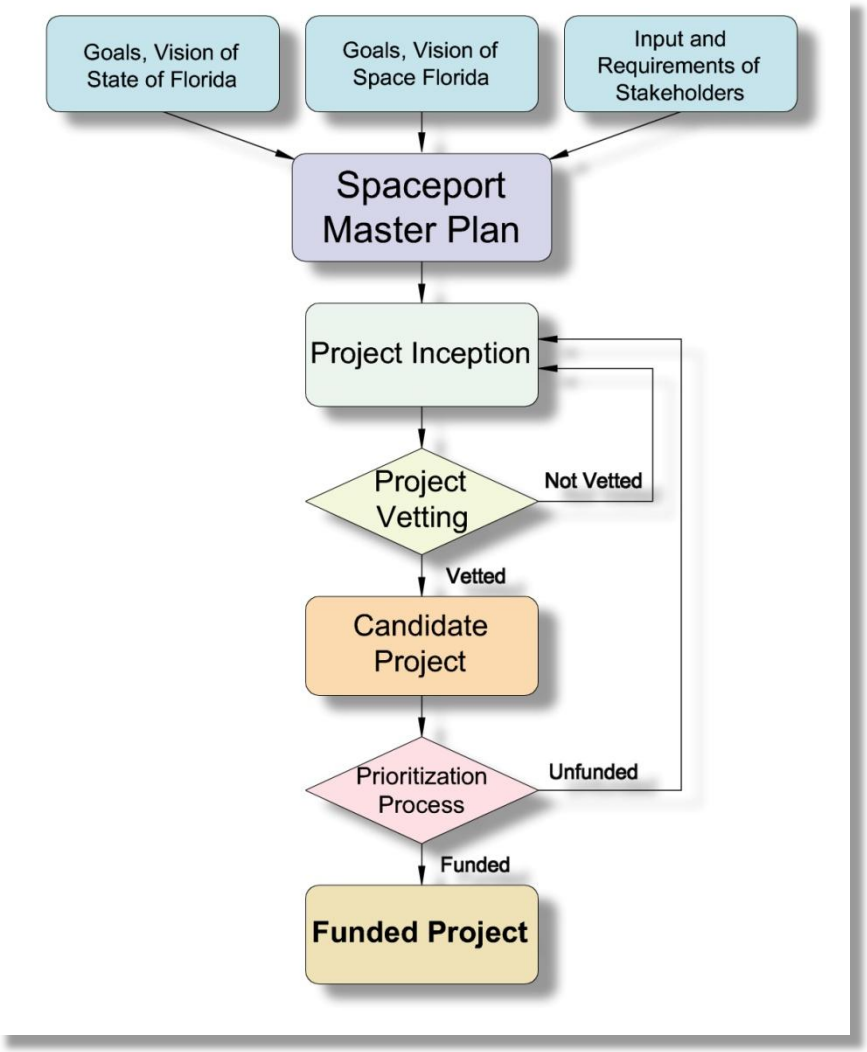

Figure 131: Project Selection Process

Project Inception

A candidate project is a project that has not been vetted, prioritized or funded, but it is a collection of real tasks that together address an established requirement or need.

Project Vetting

A set of strict and high-level criteria will be used to vet each candidate project. The vetting criteria will be a set of pass/fail aspects that each project must meet to qualify for prioritization. The specific vetting criteria used by Space Florida to evaluate projects will be determined in future collaborative discussions with stakeholders, and presented in later updates of the Master Plan. Some example vetting criteria may be:

- Does the project benefit Florida in addition to meeting space needs?
- Does the project meet the need?
- Is the project legal?
- Does project execution risk public safety?
- Is the project achievable with existing technology?

Project Prioritization

Each project will go through a prioritization process to rank it for selection of funding. The specific method of prioritization is not presented here, but is suggested that it be based on a set of weighted criteria compared to the expected project outcome. Some possible prioritization criteria that have been already discussed and shared with stakeholders include:

- Increased Economic Competitiveness
- Improvements to Safety
- Funding Sources & Partnerships
- Economic Impact
- Retention of Workforce / Workforce Availability
- Environmental Stewardship
- Enhancement and Modernization of Existing Infrastructure
- Preservation of Existing Assets
- Geographic Balancing
- Process Bottleneck / Capacity Improvement
- Existing Committed Funded Projects
- Time to Market / Window of Opportunity
- Number of Customers Helped
- How the project lines up with Space Florida's Goals, Objectives and Vision

These criteria will be selected and weighted with input from stakeholders in future meetings and workshops. The intent of the prioritization process is to provide transparency to the public about the selection process, while selecting the projects that best support Space Florida's goals with the levels of funding available. The projects described in this master plan are not prioritized, since the prioritization process is still in development at this time.

Once the candidate projects have been vetted, and prioritized, they will be selected for funding. If funding sources are available and can be applied then the projects will be identified as "funded projects."

SECTION G: IMPLEMENTATION PLAN

HOW WE WILL GET THERE

G.1 IMPLEMENTATION STRATEGIES

The enabling legislation for Space Florida provides that Space Florida shall submit its spaceport master plan to any appropriate metropolitan planning organization for review of multimodal impacts, as well as to the Florida Department of Transportation (FDOT). The enabling legislation for Space Florida also provides for the inclusion of spaceport master plan projects in the FDOT Five Year Work Program.
Subject to the availability of appropriated funds, FDOT may participate in the capital cost of eligible spaceport discretionary capacity improvement projects [Section 331.360(3) and (4), F.S.].

G.1.a FLORIDA SPACEPORTS AND METROPOLITAN PLANNING ORGANIZATIONS (MPO)

As the first step in the implementation of the Space Florida Spaceport Master Plan, Space Florida intends to submit copies of the plan to all of the Transportation Planning Organizations (TPOs) and Metropolitan Planning Organizations (MPOs) in the state of Florida. The purpose of these submittals will be for Space Florida to solicit reviews of the multimodal impacts of the projects that are included in the Space Florida Spaceport Master Plan.

In September 2009, Space Florida submitted an interim list of projects to the Space Coast TPO for their review, along with a detailed project description for each of the projects that were included on the interim list. In 2008, Space Florida also submitted an interim project list to the Space Coast TPO for review. Both in 2008 and in 2009, the projects that were submitted by Space Florida were incorporated into the annual list of priority projects that were submitted by the Space Coast TPO to the Florida Department of Transportation (FDOT).

G.1.b FLORIDA SPACEPORTS AND THE FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT)

Space Florida has established working relationships with the Florida Department of Transportation (FDOT) that will enable FDOT and Space Florida to work together proactively to advance the implementation of the recommended projects that are included in the Space Florida Spaceport Master Plan. The primary FDOT contact for Space Florida is located in the Aviation Office of FDOT in Tallahassee. Space Florida has also established working relationships with FDOT officials at the Office of Policy Planning in Tallahassee, as well as in FDOT District 5. **As plans for spaceport facilities develop at new locations in addition to the Space Florida Spaceport, Space Florida will work proactively with additional FDOT District offices.**

G.1.c FLORIDA SPACEPORTS AND THE FDOT STRATEGIC INTERMODAL SYSTEM (SIS)

Space Florida has worked directly with FDOT in its efforts to revise and update the Strategic Intermodal System (SIS) for the state of Florida. Space Florida representatives served in an active role in the "System Wide Data Review and Designation Update" of the SIS which was completed in mid-2008.

As of the date of this report, FDOT is nearing the completion of the 2010 SIS Strategic Plan Update, a comprehensive review of the SIS that is legislatively required to be undertaken every five years. Since January 2009, an official of Space Florida has served as a member of the SIS Leadership Committee, which has functioned as the steering committee for the 2010 Strategic Plan Update. The anticipated completion date for the 2010 SIS Strategic Plan Update is January 2010.

Currently, the Cape Canaveral Spaceport Hub is the only Spaceport Hub in the Florida SIS. Although Florida Statutes Section 331.304 defines a number of areas in the State as "Spaceport territory," currently only the property located in Brevard County in District 5 is on the SIS and meets the existing designation criteria and thresholds for SIS Spaceport hubs.

It is anticipated that new SIS designation criteria and thresholds for spaceport hubs will be added to the SIS when the SIS Update is completed and officially adopted early in 2010, and that the SIS Update will also lead to the addition of new designation criteria and thresholds for Emerging and Planned SIS Spaceport hubs.

At a minimum, the designation criteria for additional spaceport hubs should include spaceports capable of handling civilian passengers or space tourists, as well as commercial or military payloads. Given that quantifiable minimum size threshold criteria have been developed for all other categories of hubs in the SIS, it appears reasonable to also develop quantifiable minimum size threshold criteria for additional spaceport hubs. It also appears reasonable to develop criteria for the designation of Emerging or Planned Spaceport hubs at locations where launches may have not yet occurred. Separate sets of designation criteria and thresholds may be required for military, civil, and commercial spaceports.

To date, the boundary of the existing Cape Canaveral Spaceport hub is not specifically defined in the SIS, although FDOT has issued maps which show that both the KSC and the CCAFS are within the boundary of the Cape Canaveral Spaceport hub.

Pending the completion of the 2010 SIS Strategic Plan Update, all space related activity that occurs at Kennedy Space Center (KSC) and the Cape Canaveral Air Force Station (CCAFS) is considered to occur at the hub that is identified in the SIS as the "Cape Canaveral Spaceport". At this time it appears likely that when the 2010 SIS Strategic Plan Update is completed and officially adopted, major military facilities in the state, including CCAFS, will be added to the Strategic Intermodal System, and that connector roads to CCAFS and other major military facilities will also be added to the SIS network.

In general, projects within hubs would be eligible for SIS funding, but due to augmentation issues (See Section G.1.f), projects within military facilities would not be eligible for SIS funding. Cape Canaveral Air Force Station is guided by Title 10 which does not allow the Department of Defense to accept external funding facilities projects. The exception is that properties at CCAFS that are licensed to a user (such as SLC-36 for Space Florida) can be funded by outside money.

The Jacksonville Aviation Authority (JAA) has requested that Cecil Field Airport, located with the Cecil Commerce Center, be considered for designation as an Emerging SIS Spaceport Hub. In conjunction with this designation, JAA has also requested that the Brannan Field-Chaffee Road be designated as an Emerging SIS Connector that would link the Cecil Field Spaceport hub to the I-10 SIS Corridor and eventually the I-95 SIS Corridor, through Clay County & St. John's County.

As of the date of this report, there is a significant discrepancy between SIS Airport Hubs and SIS Spaceport Hubs, with respect to the funding eligibility of capacity projects.

According to the FDOT "Capacity Funding Eligibility Matrix for Strategic Intermodal Facilities" (Ref [6] [6]), dated July 2009, there are five categories of project facilities that are eligible for funding at SIS Airport Hubs, including projects involving landside, airside, and terminal connections, as well as projects at Reliever Airports. But at SIS Spaceport Hubs, there is only one category of projects that is identified as eligible for funding.

The only projects currently eligible for SIS funding at SIS Spaceport Hubs are "on-site roadways and railways" that directly link cargo/industrial facilities to SIS connectors. The FDOT Matrix also notes that "Eligible improvements are for cargo/industrial facilities not for visitor purposes."

As of the date of this report, Space Florida recommends that FDOT take steps to eliminate this discrepancy. It is anticipated that this discrepancy will be addressed in the final steps towards the completion of the FDOT SIS 2010 Strategic Plan Update

G.1.d FLORIDA SPACEPORTS AND THE FDOT CFASPP

In addition to coordination with metropolitan planning organizations and its initiatives with regard to the Strategic Intermodal System (SIS), Space Florida is also involved with the Continuing Florida Aviation Systems Planning Process (CFASPP), through participation in meetings of the CFASPP East Central Region Steering Committee.

The state of Florida maintains the Continuing Florida Aviation Systems Planning Process (CFASPP), as a means for identifying and prioritizing improvements to designated civil aviation facilities in Florida, including primary, reliever, and general aviation airports.

G.1.e FLORIDA SPACEPORTS AND THE FDOT FIVE YEAR WORK PROGRAM

Before FDOT can undertake the funding of any project, that project must be part of the adopted FDOT Five Year Work Program. If a project is not listed in the adopted FDOT Five Year Work Program, it cannot be undertaken by FDOT without formally processing an amendment to the adopted work program in accordance with applicable state legislation [Section 339.135, F.S.].

> As provided for in its enabling legislation, Space Florida plans to submit this Spaceport Master Plan to FDOT so that projects identified in this plan can be included within the FDOT Five Year Work Program.

The process by which FDOT develops the work program is described with the term, "Policy to Projects." Policies and program objectives are outlined long range and short range components of the Florida Transportation Plan, which in turn is derived from the State Comprehensive Plan, Federal Law, and the State Transportation Code, with input from metropolitan planning organizations, regional planning councils, local governments, stakeholders, and partners, including Space Florida.

Under state law, capacity projects that are included in the Florida Strategic Intermodal System (SIS) have a higher priority for state funding than other capacity projects that are not included in the SIS.

At the local level, the program has to be consistent with the capital improvement elements of the local government comprehensive plans. The first three years of the FDOT Five Year Work Program represent the state's commitment to local governments.

State law requires that the adopted FDOT Five Year Work Program must be balanced to cash and revenue forecasts. The Department utilizes the best available forecasts of costs and funding, which accounts for expected levels of expenditures, expected levels of federal aid, expected state revenues, and the resulting expected cash balance in the State Transportation Trust Fund.

Funds are allocated among the seven FDOT districts and the Florida Turnpike Enterprise, which have the authority to determine the best use of their funds in a manner consistent with the Work Program Instructions and the policies and objectives outlined in the short range component of the Florida Transportation Plan. Input to District Work Plans is also provided by Metropolitan Planning Organizations' Transportation Improvement Programs and priority project lists. Within the limitations of the funds allocated to them, the districts identify projects and develop schedules based on project priorities.

