ST. LUCIE COUNTY
FLORIDA

Chapter 4
Demand/Capacity and Facility Requirements

THE LPA GROUP
AVIATION CONSULTANTS

CHAPTER FOUR
Demand Capacity/Facility Requirements

This *Demand Capacity/Facility Requirements* chapter presents an evaluation of St. Lucie County International Airport's (FPR's) baseline conditions as they relate to the FAA-approved forecasts of aviation demand, as well as the St. Lucie County Board of County Commissioner's (BOCC's) identified goals and objectives, to determine short-term and long-term calculations of airfield capacity and facility requirements. This was achieved through the use of Federal Aviation Administration (FAA) and Florida Department of Transportation (FDOT) airport planning guidance and other applicable publications, and through consultation with the Technical Advisory Committee (TAC) and airport tenants. Determined facility requirements provide the basis for future aviation and non-aviation development over the course of the twenty-year planning period (2008-2028) and beyond. Alternative development as provided in **Chapter 5**, *Airport Alternatives Analysis*, considered the financial feasibility, operational efficiency, environmental compliance and sustainability as well as existing and proposed contiguous land use and growth management plans.

4.1 Airport Role and Service Level

4.1.1 Federal and State Systems

According to the FDOT guidance on *Airport Master Plans (FDOT Procedural Guidance 725-040-100-e)*, "in order for planned airport improvements to be eligible for state funding, airport master plans must be consistent with the aviation system role for the airport described in the FASP."[1] As noted in **Chapter 2**, *Inventory of Existing Conditions*, the Florida Aviation System Plan (FASP) 2025 and the National Plan of Integrated Airport Systems (NPIAS) currently designate FPR as a general aviation (GA) airport. The FASP further designates FPR as a "community" airport with the potential for commercial service. The *Treasure Coast Regional Overview* of the FASP reports that increased urbanization and population growth within the

[1] *FDOT Policy on Airport Master Plans, page 4, effective December 2, 2008.*

region will likely require one of the seven regional airports to "become an airport with commercial service."[2]

FPR is included in the NPIAS published by the U.S. Department of Transportation (U.S. DOT), and it is eligible for GA Entitlement funding. Within the NPIAS, the FAA defines the role of public use airports as essential to meet the needs of civil aviation and to support the Department of Defense (DOD) and U.S. Postal System. Within the NPIAS, the role of each airport is identified as one of four basic service levels: Primary, Commercial Service, Reliever, or General Aviation. FPR's current and five-year anticipated role within the NPIAS is identified as a "general aviation" airport.

Single-engine aircraft operations at FPR have historically dominated due to the airport's use for flight training. Still, with continued growth of APP Jet Center of Ft. Pierce (formerly Volo Aviation) and Key Air Treasure Coast, the two Fixed Base Operators (FBOs), it is anticipated that operations associated with turboprop and turbojet operations would only increase. GA operations associated with corporate and business users are not uncommon at FPR. These operations represented approximately six (6) percent of total operations in 2008. Of this six percent, approximately 229 annual operations were associated with corporate aircraft with operating weights greater than 60,000 pounds (Cessna Citationjets (601 and 605), Gulfstreams 350, 450, 550, Bombardier Global Express, etc). The airport also expects continued growth in flight training, corporate jets and air taxi operations including those related to Very Light Jets (VLJs).

However, according to the April 2009 *Airport Newsletter*, airport management reported that the Grand Bahamas Chamber of Commerce expressed some interest in a possible partnership with St. Lucie County to provide service between FPR and The Bahamas. The St. Lucie County Tourism Development Council is actively pursuing a partnership with the Grand Bahamas Chamber of Commerce and is interested in providing the necessary facilities at FPR to support commercial operations. Airline service would be beneficial for the local economy in terms of job creation, tourism revenue, and would also potentially encourage future business investments within St. Lucie County and at FPR.

Still, with continued urbanization of the Treasure Coast region, it is important to protect the region's airports from incompatible, contiguous land uses. Even if nearby urban development does not pose hazards to flight, local communities and residents may be inclined to inhibit airport expansion and growth due to actual and/or perceived noise impacts. Protecting the

[2] *Treasure Coast Regional Overview, Florida Aviation System Plan, 2007, Page 18.*

region's airports from encroachment of incompatible land use is critical for economic development and will save large amounts of money, time and conflict in future years.[3]

4.1.2 St. Lucie County Comprehensive Plan

FPR is designated currently by Federal, State and Local plans as a general aviation airport. The airport was established in the 1930s and is home to U.S. Customs and Border Protection services. Prior to 1998, the St. Lucie County Port and Airport Authority was the governing agency. With its dissolution, the airport became a department of St. Lucie County. With this change, special taxing districts associated with the airport were also terminated.

According to the *St. Lucie County Comprehensive Plan*, revised January 6, 2004, as well as the 2002 Master Plan Update, limited development was previously planned for FPR due to noise concerns for nearby residential areas and potential impacts to sensitive environmental features such as wetlands. Also, the *Comprehensive Plan* states "Assuming that the cited concerns of the community can be satisfactorily addressed, the most revised long term plans for the airport contemplate the extension of the main east/west runway to 10,000 feet and the addition of a 6,000 foot parallel runway to the north of the east/west runway…There are no plans of the County to expand the airport beyond those of a general aviation airport."[4] The *Comprehensive Plan* recognizes the need to promote airport compatibility with the surrounding community and sensitive environmental features, and is also cognizant of the potential for growth to occur at FPR. As a result, the *Transportation Element* of the *Comprehensive Plan* was revised in 2007 to incorporate the recommendations of the Airport Master Plan. The *Comprehensive Plan* further recommends the preparation of a Master Plan Update every five years so that airport development needs can continually be monitored.