The FDOT Five Year Work Program, which is administered by the FDOT Office of Work Program, is updated annually. The new work program is formally adopted by the FDOT Secretary each July. Prior to

the annual adoption of the updated FDOT Five Year Work Program, public hearings are held in each of the seven transportation districts, and a statewide public hearing is held by the Florida Transportation Commission.

Figure 132 shows the general schedule for the annual update and adoption of the FDOT Five Year Work Program (Ref [49] & [50]).

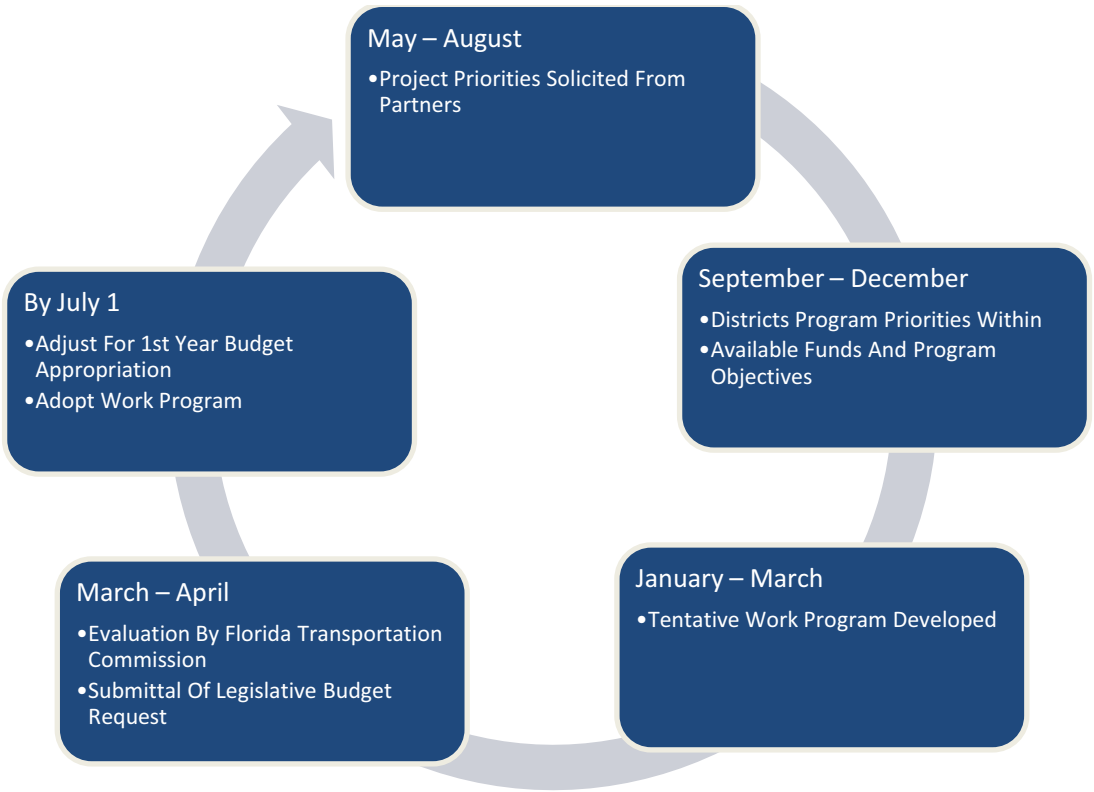

Figure 132: General Schedule for Update and Adoption of FDOT Five Year Work Program

G.1.f FUNDING LIMITATIONS AND UNSYNCHRONIZED STATUES

The two Department of Defense (DoD) space launch ranges at Cape Canaveral AFS, Florida, and Vandenberg AFB, California are guided by Title 10 provisions as military organizations. They were originally developed to support DoD space launch and other test operations. As such, their operation is limited to those capabilities that can be funded by DoD appropriations for DoD mission requirements.
At the same time, our nation has Title 49, The Commercial Launch Act, Title 15, The Commercial Space Competitiveness Act, and NSPD-40, a Presidential National Security Directive that require the U.S. Government, including DoD, to support a broad commercialization of space agenda. Title 49 requires the DoD to make federal launch ranges available to the commercial launch industry, Title 15 requires the DoD to purchase commercial launch services (consistent with national security objectives), and national policy ties these together to promote a robust commercial space industry for both DoD and our nation's economic growth, stability and national security.

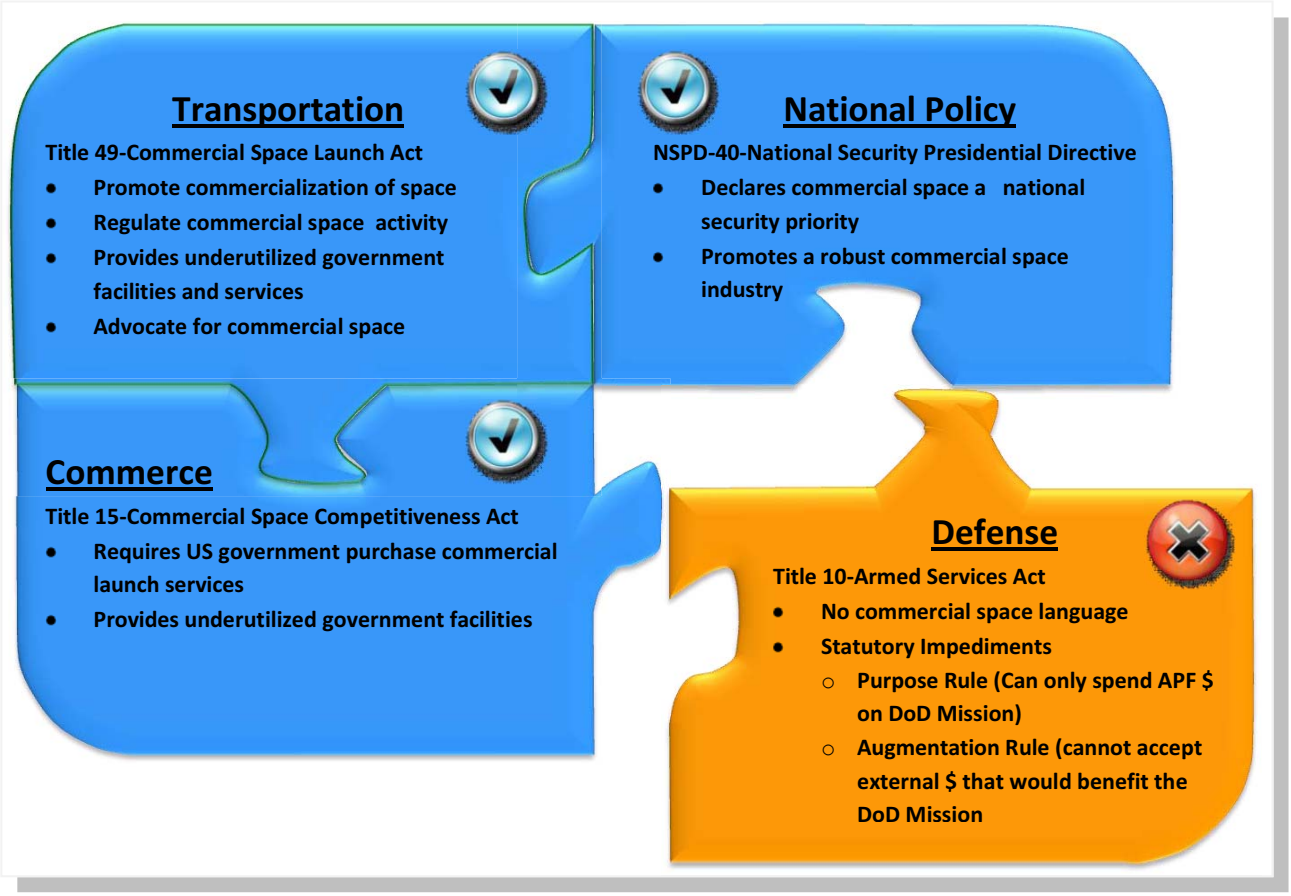

Figure 133: Unsynchronizes Statutes on Commercial Space

What are unsynchronized are Title 10 restrictions versus our nation's commercial space support mandate. Except for reimbursement of direct capability the DoD already has, they cannot accept

external funding nor can they spend their funding on external entities. These unsynchronized statutes greatly restrict and impede our nation's support to the commercial launch industry.

In order to foster and support the US commercial space industry, DoD is considering proposals to permit the commingling of DoD appropriations and non-federal commercial space funding, so long as it serves a U.S. Government national security interest. The intent is to allow commercial industry (and other government agencies – state and federal) the ability to fund space-related, launch base and range capabilities that benefit all parties. The authority to share costs would result in the Nation's ability to retain, upgrade and utilize essential facilities and instrumentation in a fiscally constrained environment.

Examples of how shared costs can provide benefit while reducing the burden for all users:

- Allows launch bases to partner with commercial industry to modify a radar to provide capabilities desired by commercial users, such as higher resolution or multipath tracking of debris that would also provide additional capability to the DoD.
- Allows launch bases to provide more telemetry bandwidth that would benefit both the DoD and commercial spacecraft industry.
- Allows launch bases to design, build or modify shared facilities, such as launch pads or processing facilities to optimize usage, retain national assets between program campaigns, and saving costs for all users.
- Allows launch bases to share costs for providing a more robust infrastructure to make it more dependable for all users. This might include upgrading the power grid (current problem), upgrade communication and fiber optic lines, or enhancing internal roads, rail, and airfield or port transportation access modes.
- Reduces environmental requirement's costs for DoD.

G.2 SPACE TRANSPORTATION AND THE STATE TRANSPORTATION TRUST FUND

According to Florida Statute 331.360 the spaceport master plan is required to "include recommendations on appropriate sources of revenue that may be developed to contribute the State Transportation Trust Fund". Portions of this legislation were passed in 1999 as part of the Space Transportation Planning Act. The public resources to support the state's role in transportation come from a variety of sources, the State Transportation Trust Fund being one of them.

The Florida State Transportation Trust Fund (STTF) is a major source of state and local revenue for transportation, specifically airport, transit, rail, water port and highway programs. Highway fuel taxes constitute the oldest continuous source of dedicated transportation revenues in Florida. Additionally, the State Transportation Trust Fund also receives funds from off-highway fuel taxes (fuel consumed in various "off-road" activities including intrastate railroads, commercial vessels, and construction equipment). These sources include the highway fuel sales tax, off-highway fuel sales tax, State Comprehensive Enhanced Transportation System (SCETS) tax (an additional state imposed excise tax on all highway fuels), fuel use tax, and the out-of-state vehicle fuel tax.

In addition to highway fuel taxes, state motor vehicle license fees are designed as a highway user charge that partly covers the costs of constructing and maintaining roads. These fees include motor vehicle licenses, initial registration, motor vehicle titles, and rental car surcharges. Furthermore a state aviation fuel tax is collected, of which 92.7 percent is directed towards the State Transportation Trust Fund. Local government revenue sources also contribute to the STTF, and include an alternative fuel tax and a local option fuel tax on gas/gasohol and diesel. The STTF also receives a distribution of excise taxes from documentary stamps as part of the growth management legislation passed in 2005, and subsequently updated in 2008.

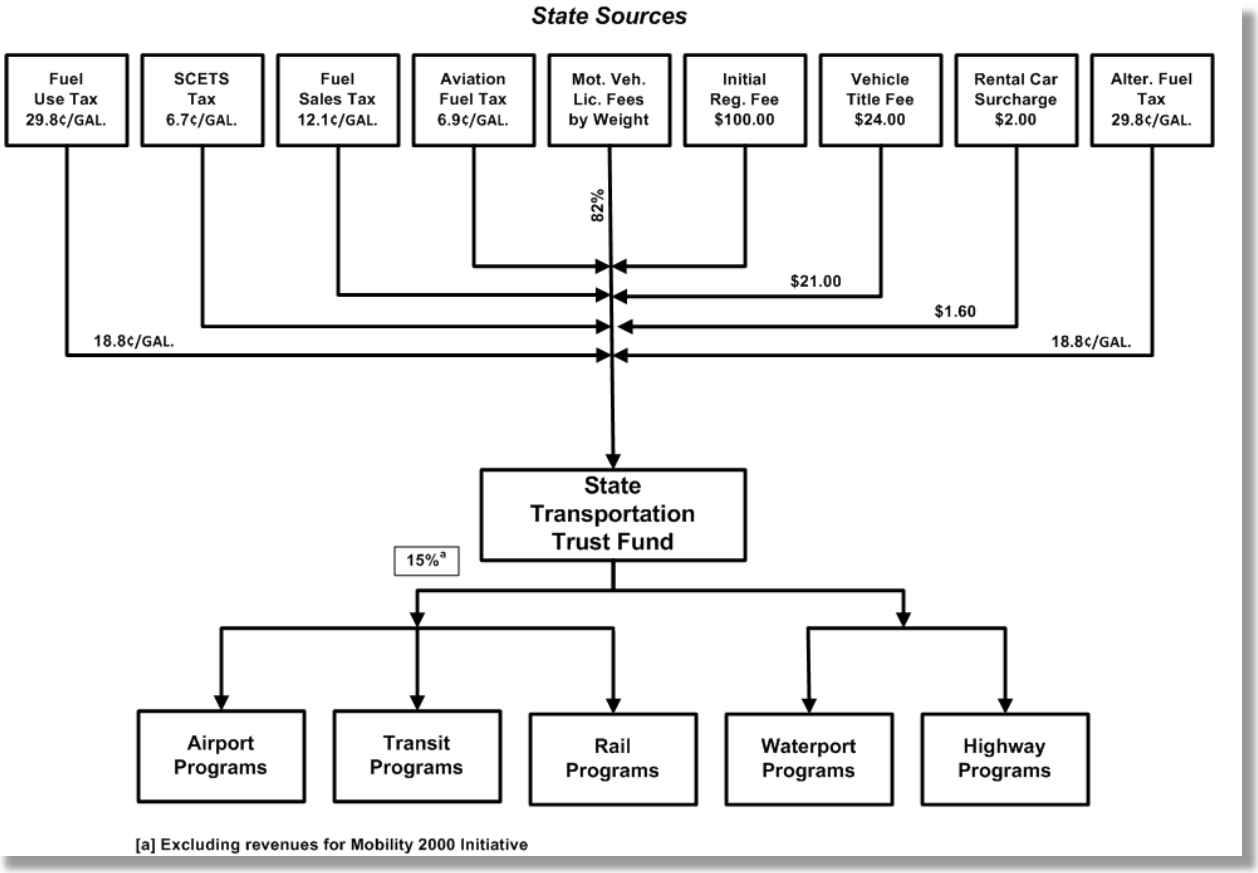

Figure 134: Funding Sources and Allocations for the State Transportation Trust Fund (Ref [28])

Since a transportation project usually takes several years to complete from planning to construction, the Florida Department of Transportation (FDOT) has been given statutory authority to commit funds based on projected cash needs and estimated cash receipts. The Florida Department of Transportation (FDOT) is the only state agency operating on a "cash flow" basis, in which major project phases begin before the total amount of cash is available to fund the project phase. FDOT must take into account expected levels of expenditures, expected levels of federal aid, expected state revenues, and the resulting expected cash balance in the STTF. Recent revenue forecast have shown modest revenue growth opportunities and program commitments that are outpacing revenues and causing major challenges for transportation funding in Florida.