Since the 2007 revision, discussions have occurred regarding initiating limited commercial service operations at FPR within the next several years. Therefore, this Master Plan Update was faced with the challenge of identifying requirements that would satisfy aviation demand while simultaneously meeting the goals of the *Comprehensive Plan.* This task was accomplished through close coordination with officials from St. Lucie County (airport management, Commissioners, Growth Management, etc.), airport tenants, the TAC, and the public.

4.1.3 Potential Commercial Service

Although the airport is currently designated as GA, interest regarding the viability of FPR accommodating future scheduled commercial service was raised by Port St. Lucie Officials.

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[3] *Treasure Coast Regional Overview, Florida Aviation System Plan, 2007*
[4] *St. Lucie County Comprehensive Plan, January 2004, page 2-13.*

Thus as part of this Master Plan Update, commercial service requirements were identified. Prior to initiation of scheduled commercial service, the airport must obtain Federal Aviation Regulation (FAR) Part 139 certification.

According to **FAR Part 139**, *Certification of Airports*, there are four classifications of Airport Operating Certificates (AOCs) as defined below.

- "Class I means an airport certificated to serve scheduled operations of large air carrier aircraft (30+ seat aircraft).
- Class II means an airport certificated to served scheduled operations of small air carrier aircraft (10 to 30 seat aircraft) and unscheduled operations of large air carrier aircraft
- Class III means an airport certificated to serve scheduled operations of small air carrier aircraft.
- Class IV means an airport certificated to serve unscheduled passenger operations of large air carrier aircraft."[5]

Newly certified airports all start at Class III, then may switch classification depending upon actual operations. FPR would initially receive Class III certification, and then be recertified as Class I dependent upon the level of operations. FAR Part 139 also requires the submission of an Airport Certification Manual (ACM) for an airport to receive an AOC. The ACM includes a collection of procedures for security, inspections, management, records, wildlife, obstruction removal, etc. Although many Part 139 Certification requirements are more stringent than those for GA airports, FPR currently meets many of the physical requirements of Part 139, such as Airport Rescue and Firefighting (ARFF) facilities and equipment, traffic and wind direction indicators, and restricted access to aircraft movement areas. At the time of this writing, airport management was in the process of completing the ACM necessary to obtain Part 139 Certification as well as upgrading several essential facilities including airport fencing, electrical vault, partial perimeter road, etc.[6]

In summary, based on the potential for commercial airline service during the planning period, FPR's role within the state and national aviation systems may ultimately change as follows: the FASP role may change from a "community airport" to a "commercial airport;" the NPIAS role may change from a "general aviation airport" to one of the highlighted commercial service categories listed in **Table 4-1**.

[5] *FAR Part 139, Certification of Airports, Paragraph 139.5.*

[6] Minimum FAR Part 139 Commercial Passenger Service requirements are discussed in detail in Chapter 5 of this report.

TABLE 4-1 FAA NPIAS SERVICE LEVELS – COMMERCIAL AIRPORTS	
NPIAS Service Level	**Criteria**
Primary – Large Hub	Airports with at least 1.00% of all annual passenger enplanements
Primary – Medium Hub	Airports with 0.25% to 1.00% of all annual passenger enplanements
Primary – Small Hub	Airports with 0.05% to 0.25% of all annual passenger enplanements
Primary – Nonhub	Airports with less than 0.05% of all annual passenger enplanements but more than 10,000 annual passenger enplanements
Nonprimary	Airports with 2,500 to 10,000 annual passenger enplanements
Source: FAA Order 5090.3, Field Formulation of the National Plan of Integrated Airport Systems.	

This potential role change is consistent with planning efforts herein. Therefore, this study considered not only requirements necessary to accommodate GA demand, including corporate and flight training operations, but also the potential for future commercial service, including commercial terminal requirements. However, without forecast data to substantiate future commercial service at FPR, the FAA may be hesitant to grant a change in NPIAS classification at this time. It is therefore recommended that the airport obtain letters of interest from prospect airlines to validate any requested change in NPIAS classification.

4.2 Factors and Opportunities

The FAA is in the process of modernizing the National Airspace System (NAS). Next Generation Air Transportation System (NextGen) was developed to address the impact of air traffic growth by increasing the NAS capacity and efficiency while simultaneously improving safety, environmental impacts (noise and air quality) and user access. NextGen in conjunction with the certification of VLJs are anticipated to change the face of aviation by allowing greater use of smaller airports around the United States.

Next Generation Air Transportation System (NextGen)

The term "NextGen" refers to the systematic transformation of the NAS from a reliance on the current ground-based communications and navigation system to one based on digital and satellite technology for managing the management of air traffic control. In many respects, the term "NextGen" is being replaced with "NowGen" to reflect that many of the technologies, policies, and procedures originally conceived as futuristic were adopted and are currently being implemented.

For example, the implementation of NextGen begins with increasing the establishment of en route and terminal area navigation procedures using the Global Positioning Satellite system (GPS) and the introduction of Automatic Dependent Surveillance – Broadcast (ADS-B) services. ADS-B is considered a critical component of NextGen and uses GPS technology to provide real-time three-dimensional position, tracking prediction, and concurrent situational awareness among all participating aircraft while simultaneously transmitting to pilots and ATC facilities. NextGen capabilities will expand with the introduction of technological innovations in areas such as continuous airborne navigational networking, real-time weather forecasting and reporting, and digital data communications.

The primary goal of NextGen is to provide order-of-magnitude improvements in the efficiency of the NAS by allowing aircraft to fly on more direct routes, to safely reduce aircraft separation standards and to provide more data to aircrews for operating their aircraft. Major benefits of NextGen involve both economic and environmental factors. With certain decision-making responsibilities transferred from controllers to the cockpit, the cost of operating the NAS will be reduced as the need for ground-based equipment and manpower diminishes. Economic benefits for users include reductions in en route flight times, departure delays and cancellations, and rigid terminal approach procedures. These in turn, will translate into reduced fuel consumption, carbon emissions and other air pollutants, and aircraft noise.

Other than new GPS-based instrument approach procedures, airport-specific elements of NextGen have focused on the development of additional infrastructure, including the development of new parallel runways and taxiways, and “end-around” taxiways at the busiest commercial service airports. Future NextGen-related airport projects will be concentrated on providing adequate airspace protection (runway protection/approach zones) associated with more precise approaches and unconstrained access to the runway/taxiway/terminal gate system. It is expected that as a result of NextGen, significant improvement in airfield capacity, measured as Annual Service Volume (ASV) and in VFR/IFR hourly peak runway capacities, will result.

NextGen and St Lucie County International Airport

The availability of NextGen technologies will continue to expand as the FAA’s plan is implemented. One of the more recent ADS-B expansion projects completed was to install 11 ADS-B ground stations in the South Florida region to initiate ADS-B services. The ground stations serve as receivers of airborne ADS-B transmissions and transmitter for data uplinks to aircraft and ATC personnel. Resembling cell phone towers, ADS-B ground stations are not absolutely required to be located on airport property to be effective. Of the 11 ground-based ADS-B stations located in Southern Florida, two are located within 35 miles of FPR. The closest station to FPR is located at the Sebastian Municipal Airport (25 miles to the north) while Hobe Sound is the site of another station, located 33 miles to the south. Coverage provided by these two stations will provide adequate coverage for most terminal departure and approach requirements in addition to assisting aircraft transitioning along the major airways along Florida’s east coast.

There are several instrument approaches available to access the airport during inclement weather conditions. A standard Instrument Landing System (ILS) has been established for Runway 10R and allows descents down to 200 feet (AGL) in visibility conditions of at least 3/4 mile. An RNAV (GPS) approach to the same runway only provides minimums of 417 feet in one-mile visibility. **Table 4-2** provides more information on the current instrument approaches available at FPR.

TABLE 4-2
CURRENT INSTRUMENT APPROACH CAPABILITIES

Runway	Type	Category	DH/MDA[1]	Visibility	Remarks
Runway 10R	ILS[2]	P	200	¾ mile[3]	No MALSR
Runway 10R	RNAV/LNAV[4]	NPI	417	1-mile	
Runway 28L	RNAV/LNAV[4]	NPI	396	1-mile	Offset from Runway by 16°
Runway 28L	NDB	NPI	616	1-mile	Offset from Runway by 29°
Runway 14	RNAV/LPV[5]	NPI	301	1-mile	Offset from Runway by 13°
Runway 14	VOR/DME	NPI	396	1-mile	

Source: Dr. David Byers, Quadrex Corporation, and The LPA Group Incorporated, 2009.
Notes:
(1) Lowest approach altitude above ground level
(2) Outer Marker Beacon and Compass (LUUCE) located 5.1 NM from approach end of Runway 10R; Middle Marker Beacon located 0.5 NM from approach end of Runway 10R.
(3) Runway 10R limited to ¾ mile visibility due to location of Florida Power and Light power lines adjacent to Taylor Dairy Road.
(4) GPS approach with lateral navigation guidance only.
(5) GPS approach with both lateral and vertical guidance (LPV -localizer performance and vertical guidance)

In addition, an RNAV (GPS) approach is in design for Runway 32 and is scheduled to be published in late 2009. The ILS system for Runway 10R currently does not include an approach lighting system to assist pilots in making the transition from instrument reference to visual contact with the airfield, but does have an middle marker located approximately 0.5 NM from the approach end of Runway 10R to signal the missed approach point. Further, due to the current location of the Florida Power and Light (FPL) power lines adjacent to Taylor Dairy Road, the visibility minimums are limited to ¾ mile rather than the standard ½-mile for precision instrument runways.

Some of the potential benefits of NextGen as it relates to FPR include the development of more precise approaches to the primary runway (Runway 10R-28L). More precise operation of aircraft arrivals and departures within the traffic pattern will serve to better avoid noise sensitive areas adjacent to the airport.

4.3 Airport Reference Code

The FAA has established an Airport Reference Code (ARC) to define the operational characteristics of the most demanding aircraft using the airport. As shown in **Table 4-3**, the ARC consists of two components: the Aircraft Approach Speed, which is based upon 1.3 times the aircraft's stall speed in landing configuration, and Airplane Design Group (ADG), which relates to the aircraft wingspan and tail height. Generally, aircraft approach speed applies to runways and runway-related facilities (runway length and strength, approach capability, etc.), while wingspan and tail height relates to runway and taxiway width and separation criteria.

TABLE 4-3
FAA AIRPORT REFERENCE CODE (ARC) CLASSIFICATION

Aircraft Approach Category	Approach Speed (Knots)	Airplane Design Group	Wingspan (ft)	Tail Height (ft)
A	< 91	I	< 49	< 20
B	91 < 121	II	49 < 79	20 < 30
C	121 < 141	III	79 < 118	30 < 45
D	141 < 166	IV	118 < 171	45 < 60
E	166	V	171 < 214	60 < 66
		VI	214 < 262	66 < 80

Source: FAA Advisory Circular (AC) 150/5300-13.