Currently, space transportation does not have any dedicated funding in the state of Florida, and no STTF revenue sources are designed to specifically support space transportation.

Other states such as California, Virginia, Texas, Alaska, Oklahoma, and New Mexico do not appear to fund space transportation through their State Transportation Trust Fund.

Is it appropriate to allow Florida's STTF dollars to be used on a mode that is not significantly contributing revenue to the STTF? There is a general but not a specific link between revenue generation and levels of expenditure. Road builders and trucking firms seek to maximize the fuel tax revenue that goes to highway construction and maintenance, and the annual levels of aviation grants generally reflect the level of revenue generated by sales of aviation fuel. The expenditure of STTF funds on transportation modes in excess of the levels of revenue generated by the mode is well established, including the programs for seaports, rail and transit. However, these programs, modes and facilities provide other benefits beyond generating gas taxes. Although seaport, rail and transit programs do not generate significant fuel taxes, they provide transportation alternatives that divert traffic from roadways and/or provide economic impact to the state of Florida.

G.2.a ECONOMIC CONTRIBUTION FROM SPACE TRANSPORTATION

The commercial impact of space transportation on the U.S. economy is significant and continues to grow. According to a FAA report, in 2006 commercial space transportation generated nearly $139.3 billion in economic activity, over $35.7 billion in earnings, and over 729,000 jobs. The development of commercial space transportation has fostered the growth of industries and opened doors to new commercial markets. For instance, the communications industry has expanded its use of communication satellites from simple infrastructure purposes such as television transmissions to more complex, value added services such as data services, direct-to-home television, and digital audio radio service. The economic contributions of space transportation are tremendous.

The commercial impact of space transportation has a significant impact on Florida's economy. According to a 2008 NASA assessment, the Kennedy Space Center and other NASA centers' expenditures in support of space program activities in the state was $1.93 billion. Total direct spending was $1.82 billion in Brevard County, $83 million in other Central Florida counties, and $45 million in other Florida counties. Total gross earnings of space-related workers in Florida were $1.124 billion. The Kennedy Space Center Visitor Center had approximately 1.6 million visitors, 85 percent of which were out-of-state visitors. Visitors spent about $78 million on goods and services provided by the Visitor Center. In addition to the contribution of NASA, the Department of Defense related space activities also contribute significantly to the Florida economy via space related activities that occur at Patrick Air Force Base and Cape Canaveral Air Force Station.

In 2008, the total economic contribution to Florida, of NASA alone, was $4.1 billion in output, $2.1 billion of household income and 40,802 jobs.

The economic benefit of space transportation in Florida is undeniable.

G.2.b EXISTING SPACE TRANSPORTATION FUNDING, CONTRIBUTIONS AND INCENTIVES

Currently commercial space transportation in Florida is funded by federal appropriations and grants, state appropriations, financing through lease-back, bonds or other private facilitated mechanisms, and in-kind grant of site and/or equipment. Florida also offers standard tax incentives, space transportation incentives, authority related incentives (incentives offered by state entity supported through the executive branch, in this case Space Florida), and regulatory incentives intended to foster space transportation business development. Florida has adopted a strategy of not imposing taxation as space enterprises move from being governmentally operated to commercially provided, which has resulted in exemptions from sales tax, property tax and other levies.

- Florida's standard incentives are considerable, for instance the Qualified Defense Contractor Tax Refund (QDC), expanded to include "space flight" by the Spaceflight Contractor's Tax Refunds Act, provides tax refunds of up to $5,000 per job created. Additionally, the Economic Development Transportation Fund provides discretionary grants for development of transportation infrastructure for high-impact projects.
- Space transportation incentives are also considerable. Florida offers an exemption from its six percent tax on real estate rents for "Space flight businesses" which include manufacturing, processing, assembly of a space flight facility, space propulsion system, space vehicle, satellite or station of any kind possessing capacity of space flight, as well as launch facilities, flight operations, ground control, ground support, and all administrative activities related to space flight. There is an exemption of 25 percent of the sales tax on machinery and equipment for space technology products and research. Furthermore, there is a 100 percent tax exemption for rockets, satellites, payloads, space-related components, and rocket and satellite fuel. Electricity used in aerospace manufacturing is also exempt from sales tax. Other major players such as Virginia and New Mexico offer tax deductions related to fuel and payload and rocket launches.

As previously stated, STTF revenues are not currently designed to specifically fund space transportation. Moreover, with Florida's current incentives in place it is unlikely any significant revenue for space transportation can be generated by fuel taxes, a major source of revenue for the trust fund. Additionally, in early 2009, the state legislature took funds from the transportation trust fund to use on general revenue needs. Therefore, due to existing competing state obligations, recent decreases in the STTF, and the fund's (i.e., gas tax's) failure to keep up with inflation, existing State Transportation Trust Fund dollars would likely be unsuitable for funding the expansion and modernization of Florida's space transportation facilities.

New funding sources dedicated to funding space transportation will need to be developed; either to augment the existing trust fund or to establish a separate Space Transportation Trust Fund to fund and finance capital projects.

G.2.c POTENTIAL SPACE TRANSPORTATION REVENUE SOURCES

As a result of Florida's incentive programs, traditional revenue sources such as fuel taxes, property lease taxes, and power consumption taxes are not viable. Therefore, new innovative revenue sources to fund capital projects and sustain operations are necessary. Revenue sources for space transportation will likely need to include a combination of options. A few potential sources are listed below for consideration.

Adopt a non-operator end user fee or tax, such as a new charge or an allocation of an existing tax stream placed on "space enabled" goods and services. An example is space enabled goods and services include satellite television, global positioning systems and other telecommunications services.

Develop a surcharge to tickets at the Kennedy Space Center Visitor Center. As of 2008, 1.6 million tourists visited the Kennedy Space Center Visitor Center. Considering tourism, additional surcharges to Visitor Center concessions or to hotels and rental cars in surrounding counties may be conceivable.

Parking revenues are the most significant source of nonairline revenue at airports. Conceivably this could generate revenue at a spaceport/Kennedy Visitor Center. Currently, the Kennedy Visitor Center does not charge for parking. Monthly or corporate reserved parking would sell access cards and guarantee that card holders find an empty space in the parking area reserved for their use. Card holders are charged a premium rate, often a monthly fee, to gain access to reserved spaces.

Adopt an alternative spaceport / launch use based tax, such as a surcharge to a federal commercial launch license.

Advertising with banners, moving walkways and escalators, and websites have been cost effective ways of generating additional revenue for airports.

Naming-rights deals are commonplace among the nation's stadiums, arenas and ballparks. Likewise, selling the naming rights of launch or other major space facilities could be considered.

A spaceport may have the opportunity to generate and sell energy and utility services to tenants, nearby business or communities, or regional utilities at a net profit. A sustainable approach for example would be power generated from solar or wind sources on spaceport property to offset spaceport electricity costs and sold to tenants, local electric utility or others.

G.2.d USAGE OF FAA AIP FUNDS FOR SPACEPORT INFRASTRUCTURE

The nation's commercial aviation industry has been the long standing beneficiary of the Federal Aviation Administration (FAA) Airport and Airway Trust Fund (AATF) and its successor the Airport Improvement Program (AIP). The AIP was established by the Airport and Airway Improvement Act of 1982 and has been re-authored several times since then. At present, the AIP has been extended temporarily through December 2009 but is expected to be fully re-authored under the pending FAA re-authoring act. This program provides federal grant funds to airports to help improve safety and efficient and has applicability to runways, taxiways, ramps, signage, weather stations, NAVAIDS, land acquisitions, and some areas of planning.

Space Florida intends to investigate the possibility of expanding the AIP to include spaceports and related infrastructure. Further, it may be advantageous for Florida to participate in the State Block Grant Program (SBGP) wherein the state would administer AIP grants for resident Spaceports. Normally states use AIP funds through the SBGP for improving non-commercial airports but in the case of spaceports this might prove to be of interest.

G.2.e SPACE TRANSPORTATION INFRASTRUCTURE MATCHING GRANTS PROGRAM

The Commercial Spaceflight Federation is calling upon Congress and the current administration to provide federal funding to the nation's spaceports under and unfunded 1993 law. Unlike airports, commercial spaceports currently have no opportunity to apply for federal matching dollars for infrastructure to support operations and protect public safety. In the 1993 NASA Authorization Act (Public Law No. 102-588), Congress authorized a new program to support commercial space transportation facilities, but no funding has been appropriated to date (Ref [86]).

To build infrastructure for a vital national capability and develop a source of high-tech, high-wage jobs, funding support for the Space Transportation Infrastructure Matching Grants (STIM-Grants) Program is crucial.

Details of the STIM-Grants Program include:

- STIM-Grants Program created under Section 505 of the 1993 NASA Authorization Act to "ensure the resiliency of the Nation's space transportation infrastructure."
- Grants administered by Secretary of Transportation, under consultation with the Secretary of Defense and the NASA Administrator.
- Grants must be for less than 50% of project cost; private sector must cover at least 10%.
- Existing and proposed spaceports in California, Florida, New Mexico, Oklahoma, Virginia / Maryland, Alaska, Wisconsin, Indiana, and other states, will be eligible for competitively-awarded grants.

G.2.f NEXT STEPS

The potential funding sources identified above suggest only broad frameworks. A process of developing and evaluating the funding sources will need to occur, coupled with extensive stakeholder participation.

Sustainable Funding Sources

- Given the historic and anticipated future economic contributions of space transportation to Florida and to the country, coupled with the launch facility project needs identified in this Spaceport Master Plan, Florida's space transportation funding sources will need to keep up with long-term future space transportation needs in a way that continually upholds and protects public welfare.

Performance Measures and Criteria

- Establishing performance measures and evaluation criteria for potential space transportation funding sources should play a role in the process of fully evaluating the funding sources. Performance measures should establish parameters within which revenue and investments can reach desired results, and gauge financial performance and resource utilization. Potential suggested evaluation criteria are revenue potential, sustainability, political viability, ease/cost of administration/implementation/compliance, etc.

Figure 135: Space Transportation and the State Transportation Trust Fund – Next Steps

G.3 SPACEPORT MASTER PLAN MANAGEMENT AND MAINTENANCE

In its January 30, 2009 report, "Review of Space Florida", the Office of Program Policy Analysis and Government Accountability (OPPAGA) recommended to the Florida Legislature to amend Ch. 331, Part II, Florida Statutes, specifically to establish deadlines for the completion of the spaceport master plan and other required plans. To enable Space Florida to effectively communicate its goals, objectives, and performance measures to the Florida Legislature and other stakeholders, it is essential that the Space Florida Management Team, in coordination with the Board of Directors and the Standing and Advisory Committees, establish a framework for continued management and maintenance of the spaceport master planning process. While Space Florida has created a business plan to foster the growth and development of the aerospace industry by addressing issues related to business development; finance; spaceport operations; research and development; workforce development; and education, the development and continued maintenance of a comprehensive master plan will enhance future business development opportunities and implementation by addressing in more detail specific objectives and potential performance measures supporting long-term goals and projects.

The 2002 Cape Canaveral Spaceport Master Plan recommended a series of important steps that reflect the need for continued administration, assessment, and timelines for future spaceport planning and supporting studies and actions. The 2002 plan also recommended the identification of a **planning entity** to oversee and integrate all planning and development programs consistent with master plan recommendations. These actions will promote consistency and formality with respect to spaceport master planning initiatives, while also providing the flexibility needed to respond to changing market conditions and evolving technologies. The following examines other existing master planning frameworks as potential models for Space Florida, as well as recommended strategies for the administration and regular maintenance of spaceport master planning.