At an airport with multiple runways like FPR, it is possible to assign a different ARC to each runway. This allows each runway and associated taxiways to be designed for its specific users. For example, FPR's primary Runway 10R-28L is frequently used by corporate jets with an ARC of C-III (e.g., Gulfstream V), while the largest users of training Runway 10L-28R would typically be turboprops with an ARC of B-II (e.g., Beechcraft King Air 350). It would not be cost-effective or appropriate for both runways to be designed to the same ARC criteria, since an ARC of C-III necessitates much greater separations, lengths, widths, strengths, approach equipment, etc., compared to an ARC of B-II. FPR's most recent FAA-approved Airport Layout Plan (ALP) identifies the following runway ARCs:

- Primary Runway 10R-28L – ARC C-III
- Runway 14-32 – ARC C-II
- Training Runway 10L-28R – ARC B-II

In reviewing current airfield separations and design standards, the previously-identified ARCs were determined to be consistent with current and forecast airport activity levels and the anticipated aircraft fleet mix. However, the FAA typically requires additional information to support the ARC determination. Since no change in ARC is recommended during the planning period, previous activity data was reviewed to substantiate the identified ARCs. According to **FAA Order 5100.38C**, *Airport Improvement Program Handbook*, "more than one critical aircraft may control the design of any specific airport's different facility features, such as runway length, strength, or paved areas or lateral separations in airfield layout. A critical aircraft is that airplane using (or is highly likely to use) the airport on a regular basis. A regular basis is at least 500 annual itinerant operations." [7] In other words, an airport's design criteria is not determined by one single aircraft but by a family of multiple aircraft.

There were 3,375 jet operations at FPR in 2008, of which approximately 1,300 have published approach speeds of greater than 121 knots, thus falling into the "C" approach speed category. Approximately 20 of those operations were also conducted by jets with wingspans of greater than 79 feet, thus falling into the ADG "III" category, and there were also 328 operations by Douglas DC-3 turboprops which have wingspans of 95 feet. Therefore, in consideration of both the approach speed and wingspan factors at FPR, the combination of aircraft families produces an ARC of C-III for primary Runway 10R-28L.

Similarly, an ARC of C-II was determined for Runway 14-32 and an ARC of B-II was determined for training Runway 10L-28R. Further, according to **FAA AC 150-5325-4**, *Runway Length Requirements for Airport Design* (Table 1-2), an additional primary runway needed for capacity, noise mitigation, or regional jet service should have a runway length equal to 100 percent of the primary runway length, and for an additional primary runway that is needed for separating aircraft classes, the length should be determined by the less demanding airplane group or individual design airplane. Although Runway 14-32 was historically referred to as a "crosswind runway," it is technically a secondary primary runway because it is needed for capacity, noise, and separation of aircraft classes rather than wind coverage. Therefore, the design criteria for Runway 14-32 should be similar to the primary Runway 10R-28L, particularly since Runway 14-32 plays a vital role in providing an alternate runway during calm wind conditions[8] as well as directing traffic away from St. Lucie Village. However, airport management still receives complaints from local residents when Runway 14-32 is in use even though the 2005 FAR Part 150 Study does not show noise impacts off airport property. Additional information on critical aircraft, specific to each design feature of the airport (runway length, runway strength, separations, etc.) is presented later in this chapter.

[7] *FAA Order 5100.38C, Airport Improvement Program Handbook, pgs. 56-27.*

[8] *Noise sensitive areas were determined based upon the FAA Approved Noise Compatibility Program (NCP) Operational Measure 3, "Runway 14 Preferred in Calm Wind" – FAA approval date August 21, 2006.*

4.3.1 Aircraft Fleet Mix and Critical Aircraft

The critical aircraft represents the single aircraft that is used to identify the design criteria for a specific runway. Unlike an ARC which is used primarily to determine airfield separation criteria, the critical aircraft affects the length and strength of runways. For example, the most recent FAA-approved ALP identifies the following critical aircraft for each runway at FPR:

- Primary Runway 10R-28L – Existing (Gulfstream II); Future (Gulfstream V)
- Runway 14-32 – Existing (Lear 25/35); Future (Gulfstream V)
- Training Runway 10L-28R – King Air 200

According to airport records, 14 jets[9] are based at FPR, the largest of which is the Gulfstream III with an ARC of C-II. There are also three large Douglas DC-3 turboprops designated as ARC A-III because of their 95 foot wingspans. This combination of "C" and "III" category aircraft results in the designation of ARC C-III for Runway 10R-28L. Using the FAA's Enhanced Traffic Management System Counts (ETMSC) database, the activity data presented in **Table 4-4** illustrates how an ARC of C-III was determined for Runway 10R-28L. Note that the information in the table is not an exhaustive list of all jet or turboprop operations at FPR, but represents a sample of critical aircraft discussed throughout this chapter.