G.3.a EXISTING MODEL FRAMEWORKS

Several existing frameworks master planning management and maintenance were analyzed. These models include State University System of Florida Campus Planning, California Space Authority Strategic Planning,

<u>State University System (SUS) of Florida Campus Planning</u>

The state of Florida has established legislative procedures for the planning and construction of educational facilities, including specific mandates regarding University Campus Master Plans and the necessary coordination of planning activities with local governing bodies. (Ch. 1013, Part III, Florida Statutes). Similar to spaceport and other aerospace master planning frameworks, University Campus Master Plans identify general uses and address the need and plans for supporting infrastructure both in the immediate and long-term future. University Campus Plans also contain specific elements relating to

future land use, intergovernmental coordination, capital improvements, natural resources and general infrastructure, as well as address compatibility with the surrounding community. The projected impacts of new development on onsite and offsite infrastructure are also explored, particularly in the context of transportation facilities and multimodal provisions. The Board of Trustees at each University is required to prepare and adopt a campus master plan at least every five (5) years for the university and maintain a copy of the plan on the university's website. This horizon enables each University the flexibility to plan for both current and strategic (long-range) needs based upon anticipated growth and funding levels.

There are also formal provisions for review and/or dispute resolution in advance of formal adoption of each campus plan. This process enables affected host local governments, state agencies, and the public ability to review and provide comments via informal information sessions and at least two (2) public hearings. Even after formal adoption, there is additional limited time allocated for petition to determine whether or not the plan is in compliance with the required provisions in the statute. Similar in many ways to local government comprehensive planning, the University Campus Planning framework is highly comprehensive and collaborative in nature and can serve as a model for Space Florida's master planning efforts both in terms of process and organization.

California Space Authority Strategic Planning

Since 1998, when the California Space Authority was commissioned by the State of California to create the first-ever statewide space enterprise strategic plan, the California Space Authority (CSA) has served as the "trustee" of strategic planning for the California space enterprise community. The 1998 California Space Strategic Plan was the first statewide collaborative space planning effort in the U.S. involving commercial, civil and national security domains. Receiving international attention from countries like France and Japan, as well as attention from other states, this was the first plan to engage a broad, collaborative stakeholder base of hundreds of planning participants that included industry, economic development and workforce entities, education/academia and government. Most importantly, it was the first plan to leverage statewide and national space assets and resources through innovative, collective implementation of objectives designed by stakeholders themselves.

The California Space Enterprise Strategic Plan 2007-2010, is currently being implemented collaboratively statewide. CSA established the Space Enterprise Advisory Council (SEAC) a representative body of statewide space enterprise stakeholders from commercial, civil, and national security space activities plus key local, state and national space stakeholders—to guide collaborative strategic planning efforts on behalf of the CSA Board of Directors. Topic-oriented "Collaboratives" and "Working Groups" are charged with the overall implementation effort.

The plan methodology was based on modified "Participatory Action Research", where impacts, influences and decisions participate in the change process and its implementation. Over 200 individuals representing more than 120 organizations participated in the development of the new plan.

The process included face-to-face meetings, teleconferencing, personal interviews, webinars, group discussion, panels, surveys and electronic inputs. Although there are no specific legislatively mandated plan update timeframes, the SEAC supports the CSA Board of Directors in providing regular guidance and expertise on developing and implementing the California Space Enterprise Strategic Plan.

FDOT Continuing Florida Airport Systems Planning Process (CFASPP)

The Continuing Florida Aviation Systems Planning Process (CFASPP) was established by the Federal Aviation Administration (FAA) and the Florida Department of Transportation (FDOT) as a method for continually monitoring and maintaining a viable statewide aviation environment and determining the development requirements to best meet projected aviation demands. The objective of FAA, FDOT and CFASPP is to maintain and enhance the Florida aviation system. A primary function of CFASPP is to help keep the Florida Aviation System Plan (FASP) in step with the continually changing aviation environment by continually updating the FASP.

The Statewide and nine regional CFASPP Steering Committees guide the FASP 2025 “continuous” update by reviewing aviation activity forecasts, air transportation demands for each community, and a variety of statewide and regional aviation issues. Throughout this process, they help define roles for airports and development requirements to meet the total Florida air transportation demand. CFASPP Steering Committees are autonomous and are responsible for managing the twenty-year regional and metropolitan area aviation system plans from which the FASP is derived.

The Florida Department of Transportation (FDOT) Aviation Office has developed a step-by-step Mater Planning Guidebook for the development, preparation, and use of airport master planning documents in Florida, for use by airport owners/sponsors, operators, and consultants on general aviation and small hub airports throughout the state. The airport planning and programming process, the steps involved in formulating the scope of planning effort, procedures for getting started and plan implementation. The guidebook recognizes that each planning effort is unique and should respond to each airport’s specific goals, objectives, and special issues. The user can select from a menu of planning tasks and products and apply them as needed. The guidebook also contains valuable appendices with a list of references and checklists to assist the user with additional specific planning-related research, to help ensure that the appropriate steps in the planning process are complete and meet FDOT standards.

The guidebook is based upon FDOT requirements and guidelines and FAA Advisory Circulars relating to airports and applicable areas within. Specific topics supporting successful plan updates include: shortcomings of traditional airport master planning; directions on standardizing the end products, not the planning; procedures for initiating the process; public participation; detailed descriptions of the master plan work elements; and FDOT’s Joint Automated Capital Improvement Plan (JACIP) Input (The standardized process to program airport capital improvement funds via the FDOT work program and FAA Capital Improvement Plan).

G.3.b MANAGEMENT AND MAINTENANCE OF SPACE FLORIDA SPACEPORT MASTER PLANNING EFFORTS

Space Florida is required by statute to develop a comprehensive spaceport master plan to guide the development of aerospace facilities within the State. The development of a formal master planning administration provides the following benefits:

- Provide strategic direction for aerospace-related research priorities of the State and its aerospace-related businesses
- Identify, define, and guide Space Florida's strategies for modernizing or expanding existing launch and storage facilities
- Provide current information to avoid confusion/delay with respect to communication with elected officials and stakeholders
- Incorporate flexibility into current facility improvement projects, with respect to identifying efficient and cost-effective solutions.
- Create new facilities and programs to meet current and future demand for commercial, national, and state space transportation
- Ensure additional quality assurance/quality control during the process of executing intergovernmental agreements/development agreements consistent with statutory provisions
- Ensures proactive visioning and effective planning to optimize long-term growth rather than reactive to imposed limitations

<u>Statewide Spaceport Council</u>

Using the present resources and structure of the Standing and Advisory Committees, as well as select additional resources, it is recommended that Space Florida create a new Statewide Spaceport Council. Securing and building capacity early in the process, with support of the critical public and private sector organizations, will be essential for implementing the consensus-based vision. This Council, as stewards of the planning process, should represent those who are committed to being involved from the earliest planning stages through post-master plan implementation.

The existing Spaceport Operations Advisory Committee, which is currently tasked with supporting Space Florida's efforts to establish and operate spaceport infrastructure and related facilities, functions in many ways as Space Florida's "facilities planning department". As part of a newly formed Statewide Spaceport Council, select members of the Spaceport Operations Advisory Committee, as the "plan custodians", would be tasked with keeping the master plan process and requisite updates on course. This role would be in coordination with select appointed members from each of the Standing and Advisory Committees, as well as potential members from both the host local government(s) and/or other affected external agencies. This structure would enable the existing resources and expertise from each of the current Standing and Advisory Committee functions to focus their roles in the context of master planning.

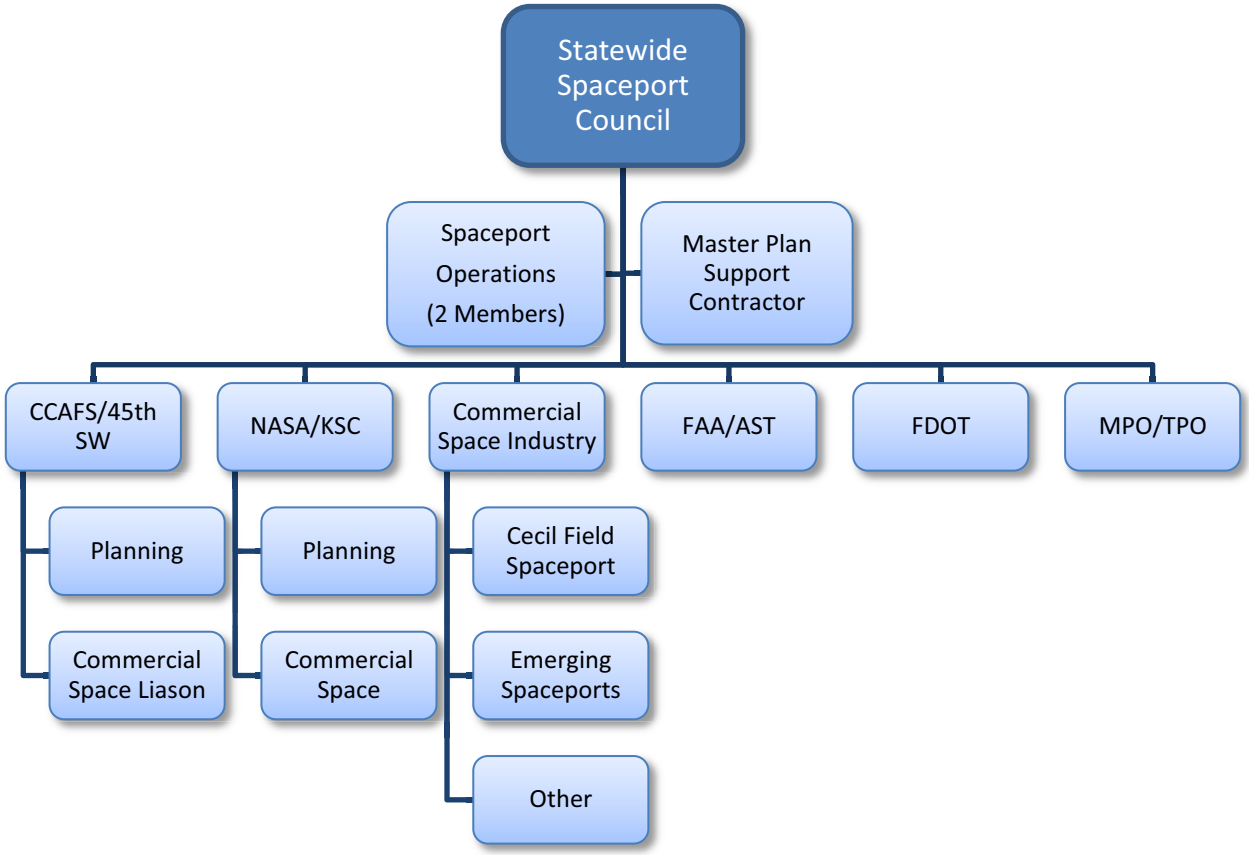

Figure 136: Statewide Spaceport Council Organizational Framework

Working collaboratively, this master planning Council would provide direction and oversight to the planning process and ensure master plan goals and objectives are being met and in compliance with the Space Florida business plan. Figure 136 represents a potential organizational framework for the Statewide Spaceport Council.

G.3.c SPACEPORT MASTER PLANNING SCHEDULE

It is important that the master plan be updated on a regular basis to reflect the long-term vision of Space Florida as well as the immediate needs of spaceport facilities. It is recommended that the plan be updated comprehensively at least every 2-5 years to reflect the strategic planning horizon of Space Florida. Initially, this plan should be coordinated closely with the 45th Space Wing and NASA/KSC and updated in late 2010. This also facilitates the development of realistic timelines and schedules for proposed facilities that would be directly linked to a more financially-feasible capital improvement budget. Likewise, recognizing the need to address short-term goals and objectives, the Statewide Spaceport Council should have the authority to provide amendments to the plan's capital improvement element on an annual or semi-annual basis (within the 5 year Plan horizon). Annual updates, if necessary, to the plan will also support Space Florida's ability to be flexible to immediate needs and

emerging technologies, while having the capacity to provide incentives to new job-generating business development opportunities. It is also advisable to develop a formalized hearing/adoption process at the completion of the spaceport master plan. Similar to the University Master Planning model, the Space Florida Board of Directors shall be responsible for approval of each plan, while providing an opportunity for review, comment, and/or dispute resolution that will foster plan ownership internally as well as public buy-in and oversight externally.

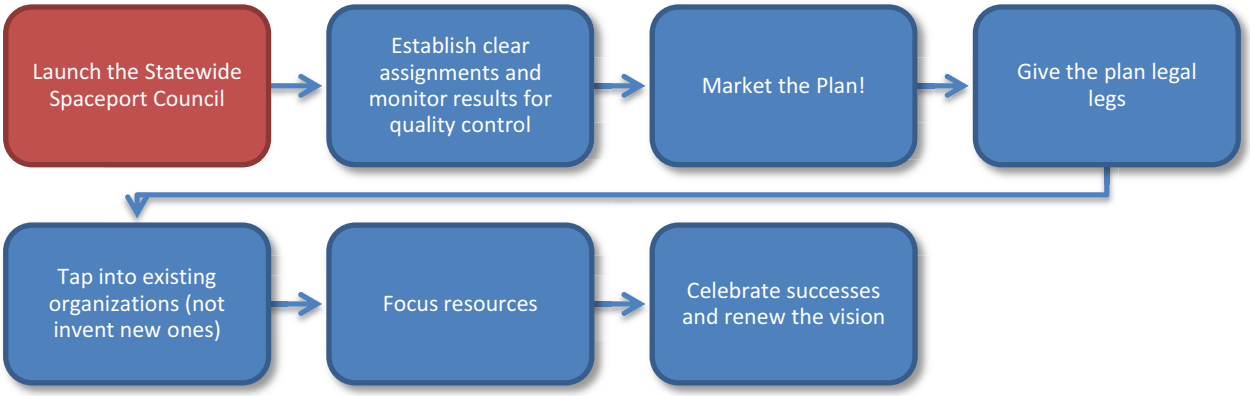

Figure 137: Potential Guiding Steps for Successful Spaceport Master Plan Implementation

Council Meetings

Regular master plan oversight and maintenance meetings should take place on a routine basis and at more frequent intervals leading up to and during plan updates. It is recommended that the Statewide Spaceport Council **should meet on a semi-annual basis, at minimum, to discuss short-term and long-term goals and objectives as they relate to the spaceport master plan**. The basis for this schedule is twofold: First, it attempts to avoid conflict with the scheduling of existing Standing and Advisory Committee meetings, which are conducted at least 4-6 times per year, and second, it enables the transfer of valuable information and performance objectives from these meetings to the Council as each potentially relates to strategic planning initiatives. This meeting schedule would also facilitate the updating of the annual and/or semi-annual capital improvement program in response to immediate business development needs, while continuing to address long-term planning topics such as:

- Funding
- National Defense
- Commercial Space Exploration
- Environment
- Education/Public Involvement
- Research and Development
- Tourism
- Spaceport Identity
- Global Spaceport Network

G.4 LONG TERM INITIATIVES

As one of the three key objectives of its Strategic Business Plan, Space Florida is committed to develop the infrastructure and processes required to activate and sustain a globally competitive commercial space launch capability in Florida. Over the long term, Space Florida plans to achieve this objective by developing and sustaining close working partnerships with the Federal government, the Florida Department of Transportation (FDOT), metropolitan planning organizations in Florida, and the commercial space industry.

In the region surrounding the Space Florida Spaceport at Cape Canaveral, Space Florida will build upon its membership in the Space Coast Transportation Planning Organization (SC TPO), and will work with other members of the SC TPO in order to ensure that regional long term transportation plans are developed that support the role of the space industry as an established mainstay of the regional economy.

As spaceport facilities are developed at locations outside of the Cape Canaveral area, e.g. at Cecil Field in Jacksonville, Space Florida will establish working relationships with additional metropolitan planning organizations in Florida.

At the state level, Space Florida will build on its relationship with officials in the FDOT Aviation Office, Office of Policy Planning, and District 5 offices, in order to promote a fuller understanding by FDOT of transportation facility requirements for the development and expansion of the space industry in Florida. As spaceport facilities expand beyond the boundaries of District 5, Space Florida will work to engage FDOT officials in additional FDOT district offices.

Space Florida will work to expand and further develop the Florida Strategic Intermodal System (SIS), so that along with railroads, ports, and aviation facilities, space transportation facilities are recognized as a component of a major mode of transportation in the state of Florida.

Space Florida will continue to engage with the FDOT through appropriate Office in the annual development of projects that will support the development and expansion of the Florida space industry.

In order to ensure that adequate funding is available for space infrastructure projects to be included in the FDOT Five Year Work Program, Space Florida is committed to identifying potential sources of dedicated funding. Space Florida will also work to develop reliable forecasts of the amount of funding likely to be available from those potential funding sources that are identified, and will work to develop plans and project proposals that are cost feasible.

It should be noted here that FAA and FDOT make planning grants available for airport planning studies, and that it is reasonable for similar grants to be made available for spaceport master planning functions.

Spaceport Master Plan Updates

- Develop Project Prioritzation Criteria.
- Institute Spaceport Master Planning governance Structure.
- Provide conitnual updates and revisions to plan.

FDOT Strategic Intermodal System

- Advocate for the realignment of the SIS Spaceport Hub Funding Eligibility so that it is similar to SIS Airport Hubs.
- Develop criteria for the designation of Emerging or Planned Spaceport Hubs.
- The definition of SIS Spaceports should be expanded to include handling civilian passengers or space tourists and governmental payloads in addition to handling commercial or military payloads.

Funding for Space Transportation

- Submit Projects to FDOT for potential inclusion in 5-year Work Program.
- Develop and activate method for contributing to and receiving funding from the State Transportation Trust Fund.
- Advocate for dedicated state funding for Space Transportation
- Advocate for funding of the 1993 NASA Authorization Act (Public Law No. 102-588) and STIM-Grants.

Continued Space Transportation Advocacy

- Promote availability of FAA and FDOT planning grants for spaceport owners/sponsors for spaceport planning studies.
- Full realization of Space Transportation as a separate mode of transportation.

Modernize and Expand Space Transportation Facilities

- Develop network of Aerospaceports in the state to support suborbital RLV launches and landings.

Figure 138: Long Term Initiatives

The Spaceport Master Plan is intended to be a living document that will be monitored, updated, and revised on a regular basis, in response to changes in mission requirements as well as to changes in the utilization and functionality of the existing and potential space transportation infrastructure in Florida.

Over the past 50 years, space transportation infrastructure has developed in Florida, but as has been noted in this report, major improvements and modifications to this infrastructure will be required, both in the short term and over the long term. This will be important for Florida to maintain its longstanding strategic advantage domestically and globally as other states and nations that are now engaged in the development of their own space transportation infrastructure.

SECTION H: APPENDIX – SPACE FLORIDA SPACEPORT EVALUATION

Two evaluation methods were utilized to evaluate/validate site selection for the Space Florida Spaceport. The Spaceport Evaluation Mechanism (SEM) was used to assess commercial viability of the Spaceport at KSC/CCAFS. Additionally, a Launch Site Viability Evaluation (LSVE) was used to identify additional site factors, such as orbital performance factors and physical and natural environmental factors of launch complexes within the Spaceport. These evaluations can be applied to spaceports around Florida, as well as other potential launch sites within those spaceports.

H.1 SPACEPORT EVALUATION MECHANISM (SEM) RATINGS

The Spaceport Evaluation Mechanism (SEM) rating system is a tool used in assessing the commercial feasibility of existing and potential spaceports. The SEM also includes recommendations based on the results of the assessment. The methodology is identified in Chapter 9 of the Futurist Report dated 2008 (Ref [8]). The SEM criteria presented in Table 17 are those defined as critical path items by the SEM rating system. See Table 18 for the complete SEM chart of the Space Florida Spaceport.

Table 17: SEM Critical Path Criteria

SEM Ref #	SEM Critical Path Criteria	Description
1	Have basic business plan areas been addressed?	For a business to be viable, basic business plan areas need to be addressed. This includes a description of the business, an opportunity/market overview, an assessment of competition that includes a competitive analysis, an examination of financing issues, and an exit strategy.
2	Have financiers and multiple revenue streams been identified?	Financing for any large project is an essential element of development. Research has shown that a spaceport will not be profitable if it only focuses on providing space-specific services. Other areas for non-space-specific revenue streams must be explored and included in a spaceport business plan e.g. test facility rental or terrestrial tourism.
13	Is the spaceport subject to a regulatory framework?	Lack of a regulatory framework may cause uncertainty in planning and operations. If there is no regulatory framework specific to spaceports or space activities, regulations applicable to aviation should be used as guidelines, and/or consultation with aviation sector/aerospace sector regulators would be necessary.
14	Does the spaceport operate in accordance	Issues that aviation regulations govern include: air traffic

	with principles of international and national aviation regulations, concerning, amongst other things, minimizing the effects of operations on air traffic, and obtaining rights of over-flight from neighboring States?	management to ensure the space access vehicle has a free and safe airspace corridor, access to space without endangering local communities, and absence of conflict with civil aviation activities. Aviation regulations at national or international levels also (depending on the type of space transport) pertain to: infrastructure requirements, warning signage and markings, wind indicators, building evacuation plans; and, the sovereignty of states over their airspace.
16	Are all local, regional and national laws, including those required for licensing considered?	Environmental and planning laws, health and safety regulations, employment law, and ultimately licensing requirements (if provided for) should be taken into account.
17	Does the spaceport provide for communication radio frequency allocation, tracking and telemetry in accordance with international requirements (ITU) with respect to the spaceport airspace?	The spaceport should have its own assigned frequency, and appropriate tracking infrastructure.
21	Is there a comprehensive emergency medical response plan?	A comprehensive plan would include: on-site triage, immediate emergency facilities, and/or transport for patients to regional facilities with advanced healthcare. Integral to such a plan is the relationship with local authorities.
35	Does the spaceport launch site support the appropriate space access vehicles?	The spaceport launch infrastructure must be space access vehicle specific. Examples of launch site infrastructure that would support the space access vehicle would be a launch/landing pad, runway, etc.
47	Has an environmental impact study been completed in accordance with local law?	Local licensing may be dependent upon the acceptable completion of an environmental impact analysis. Additionally, reducing the environmental impact is a beneficial sustainable practice.

H.2 LAUNCH SITE VIABILITY EVALUATION (LSVE)

The second method of evaluation completed for the Space Florida Spaceport is a Launch Site Viability Evaluation (LSVE). This method of evaluation looks at additional factors that are not considered in the SEM rating system. Some of these additional factors include orbital performance factors and physical and natural environmental factors.

H.2.a ORBITAL PERFORMANCE FACTORS

No spaceport can provide launches at all azimuths or achieve any desired orbital inclination. A spaceport has a limited range of allowable launch azimuths so that, in the event of a launch anomaly, the risk to populated areas is minimized. Therefore, it is important to understand what launch azimuths and inclinations can be achieved at each spaceport.

Launch Azimuth and Orbital Inclination

Typical launch azimuths for the Eastern Range, per Air Force Space Command Manual 91-710 (ref [2]), are between 37 and 114° measured clockwise from 0° North (See Figure 121). These launch azimuths correlate to orbital inclinations of 28.5° to 57° for Northeast launches and 28.5° to 36° for Southeast launches. A spaceport located at CCAFS can support all of these launch azimuths and orbital inclinations. Orbital inclinations outside this typical range can be achieved; however they require the use of orbital maneuvers that can substantially reduce the size of the payload capacity of a launch vehicle.

Flyover Considerations

For specific launch sites at a spaceport it may be desired to restrict the range of launch azimuths to prevent over-flight of other launch sites or critical assets. While this limitation will not eliminate the consideration of a specific launch site, it will be one factor in its evaluation. For launch sites located directly on the coast there is typically no over-flight concern.

H.2.b PHYSICAL AND NATURAL ENVIRONMENTAL FACTORS

Some physical and natural factors include environmental impacts, such as scrub jay habitat, bald eagle nesting, sea turtles (i.e.: site lighting impacts), hurricane tidal surge, and known historic/cultural sites. For each site the Environmental Baseline Study (EBS) should be reviewed. Additional physical factors include proximity to public areas, proximity to salt laden air, proximity to transportation routes, and proximity to seismic areas.

Environment

Environmental evaluation criteria include identifying wetlands, fauna and contamination. Areas that are identified as having a larger concentration of wetlands will receive lower ratings than those with more upland. Areas identified as prime habitat for scrub jay, gopher tortoise, bald eagle or other threatened species will also receive a lower rating than those areas with less.

Archeological

It is a priority to preserve cultural and historic resources; therefore it is advantageous to find a site with a low impact to archeologically significant areas. Depending on the density of cultural and historical resources located at or near each of the areas, there may be an impact to design, location and schedule of a construction project. A higher rating is given to areas with a lower probability of archeological constraints.

Contiguous Un-submerged Land

Wetlands are prevalent throughout CCAFS and are an important environmental asset to the state of Florida. Wetland mitigation can be accomplished with restoration, enhancement or creation. Areas with a higher density of submerged lands will receive lower ratings while areas with the largest amount of contiguous un-submerged land will receive higher ratings.

Category 1 (3) Hurricane Tidal Surge

Each hurricane season presents the possibility for a hurricane event at KSC/CCAFS. The effects of tidal surge are known to be more severe than that of wind. To reduce the possible impact of hurricane tidal surges, this evaluation identifies all areas that are susceptible to the effects of the tidal surge from a Category 1 or 3 Hurricane based on the Saffrin-Simpson Hurricane Scale.

Proximity to Salt Laden Air (Corrosion)

Corrosion control of launch facilities is a recurring cost that can be reduced by locating a facility farther from salt-laden air and the coastline. Experience has shown that launch facilities near the coast (such as LC-39A) experience more corrosion than those farther away (such as the Vehicle Assembly Building). A location that is farther from salt-laden air will be viewed favorably.

Proximity to Populated Areas

To increase the level of safety to the public, a proximity limit is used for the evaluation criteria. Ideally the farther a launch complex is away from public areas the safer the general public is in the event that there is a catastrophic space launch vehicle malfunction on the launch pad or within the first seconds of a launch.

Previous Explosive Quantity Distances Siting

Explosive Quantity Distance (QD) pertains to the amounts and kinds of explosives that can be stored and the proximity of such storage to buildings, highways, railways, magazines, or other installations. Locations are rated favorable when the quantity distances of stored propellants, integrated vehicles, and fueled vehicles have the lowest impact on existing facilities and public transportation routes.

Launch Vehicle Size Range/Class Requirements

Launch Complexes are typically designed, sized, and licensed for specific sizes/classes of space launch vehicles and specific propellant types. It is favorable for the launch complex to safety meet the specific requirements of the particular launch vehicle class identified to operate from the launch site. It is also favorable for a site to provide flexibility to adapt to variations of launch vehicle sizes and classes.

Proximity to Usable: Road, Rail, Barge Dock, Aircraft Runway

Proximity to transportation modes is dependent on both the requirements of the launch vehicle components and the relative distance of the launch facility to existing transportation infrastructure. A favorable rating is given to locations that have existing infrastructure nearby or have a greater ease of providing access to a variety of transportation methods. Transportation improvements are compared for roads, rail, barge docks, and aircraft runways. Short distances to all these items were deemed positive for vehicle component transportation.

Proximity to Active Seismic Areas

Ideally a launch facility would be constructed away from a location with a high potential for seismic activity. It is important, not only for reducing the likelihood of death and injury, but also for reducing the potential for losses associated with earthquake damage repair and space flight interruption.

H.3 SPACE FLORIDA SPACEPORT EVALUATION

The following spaceport evaluation is based on the Spaceport Evaluation Mechanism (SEM) Rating identified in Section H.1. Again, the following criteria are those that are defined as critical path items by the SEM rating system. This provides a qualitative assessment of potential spaceports. See Table 18 for the complete SEM evaluation of the Space Florida Spaceport and Table 22 for comparisons of SEM evaluations of Space Florida Space to two other spaceports, one within the United States and the other located internationally.