As can be seen, in 2007 and 2008 there were enough operations by "C" and "D" category aircraft to apply an approach speed designation of "C" to FPR's two primary runways. There is very little difference between the design criteria for "C" and "D" category runways, thus "C" was selected because it better represents the current and anticipated mix of business jets operating at FPR. Also, the Learjet 35, which is a "D" category aircraft, is an older jet that stopped being produced in 1994, and consistent with the drop in operations between 2007 and 2008 at FPR, the number of Learjet 35 operations around the country should continue to decline as more and more are retired from service.[10]

[9] *In 2008/2009*
[10] *Airliners.net.*

TABLE 4-4 CRITICAL AIRCRAFT EVALUATION						
Aircraft	**ARC**	**Approach Speed**	**Wingspan**	**Max Takeoff Weight**	**2007 Operations**	**2008 Operations**
Douglas DC-3 Turboprop	A-III	72 Knots	95.0 Feet	25,200 Pounds	316	328
Global Express Jet	B-III	106 Knots	94.0 Feet	98,250 Pounds	5	4
Gulfstream II Jet	D-II	141 Knots	68.8 Feet	65,300 Pounds	141	79
Gulfstream III Jet	C-II	135 Knots	77.8 Feet	70,200 Pounds	94	94
Gulfstream IV Jet	D-II	149 Knots	77.8 Feet	75,000 Pounds	39	57
Gulfstream V Jet	C-III	136 Knots	93.5 Feet	90,900 Pounds	11	16
Hawker HS 125 Jet	C-I	125 Knots	47.0 Feet	24,200 Pounds	117	164
Learjet 25	C-I	137 Knots	35.6 Feet	15,000 Pounds	111	334
Learjet 35	D-I	143 Knots	39.5 Feet	18,300 Pounds	729	499
Learjet 60	C-I	139 Knots	43.8 Feet	23,750 Pounds	55	39
C or D Category Aircraft Operations					**1,297**	**1,282**
III Category Aircraft Operations					**332**	**348**

Source: FAA ETMSC database, Aviation Week Aerospace Source Book 2006, FAA AC 150/5300-13, The LPA Group Incorporated, 2009.

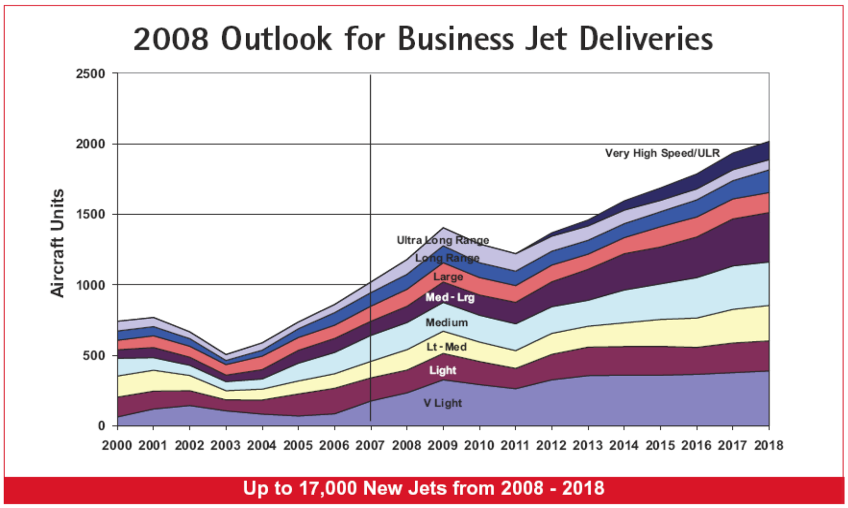
Although, at least in recent years, FPR has not experienced more than 500 operations by category "III" aircraft (i.e., those with wingspans ≥ 79 feet < 118 feet), maintaining the "III" designation for Runway 10R-28L is considered necessary for several reasons. First, according to Honeywell Aerospace's *Business Aviation Outlook Forecasts for 2008-2018*, even considering the weakened economic conditions around the world at the end of 2008, "Sustained interest in the long- and ultra-long-range segment has been present for several years and reflects increased need for aircraft capable of trans-Pacific flights, as well as the growth in demand requiring more long-range operations as trade and economic growth flourishes."[11] In recent years there has been a buzz about the introduction of VLJs such as the Eclipse Aviation 500. However, with the failure of companies like Eclipse Aviation and DayJet[12] at the conclusion of 2008 and beginning of 2009, and aircraft buyers opting for less expensive but more efficient turboprop aircraft rather than VLJs, both Honeywell and the FAA have slightly scaled back their forecasts of VLJ growth. At the same time, the stock of used corporate jets has been increasing as businesses show preference towards new jets because of associated fuel, maintenance, and performance savings. Time has also been reemphasized as an important asset – specifically the ability to transport business executives between far-reaching destinations on non-stop flights. This is why Honeywell projects the

[11] *Honeywell Keeps Faith In Forecast, World Aircraft Sales Magazine, November 2008.*

[12] *DayJet was an American commercial aviation operation that provided on-demand jet travel using Eclipse 500 Very Light Jets. The company began operations in Florida in October 2007 and suspended operations on September 19, 2008. (http://en.wikipedia.org/wiki/DayJet).*

delivery of 2,300 new long- and ultra-long-range jets by 2018, the highest growth sector for corporate jets as shown in **Figure 4-1**. Subsequently, aircraft manufacturers have been developing these new jets with wider category "III" wingspans to accommodate long-range fuel loads, including the Bombardier Global Express and Global 5000 with wingspans of 94 feet, the Gulfstream G500, G550, and G650 with wingspans of 93 feet, and the Dassault Falcon 7X with a wingspan of 86 feet. As these new jets are delivered, an increasing number of category "III" aircraft operations should be expected at FPR.

Figure 4-1
Honeywell Business Aviation Outlook, 2008-2018



Source: World Aircraft Sales Magazine, November 2008.