Table 18: SEM Evaluation of the Proposed Space Florida Spaceport

Ref. No	Criterion	Result	Discussion and Recommendations
		Business	
1.	Have basic business plan areas been addressed?	Potentially Fulfilled	See Space Florida Strategic Business Plan
2.	Have financiers and multiple revenue streams been identified?	Potentially Fulfilled	See Space Florida Strategic Business Plan
3.	Can the spaceport secure a substantial share of the spaceport market?	Sufficiently Fulfilled	The Space Florida Spaceport includes SLC-36, 46, and 47 which together encompass small, medium and potentially large lift capacity vehicles both liquid and solid fueled.
4.	Can the spaceport take advantage of a particular customer segment, and/or does it address a specific customer need?	Sufficiently Fulfilled	SLC-36 is developed to meet the needs of small and medium sized liquid fueled commercial vehicles.
5.	Are the engineering and development costs plus capital expenditures reasonable based on analogous projects?	Sufficiently Fulfilled	Cost estimates are within the scope of previously built, vertical launch complexes.
6.	Has an analysis of the business risks and costs of failure, including potential business interruption, been conducted?	Sufficiently Fulfilled	See Space Florida Spaceport Financial Plan. Proximity to the Atlantic Ocean keeps risk to human life minimized. Risk of earthquakes is very low.
7.	Are there healthy financial ratios and financial figures after the 'break-even' point?	Potentially Fulfilled	See Space Florida Spaceport Financial Plan
8.	Are there manageable quarterly expenses after the 'break-even' point?	Potentially Fulfilled	See Space Florida Spaceport Financial Plan
9.	Is the break-even point achievable in a	Potentially	See Space Florida Spaceport Financial Plan

	reasonable amount of time?	Fulfilled	
10.	Is a return on investment achievable in a reasonable amount of time?	Potentially Fulfilled	See Space Florida Spaceport Financial Plan
11.	Has an exit strategy been defined?	Potentially Fulfilled	See Space Florida Spaceport Financial Plan
12.	Is the spaceport well situated geographically to access the orbits/sub-orbits which are desirable to the targeted market?	Sufficiently Fulfilled	Latitude aids with orbital launches of low degree. Location allows for launch angles of 45 to 90 degrees. Sub orbital flights have good scenery and opportunity for ocean splashdown or horizontal landing at CCAFS skid strip or SLF.
	Regulatory Issues		
13.	Is the spaceport subject to a regulatory framework?	Sufficiently Fulfilled	FAA License, Cape Canaveral Air Force Station License, DDESB approval of explosive siting.
14.	Does the spaceport operate in accordance with principles of international and national aviation regulations, concerning, amongst other things, minimizing the effects of operations on air traffic, and obtaining rights of over-flight from neighboring States?	Sufficiently Fulfilled	SLC-36 and SLC-46 have supported over 150 launches since 1962. This criterion must have been met.
15.	Are the international obligations of the State within which the spaceport is located taken into consideration by the spaceport management?	Sufficiently Fulfilled	SLC-36 and SLC-46 have supported over 150 launches since 1962. This criterion must have been met.
16.	Are all local, regional and national laws, including those required for licensing considered?	Sufficiently Fulfilled	SLC-36 and SLC-46 have supported over 150 launches since 1962. This criterion must have been met.
17.	Does the spaceport provide for communication radio frequency allocation, tracking and telemetry in accordance with international requirements (ITU) with respect to the spaceport airspace?	Sufficiently Fulfilled	SLC-36 and SLC-46 have supported over 150 launches since 1962. This criterion must have been met.
	Operational		
18.	Is there adequate nominal and	Not Evaluated	Data not available at this time.

	emergency ventilation?		
19.	Does the spaceport have the fire, HAZMAT, and Emergency crews (with access to emergency onsite fire station) to respond to any operational emergencies?	Sufficiently Fulfilled	As part of CCAFS.
20.	Are there built-in redundant power systems for contingency operations?	Sufficiently Fulfilled	Back-up power requirements for critical GSE will be provided for with portable generators.
21.	Is there comprehensive emergency medical response plan?	Sufficiently Fulfilled	As part of CCAFS.
22.	Does the spaceport emergency health care plan have redundancy in the event of failure, i.e. do they demonstrate fault tolerance?	Sufficiently Fulfilled	As part of CCAFS.
23.	Are spaceport personnel performing operations according to applicable occupational health and safety standards?	Not Evaluated	
24.	Is there a manifest that will document in real-time the location of users and personnel and their proximity to areas of higher risk?	Not Evaluated	
25.	Can the spaceport management provide appropriate training to personnel?	Not Evaluated	
26.	Is informed consent obtained from personnel who may be exposed to hazardous areas related to space access vehicle operations and launch?	Not Evaluated	
27.	Does the spaceport have sufficient access to utilities?	Sufficiently Fulfilled	Utilities include communication fiber, power, water, sewer, and nitrogen gas.
28.	Is there an environmentally sustainable plan for waste management and removal?	Sufficiently Fulfilled	Yes, per SLC-36 procedures.
29.	Is adequate provision made for hazardous and toxic material management?	Potentially Fulfilled	Environmental Assessment (EA) with FAA-AST is ongoing, not yet approved.
30.	Does the spaceport have a propellant management plan?	Potentially Fulfilled	New siting for propellants does not yet have an approved management plan.

31.	Does the spaceport have a security plan?	Sufficiently Fulfilled	Location within gated perimeter of CCAFS.
32.	Has the spaceport management performed a safety risk analysis based on identified risks for pre-launch, launch, and re-entry operations?	Not Evaluated	
33.	Is there a downrange emergency recovery, search and rescue plan?	Sufficiently Fulfilled	As part of CCAFS
34.	Is the spaceport located where suitable prevailing weather conditions meet the requirements of the appropriate space access vehicle?	Sufficiently Fulfilled	Yes, Cape Canaveral has ideal weather conditions for launches year round.
	Infrastructure		
35.	Does the spaceport launch site support the appropriate space access vehicles?	Sufficiently Fulfilled	Yes, design of facilities includes propellant handling, vertical launch stand, flame deflector, inert commodities, payload and vehicle support systems.
36.	Has an emergency response plan been developed for the contingency situation where a failure occurs within the boundaries of the spaceport?	Sufficiently Fulfilled	Operations to be coordinated with the Air Force.
37.	Does the spaceport have space access vehicle and payload specific assembly and integration facilities?	Sufficiently Fulfilled	There are many assembly and integration facilities available for use within the Cape Canaveral region.
38.	Are there storage and maintenance facilities for space access vehicles?	Sufficiently Fulfilled	There are many assembly and integration facilities available for use within the Cape Canaveral region.
39.	Is there capacity for future infrastructure expansion?	Sufficiently Fulfilled	Yes, future expansion can take place on Pad B, as well as other adjacent launch pads.
	Location, Community, and Environment		
40.	Is the location of the spaceport publicly accessible?	Sufficiently Fulfilled	SLC-36 is within the perimeter of CCAFS as part of the Commercial Launch Zone (Space Florida Spaceport). Space Florida Spaceport areas can be located anywhere in the state of Florida.
41.	Is the spaceport situated near transportation infrastructure that	Sufficiently Fulfilled	Transportation infrastructure includes highways, railways, seaports and airports.

	facilitates transport outside the region (national/international)?		
42.	Is there existing local tourism infrastructure (hotels, attractions, etc) and can the spaceport absorb seasonal fluctuation in tourism activities?	Sufficiently Fulfilled	There are many hotels, and attractions at nearby Cocoa Beach. SLC-36 is within 60 miles of Orlando, FL.
43.	Does the spaceport provide or intend to provide entertainment venues and activities for terrestrial tourists?	Sufficiently Fulfilled	Entertainment venues and activities are available at the adjacent NASA visitor's center.
44.	Is there an expandable commercial airport with a passenger terminal on-site?	Sufficiently Fulfilled	No. The nearest commercial airport is Space Coast Regional Airport in Titusville, located within 20 miles.
45.	Does the spaceport infrastructure harmonize with the landscape of the location?	Insufficiently Fulfilled	Existing buildings were not designed with aesthetics in mind.
46.	Is there a wildlife hazard assessment, management, and protection plan?	Sufficiently Fulfilled	Yes, as part of the EA adjacent wetlands will not be disturbed.
47.	Has an environmental impact study been completed in accordance with local law?	Sufficiently Fulfilled	Yes, as part of the EA.
48.	Does the spaceport have a plan to minimize noise pollution in local community?	Sufficiently Fulfilled	Yes, as part of the EA.
49.	Is there an ethical communication strategy that facilitates community feedback?	Sufficiently Fulfilled	Space Florida has quarterly updates, has numerous public engagements, and an informative website with many opportunities for community feedback.
50.	Does the spaceport management have a corporate social accountability plan?	Sufficiently Fulfilled	Space Florida is accountable to the State of Florida under Florida Statutes.
51.	Does the spaceport promote human resource development within local and regional communities?	Sufficiently Fulfilled	Space Florida offers students and teachers innovative workshops and programs, and is engaged with the Space Coast Economic Development Commission and Brevard Workforce Development Council
	Human Spaceflight		
52.	Is there infrastructure necessary to perform screening, training and flight preparation of passengers and flight crew?	Insufficiently Fulfilled	The scope of the Space Florida Spaceport does not include human spaceflight at this time.

53.	Can the spaceport provide ground-based in-flight physiological monitoring and medical management?	Insufficiently Fulfilled	The scope of the Space Florida Spaceport does not include human spaceflight at this time.
54.	Is there luggage storage and processing infrastructure?	Insufficiently Fulfilled	The scope of the Space Florida Spaceport does not include human spaceflight.
55.	Does the spaceport have on-site food handling and storage infrastructure?	Sufficiently Fulfilled	A restaurant can be included in the Space Florida Spaceport as required.
Cargo and Satellite Operations			
56.	Are there space cargo processing facilities?	Sufficiently Fulfilled	Many payload and cargo processing facilities are within a short distance of SLC-36, and 46. These facilities will be included in the Space Florida Spaceport as required.
57.	Does the spaceport provide testing infrastructure for space access vehicle and payload operations?	Sufficiently Fulfilled	Test facilities are within a short distance of SLC-36, and 46. These facilities will be included in the Space Florida Spaceport as required.
58.	Does the spaceport have a clean room?	Sufficiently Fulfilled	Clean room facilities are within a short distance of SLC-36, and 46. These facilities will be included in the Space Florida Spaceport as required.

H.4 SLC-36 – SITE EVALUATION

The Launch Site Viability Evaluation discussed in Section E has been applied to Space Launch Complex 36 (SLC-36). Table 19 contains a discussion of this evaluation. The result of this evaluation identifies SLC-36 as a good candidate site for development of a launch complex to host space launch vehicles of a similar class and size as were previously launched from the complex.

Table 19: SLC-36 Evaluation Matrix

Evaluation Criteria / Factors	Discussion
Overall Spaceport Evaluation Mechanism (SEM) Review	This launch complex is included in the SEM evaluation of the Space Florida Spaceport and satisfactorily meets the criteria identified.
Launch Azimuth & Orbital Inclination	Since the launch complex is located on the Eastern Range, it can accommodate launch azimuths between 37° and 114°.
Flyover Considerations	For normal launch azimuths there is no concern of over flying other active launch complexes or facilities.
Environmental Considerations	A final environmental baseline survey (EBS) was conducted on SLC-36A/B in September 2005 and a Finding of No Significant Impact (FONSI) was issued for the deactivation of the complex. Demolition of the site began in 2006; all launch (support) structures and related facilities on SLC-36A/B have been demolished except the Launch Control Building (Bldg 5501) and the Atlas Ops Annex (Bldg 5550). RS&H is currently preparing an EBS for Space Florida for this launch site.
Archeological Considerations	Since all development at this launch complex will be completed within the existing disturbed area, there is no current archeological concerns.
Contiguous Un-submerged lands	Since this site has been previously developed there are currently no concerns with wetland mitigation.
Category 1 (3) Hurricane Tidal Surge	SLC-36 is not affected by Category 1 Hurricane tidal surge but is affected by Category 3 Hurricane tidal surge.
Proximity to Salt Laden Air	SLC-36 is located on the eastern portion of CCAFS on the Cape Canaveral seashore and is affected by salt laden air.
Proximity to Populated Areas	The SLC-36A/B launch complex is located approx 6 miles from the nearest populated area (Port Canaveral).
Explosive Quantity Distance of Previous Propellants	SLC-36 was previously sited to support storage and collocation of Liquid Oxygen, Liquid Hydrogen, RP-1, and Solid Boosters.
Vehicle Size Range/Class Requirements	SLC-36 has previously supported medium class vehicles, such as the Atlas II and III, capable of approximately 1 million lbs of thrust.
Proximity to Usable: Road, Rail, Barge Dock, Aircraft Runway	As part of CCAFS, SLC-36 is served by a comprehensive network of roads (I-95, SR 50 and SR 528), railway (NASA rail, Balloon Siding rail causeway and rail yard), deep-water port (USAF controlled dock at Port Canaveral), and runway (CCAFS skid strip and Shuttle Landing Facility).
Proximity To Seismic Areas	SLC-36 is not located in an active seismic zone.

H.5 SLC-46 – SITE EVALUATION

The Launch Site Viability Evaluation discussed in Section E has been applied to Space Launch Complex 46 (SLC-46). Table 20 contains a discussion of this evaluation. The result of this evaluation identifies SLC-46 as a good candidate site for development of a launch complex to host space launch vehicles of a similar class and size as were previously launched from the complex.

Table 20: SLC-46 Evaluation Matrix

Evaluation Criteria / Factors	Discussion
Overall Spaceport Evaluation Mechanism (SEM) Review	This launch complex is included in the SEM evaluation of the Space Florida Spaceport and satisfactorily meets the criteria identified.
Launch Azimuth & Orbital Inclination	Since the launch complex is located on the Eastern Range, it can accommodate launch azimuths between 37° and 114°.
Flyover Considerations	For normal launch azimuths there is no concern of over flying other active launch complexes or facilities.
Environmental Considerations	An EBS was conducted on SLC-46 in August 2006 to determine potential for past/present contamination of the complex facilities by hazardous substances. The EBS states that no evidence of environmental impairment was identified at the SLC46 facility.
Archeological Considerations	Since all development at this launch complex will be completed within the existing disturbed area, there is no current archeological concerns.
Contiguous Un-submerged lands	Since this site has been previously developed there are currently no concerns with wetland mitigation.
Category 1 (3) Hurricane Tidal Surge	SLC-46 is not affected by Category 1 Hurricane tidal surge but is affected by Category 3 Hurricane tidal surge.
Proximity to Salt Laden Air	SLC-46 is located on the easternmost point of CCAFS on the Cape Canaveral seashore and is affected by salt laden air.
Proximity to Populated Areas	The SLC-46 launch complex is located approx 6 miles from the nearest populated area (Port Canaveral).
Explosive Quantity Distance of Previous Propellants	SLC-36 was previously sited to support space launch vehicles based on Castor 120 solid rocket motors.
Vehicle Size Range/Class Requirements	SLC-46 can accommodate medium class space launch vehicles and has previously supported launches of Athena I & II and Trident II missile testing.
Proximity to Usable: Road, Rail, Barge Dock, Aircraft Runway	As part of CCAFS, SLC-46 is served by a comprehensive network of roads (I-95, SR 50 and SR 528), railway (NASA rail, Balloon Siding rail causeway and rail yard), deep-water port (USAF controlled dock at Port Canaveral), and runway (CCAFS skid strip and Shuttle Landing Facility).
Proximity To Seismic Areas	SLC-46 is not located in an active seismic zone.

H.6 SLC-47 – SITE EVALUATION

The Launch Site Viability Evaluation discussed in Section E has been applied to Space Launch Complex 47 (SLC-47). Table 21 contains a discussion of this evaluation. The result of this evaluation identifies SLC-47 as a good candidate site for continued development and launch support of space launch vehicles of a similar class and size as are currently launched from the complex.

Table 21: SLC-47 Evaluation Matrix

Evaluation Criteria / Factors	Discussion
Overall Spaceport Evaluation Mechanism (SEM) Review	This launch complex is included in the SEM evaluation of the Space Florida Spaceport and satisfactorily meets the criteria identified.
Launch Azimuth & Orbital Inclination	Since the launch complex is located on the Eastern Range, it can accommodate launch azimuths between 37° and 114°.
Flyover Considerations	For normal launch azimuths there is no concern of over flying other active launch complexes or facilities.
Environmental Considerations	In February 2008 an EBS was conducted on SLC-47 and it was determined that no environmental violations exist at the launch site.
Archeological Considerations	Archeological considerations are not currently a concern, however if future development of this launch site involves its expansion to the west of Samuel C. Phillips Parkway, an archeological survey may be required.
Contiguous Un-submerged lands	Since this site has been previously developed there are currently no concerns with wetland mitigation.
Category 1 (3) Hurricane Tidal Surge	SLC-47 is not affected by Category 1 Hurricane tidal surge but is affected by Category 3 Hurricane tidal surge.
Proximity to Salt Laden Air	SLC-47 is located on the northeastern portion of CCAFS on the Cape Canaveral seashore and is affected by salt laden air.
Proximity to Populated Areas	The SLC-47 launch complex is located approx 9 miles from the nearest populated area (Port Canaveral).
Explosive Quantity Distance of Previous Propellants	SLC-47 currently supports launches of Loki and Super Loki rockets containing less than 100 lbs of HTPB solid propellant.
Vehicle Size Range/Class Requirements	Small Loki/Super Loki suborbital sounding rockets are currently launched from SLC-47.
Proximity to Usable: Road, Rail, Barge Dock, Aircraft Runway	As part of CCAFS, SLC-47 is served by a comprehensive network of roads (I-95, SR 50 and SR 528), railway (NASA rail, Balloon Siding rail causeway and rail yard), deep-water port (USAF controlled dock at Port Canaveral), and runway (CCAFS skid strip and Shuttle Landing Facility).
Proximity To Seismic Areas	SLC-47 is not located in an active seismic zone.

H.7 ANALYSIS OF EVALUATION RESULTS

Through the SEM analysis, we are able to subjectively compare the capabilities of Space Florida Spaceport (SLC-36, SLC-46, and SLC-47) to other Spaceports around the world. Information regarding the capabilities of Mojave, CA and Guiana Space Center (GSC) were readily available for comparison, so these were the two benchmarks for comparison as shown in Table 22. The benefits of development of SLC-36, SLC-46, and SLC-47 per this Spaceport Master Plan are evident by the increase in satisfactory evaluation ratings obtained for the Proposed Space Florida Spaceport.

Table 22: Comparison of Space Florida Spaceport to Other Spaceports (Ref [8])

Ref. No	Space Florida Spaceport as of April 2009	Proposed Space Florida Spaceport	Mojave Air & Space Port	Guiana Space Center (GSC)
Business				
1.	⊙	⊙	●	✕
2.	⊙	⊙	●	●
3.	✕	●	●	●
4.	⊙	●	●	●
5.	●	●	●	✕
6.	●	●	○	●
7.	⊙	⊙	○	✕
8.	⊙	⊙	○	⊙
9.	⊙	⊙	○	✕
10.	⊙	⊙	○	✕
11.	⊙	⊙	○	●
12.	✕	●	●	●
Regulatory Issues				
13.	●	●	●	●
14.	●	●	●	●
15.	●	●	●	●
16.	●	●	●	●
17.	●	●	●	●
Operational				
18.	○	○	●	●
19.	●	●	●	●
20.	✕	●	●	●
21.	●	●	●	●
22.	●	●	○	●
23.	○	○	●	●
24.	○	○	●	●
25.	○	○	✕	●
26.	○	○	○	●

27.	✕	●	●	●
28.	◉	●	●	●
29.	✕	◉	●	●
30.	✕	◉	●	●
31.	●	●	●	●
32.	○	○	○	●
33.	●	●	●	✕
34.	●	●	●	●
Infrastructure				
35.	✕	●	●	●
36.	◉	●	●	●
37.	✕	●	●	●
38.	✕	●	●	●
39.	✕	●	●	●
Location, Community, and Environment				
40.	●	●	●	✕
41.	●	●	●	●
42.	●	●	●	✕
43.	●	●	✕	●
44.	●	●	●	●
45.	✕	✕	✕	✕
46.	●	●	●	●
47.	●	●	●	●
48.	●	●	●	●
49.	●	●	●	✕
50.	●	●	○	●
51.	●	●	●	●
Human Spaceflight				
52.	✕	✕	✕	●
53.	✕	✕	✕	●
54.	✕	✕	○	✕
55.	✕	●	●	✕
Cargo and Satellite Operations				
56.	◉	●	●	●
57.	◉	●	✕	●
58.	◉	●	✕	●

Legend

● Sufficiently Fulfilled ◉ Potentially Fulfilled
✕ Insufficiently Fulfilled ○ Not Evaluated

Space Florida is modifying and streamlining processes and procedures to be more responsive to commercial space transportation business interfacing with KSC and CCAFS. The full commercial utility of the Space Florida Spaceport can be realized with the planned development of SLC-36 and SLC-46. This plan is in the best interest of the State of Florida.

In addition to the SEM evaluation, a Launch Site Viability Evaluation was completed on each site. A summary of each evaluation is provided in Table 23 . The result of the evaluation rated all three complexes 'Favorable' with the exception of the hurricane tidal surge and proximity to salt laden air. All three sites are expected to be safe from the tidal surge of a Category 1 hurricane but might have some flooding from a Category 3 or higher hurricane. With proper design and maintenance practices the effects of the salt laden air can be minimized. For example, SLC-46's structure, while over fifteen years old, is in excellent condition due to quality building materials and regular maintenance.

Table 23: Launch Site Viability Evaluation Summary

Evaluation Criteria / Factors	SLC-36	SLC-46	SLC-47
Overall Spaceport Evaluation Mechanism (SEM) Review	●	●	●
Launch Azimuth & Orbital Inclination	●	●	●
Flyover Considerations	●	●	●
Environmental Considerations	●	●	●
Archeological Considerations	●	●	●
Contiguous Un-submerged lands	●	●	●
Category 1 (3) Hurricane Tidal Surge	⊙	⊙	⊙
Proximity to Salt Laden Air	✕	✕	✕
Proximity to Populated Areas	●	●	●
Explosive Quantity Distance of Previous Propellants	●	●	●
Vehicle Size Range/Class Requirements	●	●	●
Proximity to Road, Rail, Barge, and Airport Facilities	●	●	●
Proximity To Seismic Areas	●	●	●

Legend
● Favorable
⊙ Moderately Favorable
✕ Unfavorable

H.8 AREAS REQUIRING ENHANCEMENT AT SPACE FLORIDA SPACEPORT

Before a commercial space launch operator can utilize either SLC-36 or SLC-47, several enhancements must be completed. The following is a list of recommended enhancements to prepare the launch complexes for commercial space access.

Space Launch Complex 36 (SLC-36)

- Completion of FAA Launch Site Operators License Process
- Renovate existing buildings
- Continue maintenance on Support Building (Building #5550)
- Provide access to power and communication line terminations
- Add perimeter fence

Space Launch Complex 46 (SLC-46)

- Completion of FAA Launch Site Operators License Renewal
- Renovate the Mobile Access Structure (MAS)
- Verify requirement for replacement of rail between the MAS and launch point
- Inspect and establish requirement for refurbishment of flame duct
- Upgrade communications and launch control infrastructure

While SLC-47 is currently active, several enhancements are recommended to keep the launch complex in condition to continue to support Super Loki rocket launches.

Space Launch Complex 47 (SLC-47)

- Refurbish Launch Rails
- Refurbish Launch Control Center

SECTION I: APPENDIX – ACRONYMS

AADC	Alaska Aerospace Development Corporation
AATF	Airport and Airway Trust Fund
ABRP	Advanced Biological Research Platform
AIAA	American Institute of Aeronautics and Astronautics
AIP	Airport Improvement Program
AF	Air Force
AK	Alaska
AFB	Air Force Base
ARFF	Airfield Rescue and Fire Facility
AST	FAA Office of Commercial Space Transportation
ATF	Alcohol, Tobacco, and Firearms
BCC	Brevard Community College
BRAC	Base Realignment and Closure
CA	California
CASPER	Customer Assistance Service Program for the Eastern Range
CAR	Covered Air-bearing Roadway
CCAFS	Cape Canaveral Air Force Station
CCMS	Checkout, Control, and Monitor Subsystem
CD&SC	Communications Distribution & Switching Center
CDS	Central Data Substation
CEV	Crew Exploration Vehicle
CFASPP	Continuing Florida Aviation Systems Planning Process
CFR	Code of Federal Regulations
CLV	Crew Launch Vehicle
CLZ	Commercial Launch Zone
CSA	California Space Authority
COMM	Communication
COTS	Commercial Orbital Transportation Services
C3PO	Commercial Crew and Cargo Program
DoD	Department of Defense
DOT	Department of Transportation
EA	Environmental Assessment
EAFB	Edwards Air Force Base
EELV	Evolved Expendable Launch Vehicle
EIR	Economic Impact Region
ELI	Elliptical Orbit
ELV	Expendable Launch Vehicle
ER	Eastern Range

ESMC	Eastern Space & Missile Center
EXT	External Orbits
FAA	Federal Aviation Administration
FAA/AST	Federal Aviation Administration Commercial Space Transportation
FASP	Florida Aviation Systems Plan
FDOT	Florida Department of Transportation
FEC	Florida East Coast Railway
FHWA	Federal Highway Administration
FL	Florida
FOD	Foreign Object Debris
FONSI	Finding of No Significant Impact
FS	Florida Statues
FSI	Florida Space Institute
FSS	Fixed Service Structure
GSC	Guiana Space Center
GSO	Geosynchronous Orbit
HB	House Bill
HIF	Horizontal Integration Facility
IMR	Interchange Modification Report
IPF	Integrated Processing Facility
ISS	International Space Station
JAA	Jacksonville Aviation Authority
JACIP	Joint Automated Capital Improvement Plan
JIA	Jacksonville International Airport
KLC	Kodiak Launch Complex
Kg	Kilogram
KSC	Kennedy Space Center
LACB	Landing Aids Control Building
LC	Launch Complex
LCC	Launch Control Center
LEO	Low Earth Orbit
LOX	Liquid Oxygen
LPS	Launch Processing System
LSP	Launch Services Program
LTSF	Long Term Storage Facility
LSVE	Launch Site Viability Evaluation
MARS	Mid-Atlantic Regional Spaceport
MAS	Mobile Access Structure
MOA	Memorandum of Agreement
MEO	Medium Earth Orbit