Also, both FBOs at FPR have large-scale hangar development plans to house corporate jets. Their intent is not only to store their own growing aircraft fleets, including the Global Express, Global 5000, and Gulfstream GV,[13] but also to cater to new businesses that may come to St. Lucie County while also attracting corporate aircraft tenants from nearby capacity-constrained and expensive airports like Palm Beach International Airport (PBI). Since Honeywell forecasts long- and ultra-long-range jets to experience the most new deliveries by 2018, there is a significant need to maintain ARC C-III design standards for primary Runway 10R-28L to encourage the future success of the FBOs and the airport as a whole.

In **Chapter 2** (**Table 2-2**), FPR was compared to six public airports within Florida's Treasure Coast Region in an effort to identify facilities that may or may not impact regional aircraft activity. Compared to Vero Beach Municipal Airport (VRB) and Witham Field Airport (SUA), FPR is the only regional airport with a precision ILS approach and an on-site U.S. Customs

[13] *www.KeyAir.com and* www.appjetcenter.com/fortpierce.html.

and Border Patrol (CBP) facility. Further, FPR also has more property than VRB and SUA combined. However, compared to FPR's maximum dual-wheel runway strength of 60,000 pounds, VRB's main runway has a 115,000 pound dual-wheel strength and SUA's main runway has a 105,000 pound dual-wheel strength. While FPR is the only airport that can accommodate international operations, it appears that the available runway pavement strengths limit additional operations by long- and ultra-long-range corporate jets with aircraft operating weights greater than 60,000 pounds. In 2007 there were approximately 232 operations associated with aircraft with operating weights greater than 60,000 pounds at FPR, 331 at VRB, and 540 at SUA.[14] Load factors associated with these aircraft are likely compromised (i.e. aircraft do not operate at full capacity) because of the pavement strength limitations. Further evaluation of airfield pavement strengths is presented later in this chapter.

Interest in scheduled commercial service at FPR was initiated from several sources, including the FASP[15]. Discussions first occurred when residents near Palm Beach International Airport suggested sending some traffic to FPR to reduce noise and congestion. Another suggestion made was to relocate the existing airport to the west side of St. Lucie County. The Port St. Lucie City Council also expressed interest in preserving an area within the city limits for a regional airport. Due to this interest the viability of implementing commercial service at FPR and the identification of associated requirements was included as part of this Master Plan Update process. A commercial service forecast, however, was not provided since information was unavailable to accurately predict the type, level and period when commercial operations would likely occur.
This past March, tourism leaders from the Grand Bahamas Island met with local officials to foster increased tourism. During their visit to the FPR, they expressed some interest in possibly promoting commercial operations between the Bahamas and FPR. Although there has been no discussion with the official carrier, Bahamasair, the St. Lucie County BOCC BOCC recommended that airport management pursue grant funding options for terminal renovations in the hope that successful discussions with the Grand Bahamas Tourism Board would initiate potential commercial service at FPR. If Bahamasair were to initiate service at FPR, it is anticipated that the airline would use their existing 50 passenger Bombardier Dash 8 Q-300 turboprops which have wingspans of 90 feet (i.e., category "III" wingspans).

In consideration of all these factors and consistent with the previous FAA-approved ALP, the critical aircraft shown in **Table 4-5** are recommended for existing and future airfield activity at FPR. The Gulfstream G550 is a new version of the Gulfstream V and is considered an ultra-

[14] *Fboweb.com historical flight data.*
[15] Development of a committee to evaluate the viability of limited commercial service was considered but has of yet come to fruition.

long-range corporate jet with an ARC of C-III. This is comparable to the types of corporate jets that Honeywell forecasts to experience the greatest number of new deliveries by 2018. Therefore, the remainder of this chapter uses the Gulfstream G550 as a representative critical aircraft for primary Runway 10R-28L. A super-midsize ARC C-II category Hawker 4000 corporate jet was selected because it's physical and operating characteristics fit well with current and anticipated design standards for Runway 14-32. Finally, based on the previous FAA-approved ALP, an ARC B-II category King Air 350 turboprop was selected for training Runway 10L-28R.

TABLE 4-5
EXISTING AND FUTURE CRITICAL AIRCRAFT

Runway	ARC	Critical Aircraft	Approach Speed	Wingspan	Max Takeoff Weight
Primary Runway 10R-28L	C-III	Gulfstream G550	136 Knots	93.5 Feet	91,000 Pounds
Runway 14-32	C-II	Hawker 4000	128 Knots	61.8 Feet	39,500 Pounds
Training Runway 10L-28R	B-II	King Air 350	109 Knots	58.0 Feet	15,000 Pounds

Source: Aviation Week Aerospace Source Book 2006, Gulfstream.com, HawkerBeechcreaft.com, and The LPA Group Incorporated, 2009.

Currently, Runway 10R-28L is designed to accommodate C-III aircraft and has a published dual wheel weight capacity of 60,000 lbs; whereas, Runway 14-32 is designed to accommodate C-II aircraft but has a published weight bearing capacity of 15,000 lbs single wheel. Due to the current pavement condition of Runway 10R-28L, the pavement is being rehabilitated to maintain the published 60,000 dual wheel capacity[16]. Short-term demand at this time does not warrant the strengthening of Runway 10R-28L to 90,000 lbs dual wheel or Runway 14-32 to 60,000 lbs dual wheel. Therefore, operations on Runways 10R-28L, 14-32 and 10L-28R are unlikely to change in the near-term (0-5 years) unless a significant change in demand occurs.

4.4 Demand Capacity Analysis

The purpose of performing a demand/capacity analysis is to compare the capacity of the existing airfield configuration to forecast operational demand, and to identify if and when capacity improvements may be required during the twenty-year planning period. For FPR, this was accomplished by comparing the theoretical capacity of the existing three-runway airfield configuration, as determined by diagrams in **FAA Advisory Circular (AC) 150/5060-5**, *Airport Capacity and Delay*, to the *Forecasts of Aviation Demand* in **Chapter 3**. An analysis of the previous two-runway airfield configuration was also conducted to highlight the importance of the recently-constructed training Runway 10L-28R as it relates to existing and

[16] Refer to **Section 4.5.2**, *Runway Pavement Strength Analysis*, for detailed information on pavement strength.

future airfield capacity demand.

Airport capacity is defined by the FAA as an estimate of the number of aircraft that can be processed through the airfield system during a specific period with acceptable levels of delay. As mentioned, airfield capacity at FPR was determined in accordance with the methods presented in the *Airport Capacity and Delay AC*. This methodology does not account for every possible situation at an airport, but rather the most common situations observed at U.S. airports when the AC was adopted. Further, the *Airport Capacity and Delay AC* provides a methodology for determining the hourly runway capacity, the Annual Service Volume (ASV), and average expected delays. In this chapter, each of these factors was calculated for existing conditions and for every five-year interval of the twenty-year planning period. An airport's hourly runway capacity expresses the maximum number of aircraft that can be accommodated under conditions of continuous demand during a one-hour period. It should be noted that the hourly capacity cannot be sustained for long periods or an airport will experience substantial increases in delay. The ASV estimates the annual number of operations that the airfield configuration should be capable of handling with minimal delays. The calculation of ASV considers the fact that a variety of conditions are experienced over a 12-month period, including periods of high volume and low volume activity. The average anticipated delay was based on a ratio of the forecast demand to the calculated ASV. These calculations, using the aforementioned FAA methodology, were based upon the airfield configuration as well as operational and meteorological characteristics, which are described in detail within the following sections.

4.4.1 Airspace Capacity

An FAA Terminal Radar Approach Control (TRACON) facility typically oversees aircraft flying Instrument Flight Rule (IFR) flight plans, which includes the majority of itinerant and business aircraft operations. The main function of a TRACON is to control the airspace around airports with high traffic density. The TRACON area of coverage includes airspace within a 30 to 50 mile radius of an airport up to altitudes of 10,000 to 15,000 feet, as well as aircraft flying over that airspace. When an arriving aircraft is within five miles of an airport and below 2,500 feet, TRACON controllers hand the aircraft off to local air traffic control[17]. TRACON controllers also hand off departing aircraft to FAA En Route Centers who guide aircraft to higher altitudes on the way to other airports. In the case of FPR, TRACON type facilities are provided by the Miami Center Air Route Traffic Control Center (ARTCC). The Miami Center ARTCC controls FPR's airspace when FPR's Air Traffic Control Tower (ATCT) is closed from 9:00 p.m. to 7:00 a.m., and also provides terminal and enroute air traffic services for all aircraft flying IFR flight plans (frequencies 132.25/370.9, VERO BEACH RCAG).

[17] Federal Aviation Administration News, January 14, 2008, *Fact Sheet: FAA Continues Commitment to South Florida Air Traffic Safety and Efficiency*, http://static.cbslocal.com/station/wfor/files/faafactsheet.pdf

However, Palm Beach International controllers have stated that consolidating TRACON facilities to Miami would compromise airspace coverage especially in Northern Airspace (i.e. Vero Beach/Ft. Pierce). Further, there has not been enough discussion with regard to the transition of services in the north – "where will pilots receive service in those areas under the new plan? Would they receive the same services, or are there plans to provide service from other FAA facilities?"[18] There were also concerns raised with regarding to tower and airspace capacity, especially concerning continued traffic growth in Palm Beach and other northern counties, technological and procedural redundancy, as well as the timeframe and cost associated with the transition.

Airport Surveillance Radar 11 (ASR-11) system is located at Fort Drum, which is approximately 28 miles from Fort Pierce and 26 miles from Vero Beach and provides additional radar coverage to aircraft operating within Treasure Coast Airspace. The FAA has designated this facility as "Vero Beach Radar". To further enhance the radar coverage, FAA installed another ASR-11 at West Palm Beach (West Palm Beach Radar) International Airport in 2005. The ASR System detects aircraft position and weather conditions in the vicinity of civilian and military airfields and consists of primary and secondary surveillance radar or beacon. "The primary surveillance radar uses electromagnetic waves which reflect/backscatter off the surface of an aircraft up to 60 miles from the radar to determine the distance of the aircraft from the radar antenna and the azimuth or direction of the aircraft from the antenna."[19] The secondary surveillance radar antenna also known as beacon transmits and receives area aircraft data for barometric altitude, identification code and emergency conditions. … The air traffic control uses this system to verify the location of aircraft within a 120-mile radius of the radar site."[18]

In addition, the FAA is investing more than $20 million in a new 231 foot air traffic control tower at Palm Beach International Airport (2011) as well as enhancing approach control service for the airport. According to the FAA Fact Sheet, the Palm Beach TRACON will be co-located with the Miami TRACON. Thus, according to FAA, with the addition of the new ATCT at Palm Beach International, the installation of ASR-11 antennae at Fort Drum and Palm Beach International and the co-location of TRACON facilities (Palm Beach and Miami), air traffic control coverage of airspace within the Treasure Coast Region is inclusive.