ML	Mobile Launcher
MLP	Mobile Launch Platform
MLW	Mean Low Water
MTMC	Military Transportation Management Command
MOC	Morrell Operations Center
MOSB	Multi-Operations Support Building
MPO	Metropolitan Planning Organization
MPPF	Multi-Payload Processing Facility
MST	Mobile Service Tower
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
NGSO	Non-Geosynchronous Orbit
NM	New Mexico
NOTU	Naval Ordnance Test Unit
NRO	National Reconnaissance Office
O&C	Operations and Checkout
OK	Oklahoma
OPF	Orbital Processing Facilities
OPPAGA	Office of Program Policy Analysis and Government Accountability
OSIDA	Oklahoma Space Industry Development Authority
OSC	Orbital Sciences Corporation
PD&E	Preliminary Design and Engineering
PER	Preliminary Engineering Review
PHSF	Payload Hazardous Service Facility
PI	Program Introduction
PRD	Program Requirement Documents
QDC	Qualified Defense Contractor
R&D	Research & Development
RLV	Reusable Launch Vehicles
ROCC	Range Operations Control Center
RPSF	Rotation Processing and Surge Facility
RSTS	Range Safety and Telemetry System
RTS	Reagan Test Site
RS&H	Reynolds, Smith & Hills, Inc.
RSS	Rotating Service Structure
SBGP	State Block Grant Program
SC TPO	Space Coast Transportation Planning Organization
SCAPE	Self Contained Atmospheric Protective Ensemble
SCETS	State Comprehensive Enhanced Transportation System
SEAC	Space Enterprise Advisory Council

SECB	Security Entry Control Building
SEM	Spaceport Evaluation Mechanism
SERPF	Space Experiment Research and Processing Facility
SF	Space Florida
SIS	Strategic Intermodal System
SLC	Space Launch Complex
SLF	Shuttle Landing Facility
SLSL	Space Life Sciences Lab
SLVR	Small Launch Vehicle Research Project
SOCC	Space Operations Control Center
SpaceX	Space Explorations Technologies Corp.
SR	State Road
SRB	Solid Rocket Booster
SRM	Solid Rocket Motor
SRMU	Solid Rocket Motor Upgrade
SSF	Segment Storage Facility
SSPF	Space Station Processing Facility
STIM	Space Transportation Infrastructure Matching
STS	Space Transportation System
STTF	Florida State Transportation Trust Fund
TIMF	Transfer/Inspection and Maintenance Facility
TMP	Transportation Master Plan
TPS	Thermal Protection System
TPO	Transportation Planning Organization
TSA	Transportation Security Administration
UCF	University of Central Florida
UDS	Universal Documentation System
ULA	United Launch Alliance
UT	Umbilical Tower
USAF	United States Air Force
VA	Virginia
VAB	Vehicle Assembly Building
VAFB	Vandenberg Air Force Base
VIF	Vertical Integration Facility
WFF	Wallops Flight Facility
WSMR	White Sands Missile Range
45 SW	45th Space Wing

SECTION J: APPENDIX – REFERENCES

Publications

[1] Air Force, "General Plan – Cape Canaveral Air Force Station", July 2002.
[2] Air Force Space Command Manual (AFSPCMAN) 91-710, July 2004.
[3] Business Florida, "Global Trade: Easy Reach", September 24, 2008.
[4] FAA/AST, "2009 U.S. Commercial Space Transportation Development and Concepts: Vehicles, Technologies, and Spaceports", January 2009
[5] Finger, G. W., Kercsmar, J. C, Hammett, R. C., Keller, D. L., Endicott, P. K., and Gulliver, B. S., "State Spaceports – If You Build It, Will They Come?", AIAA, September 2007.
[6] Florida Department of Transportation, "Capacity Funding Eligibility Matrix for Strategic Intermodal System (SIS) Facilities", July 2009.
[7] Florida Space Authority & ZHA, "Cape Canaveral Spaceport Master Plan", July 2002
[8] International Space University, FuturIST Final Report - "The Spaceport Evaluation Mechanism (SEM)", 2008.
[9] NASA, "KSC Facilities Master Plan Vol 1", 1992.
[10] NASA, "KSC Vertical Launch Site Evaluation Final - 17AUG07", August 2007.
[11] Port Canaveral, "Foreign Trade Zone 136 Fact Sheet", October 28, 2008.
[12] Space Florida, "SF TMP Outline 051308", May 2008
[13] Space Florida, "TMP 1page Scope Summary", May 2008
[14] Space Florida, "Strategic Business Plan", 2009.
[15] Federal Aviation Administration/Commercial Space Transportation: "2008 Year in Review", Washington, DC. 2009.
[16] Federal Aviation Administration, "2009 Commercial Space Transportation Forecasts". Washington, DC, May 2009.
[17] Federal Aviation Administration. "AST News Bulletin (Special ed.)", Washington, DC, 2009.
[18] Federal Aviation Administration, "Final Environmental Assessment for Jacksonville Aviation Authority Launch Site Operators License at Cecil Field, Florida", July 2009.
[19] United States Air Force, "2008 Economic Impact Analysis", Patrick AFB, FL, 2009. [Brochure]
[20] National Aeronautics and Space Administration, "Economic Impact of NASA in Florida Fiscal Year 2008", Kennedy Space Center, FL, 2009.
[21] U.S. Department of Commerce, Bureau of Economic Analysis, RIMS II Multiplier
[22] NASA Final Environmental Assessment for Expanded Use of the Shuttle Landing Facility, September. 2007
[23] Beard, Suzette and Janice Starzyk, "Space Tourism Market Study: Orbital Space Travel and Destinations with Suborbital Space Travel". Futron Corporation, October 2002
[24] The Florida Senate, "Review of Space Florida's Infrastructure Projects", Issue Brief 2010-307, Committee on Commerce, September 2009.
[25] SpaceX, "Falcon 9 Launch Vehicle Payload User's Guide", Rev 1, 2009.

[26] Haug, Howard, Memo to the Board regarding the RLV Hangar, Sept. 2009.
[27] Futron, "Futron's 2009 Space Competitive Index (SCI) – Executive Summary", June 2009.
[28] Florida Department of Transportation, "Florida's Transportation Tax Source – A Primer", January 2009.
[29] US Coast Guard, "Federal Register" Volume 74, Number 61, April 1, 2009
[30] Jacksonville Aviation Authority, "Master Plan Update for Cecil Field", Final, May 2008.
[31] Lockheed Martin, "Atlas V Launch Mission Planner's Guide", January 2007.
[32] Boeing, "Delta IV Payload Planners Guide", September 2007.
[33] SpaceX, "Falcon 9 Launch Vehicle Payload User's Guide", Rev 1, 2009.
[34] Futron, "Space Tourism Market Study – Suborbital Space Travel", October 2002.
[35] Futron, "Suborbital Space Tourism Demand Revisited", August 24, 2006.
[36] Florida Department of Transportation, "Strategic Intermodal System – Investing in Florida's Future Program Highlights", 2009.
[37] Wilbur Smith and Associates & Florida Space Authority, "Master Transportation Plan", November 2002.

Websites

[38] http://www.nasa.gov/centers/kennedy/about/history/index.html, NASA Kennedy Space Center History.
[39] http://www.patrick.af.mil//library/factsheets/factsheet.asp?id=4517, 45th Space Wing Range and Launch Operations.
[40] http://www.vandenberg.af.mil/library/factsheets/factsheet.asp?fsID=4606, Vandenberg Air Force Base, History Office.
[41] http://www.nasa.gov/centers/wallops/about/history.html, NASA Wallops Flight Facility, Wallops History.
[42] http://sites.wff.nasa.gov/slvr/, NASA Wallops Flight Facility, Small Launch Vehicle Research (SLVR).
[43] http://www.smdc.army.mil/RTS.html, Reagan Test Site.
[44] http://www.dot.state.fl.us/planning/sis/atlas/D5Map-B.pdf, District 5(a), 5(b) SIS & Emerging SIS, Florida Department of Transportation (FDOT), July 20, 2008.
[45] http://www.spaceflorida.gov/docs/09_SFL_004_SLSL_Fact_Sheet_FINAL.pdf, Space Florida Facility Fact Sheet: Space Life Sciences Laboratory, 2009.
[46] http://www.explorationpark.com/, Exploration Park at Kennedy Space Center, 2009.
[47] http://www.amfcse.org/, The Astronauts Memorial Foundation
[48] http://grin.hq.nasa.gov/ABSTRACTS/GPN-2000-000855.html, Great Images In NASA archive, Kennedy Space Center, Image #: 99PP-1213, October 14, 1999. CCAFS, Image#:64PC-0082, Nov. 13, 1964.
[49] http://www.dot.state.fl.us/programdevelopmentoffice/Development/process.pdf, FDOT Work Program, Finance, and Budget Process Overview

[50] http://www.dot.state.fl.us/rail/PlanDevel/RSAC/Mtg2files/Notebook/TAB%206%20Planning,%20Programing%20&%20Funding%20Presentaiton.pdf, FDOT Planning, Programming and Funding, August 2008.
[51] http://www.jaa.aero/AirSys/CF.aspx Jacksonville Aviation Authority, Cecil Field (VVQ)
[52] http://www.dot.state.fl.us/planning/sis/designation/cecil/request.pdf JAA Proposal to FDOT for designation of Cecil Commerce Center as an Emerging SIS facility
[53] http://pmchallenge.gsfc.nasa.gov/docs/2007Presentations/Presentations/Hanley_Jeff.pdf, "Constellation Program Initial Capability Content (PMR Rev. #1)". NASA.
[54] http://www.nasa.gov/pdf/255656main_MPIM-rev-FY2009-2%20(FINAL).pdf, Multi-Program Integrated Milestones, NASA, February 2009.
[55] http://www.nasa.gov/offices/c3po/home/http://www.nasa.gov/offices/c3po/about/c3po.html, NASA Commercial Crew & Cargo, NASA.
[56] http://www.nasaspaceflight.com/2008/12/spacex-and-orbital-win-huge-crs-contract-from-nasa, "SpaceX and Orbital win huge CRS contract from NASA" December 23, 2008.
[57] http://www.orbital.com/SatellitesSpace, Orbital Satellites & Space Systems overview, Orbital Sciences Corporation.
[58] http://www.flightglobal.com/articles/2008/09/16/316045/orbital-looks-to-october-wallops-launch-pad-build.html, "Orbital looks to October Wallops launch pad build", September 16, 2008.
[59] http://www.marsspaceport.com/facilities.php, MARS facilities website.
[60] http://www.spacex.com/falcon9.php, Falcon9 rocket overview.
[61] http://procurement.jsc.nasa.gov/ccdev/, Recovery – Commercial Crew Development, NASA, August 4, 2009.
[62] http://www.virgingalactic.com/partnershipandbransonaboardvmseve/content/other/GALACTIC%20AT%20A%20GLANCE%20JULY%202009.pdf, "Galactic At a Glance – July 2009"
[63] http://en.wikipedia.org/wiki/Soyuz_TM-32,Soyuz TM-32 Mission Detail
[64] http://en.wikipedia.org/wiki/Space_tourism, List of Space Tourists in Orbit
[65] http://upload.wikimedia.org/wikipedia/commons/b/be/GCTC.jpg, Erabee, via Wikipedia
[66] http://www.bigelowaerospace.com/, Bigelow Aerospace
[67] http://snebulos.mit.edu/projects/reference/launch_vehicles/DNEPR/Dnepr_User_Guide.pdf, Dnepr Rocket User Guide
[68] http://web.archive.org/web/20070509003629/http://www.bigelowaerospace.com/out_there/dispatches_from_yasny.php, Bigelow Aerospace, Dispatches from Yasniy (Archived)
[69] http://www.nasa.gov/centers/kennedy/pdf/167423main_MajorNASAELVLaunches-07.pdf, Major NASA ELV Launches 1990-1996
[70] http://www.boeing.com/companyoffices/gallery/images/space/delta_iv/d4_slc37_08.htm
[71] http://www.nasa.gov/pdf/384767main_SUMMARY%20REPORT%20-%20FINAL.pdf, Summary Report of the Review of U.S. Human Space Flight Plans Committee, September 8, 2009.
[72] http://www.ksc.nasa.gov/facts/impplan/intro.html

[73] http://science.ksc.nasa.gov/payload/lssm/facility/lc4041.html, Launch Complex 40-41 descripiton.
[74] http://www.spacex.com/, Falcon 9 Launch Vehicle, and Dragon Capsule descriptions.
[75] http://www.nasa.gov/centers/kennedy/moonandmars/Constellationfacilities.html, "Kennedy Prepares to Host Constellation", September 28, 2007.
[76] http://www.eflorida.com/IntelligenceCenter/Reports/Aviation_Aerospace_CS.pdf, Florida's Aviation & Aerospace Cluster Snapshop, Enterprise Florida.
[77] http://science.ksc.nasa.gov/facilities/oc.html, Operations and Checkout Building, NASA.
[78] http://dayton.hq.nasa.gov/IMAGES/LARGE/GPN-2000-000957.jpg, Great Images in NASA, NASA.
[79] http://science.ksc.nasa.gov/facilities/lcc.html, Launch Control Center, KSC, NASA.
[80] http://www.nasa.gov/pdf/396682main_Ares_I-X-pk.pdf, Ares I-X Press Kit, October 2009, NASA.
[81] http://www.jpl.nasa.gov/news/news.cfm?release=2003-062, Galaxy Evolution Explorer Launch from Pegasus at CCAFS Skid Strip, Jet Propulsion Laboratory, April 28, 2003, NASA.
[82] http://www.dot.state.fl.us/planning/sis/, Florida's Strategic Intermodal System
[83] http://m.floridatoday.com/detail.jsp?key=229934, Florida Today, "Recession Casts Doubt Over KSC Job Loss", July 13, 2009.
[84] http://www.nasaspaceflight.com/2009/08/live-last-gps-iir-satellite-launch-on-final-slc-17a-delta-ii/, "Last GPS IIR Satellite Launched on Final SLC-17A Delta II", NASA Spaceflight, August 17, 2009.
[85] http://www.patrick.af.mil/news/story.asp?id=123079383, "Atlas V Launch Scores Major Milestones", Patrick Air Force Base, December 13, 2007.
[86] http://www.commercialspaceflight.org/spaceports_infrastructure.shtml, Space Transportation Infrastructure Matching Grants (STIM-Grants) Program, Commercial Spaceflight Federation.