[18] PBI Approach Control Working Group – July 21, 2008, Meeting Minutes
[19] Federal Aviation Administration ASR-11 Factsheet, July 17, 2007, http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/terminal/surveillance/asr11/factsheets/

However, the FAA's plan to relocate the Palm Beach TRACON to Miami has raised a number of objections (i.e. workload, airspace coverage especially in Vero Beach and Ft. Pierce, technological concerns, etc), which resulted in a number of consultations between Congress, FAA, National Air Traffic Controllers Association (NATCA), and stakeholders. As a result, the Palm Beach Approach Control Working Group was formed to evaluate existing plans and concerns while providing a recommended course of action, which include the following:

- 'FAA follow through with current plan
- Modify the current plan in a way that the Group finds more suitable
- Placing a new TRACON at a site in West Palm Beach, or
- Keeping the current TRACON where it is and working with the new Palm Beach ATCT'.[20]

At the time of this writing, a decision has yet to be made as to the best course of action with regard to airspace coverage and the potential consolidation of the TRACON facilities.

In the 2005 FPR Part 150 Noise Study Update (2005 Noise Study), prepared by the MEA Group, Inc., variations to aircraft arrival and departure flight tracks and preferential runway uses were investigated. For some proposed operational measures, the FAA (Miami Center ARTCC) identified issues with separations of aircraft arriving and departing FPR, although no overall airspace capacity issues were identified for the forecast number of operations in the 2005 Noise Study, which as identified in **Chapter 3** (**Table 3-12**), projected more operations by 2010 (257,738) than this Master Plan Update does by 2025 (243,599). With ongoing upgrades to the NAS and other technological developments such as NextGen and additional satellite-based instrument approaches (e.g., Wide/Local Area Augmentation System), airspace capacity around the airport should remain relatively unhindered by the forecast increase in activity levels.

4.4.2 Airfield Demand/Capacity Analysis

Airfield demand/capacity analyses seek to identify at what point, if any, during the twenty-year planning period unacceptable levels of delay may be experienced by airport users, thereby triggering the need for airfield improvements such as additional taxiways, runways, or holding pads. As mentioned earlier, this analysis compares forecast annual aircraft operations to a theoretical airfield capacity, based on the methodology in the *Airport Capacity and Delay AC*. This methodology accounts for the most common airfield layouts observed at U.S. airports. The *Airport Capacity and Delay AC* provides a systematic approach for determining hourly runway and annual airfield capacities (i.e., the ASV), as well as the projected average hourly and annual delays. Each of these was calculated for existing conditions and for every

[20] PBI Approach Control Working Group Meeting Minutes, July 21, 2008.

five-year interval of the twenty-year planning period. The results of the capacity calculations are presented in the following sections.

Hourly Runway Capacity

An airport's hourly runway capacity represents the maximum number of aircraft that can be accommodated under conditions of continuous demand during a one-hour period. It should be noted that typical hourly capacity cannot be sustained over long periods without substantially increasing delays. Prior studies for FPR, such as the 2005 Noise Study and the 2002 Master Plan Update, prepared by Hoyle, Tanner & Associates, Inc., identified capacity issues related to the previous two-runway airfield configuration. This provided the justification for constructing training Runway 10L-28R, combined with the goal of reducing incompatible noise exposure to the surrounding community. As mentioned earlier, a re-evaluation of the previous two-runway airfield configuration is provided herein, as well as new three-runway airfield configuration.

In evaluating hourly runway capacity, the following factors were considered:

- **Runway Configuration** – The number of runways at an airport and how they are positioned in relation to one another impacts how many arrivals and departures can occur within an hour. For example, if an airport has two runways that are oriented parallel to each other then it is generally possible to have arrivals and departures to both runways at the same time. However, if the two runways intersect, an aircraft departing from one runway must wait for operations on the other to be completed prior to starting its takeoff.

  The previous two-runway airfield configuration at FPR essentially consisted of two intersecting runways, Runways 10R-28L and 14-32, although the Runway 14 threshold begins just before the intersection of the two runways, as shown in **Figure 4-2**. The majority of operations occurred from the west on an easterly heading (i.e., takeoff and landing on Runway 10R) or from the north on a southerly heading (i.e., takeoff and landing on Runway 14). This runway use configuration is best represented by **Diagram No. 75** in the *Airport Capacity and Delay AC, Figure 3-2*.

  The current three-runway airfield configuration includes the previous two-runway configuration plus an additional parallel Runway 10L-28R to the north. The new parallel runway is used primarily for training operations such as "touch-and-gos," and therefore has the potential to accommodate a substantial amount of additional traffic due to its separation from the main airfield area. This runway use configuration is best represented by **Diagram No. 81** in the *Airport Capacity and Delay AC, Figure 3-2*.

- **Runway Utilization** – Since each runway may have different characteristics like aircraft mix index, number of exit taxiways, or percent touch-and-go operations, the calculation of airfield capacity also considers runway utilization rates for Visual Flight Rules (VFR), IFR, and also Closed/Inoperable conditions (i.e., when the ceiling is less than 200 feet and/or visibility is less than one-half mile). The runway utilization rates shown in **Table 4-6** were determined through a review of the 2005 Noise Study, historical wind data, and consultation with ATCT staff. Since these runway utilization rates have the potential to change during the planning period, the airfield capacity calculations should be periodically reviewed for currency.

TABLE 4-6
RUNWAY UTILIZATION RATES

Runway End Use	Two-Runway Configuration (Arrivals & Departures)		Three-Runway Configuration (Arrivals & Departures)	
	VFR	IFR	VFR	IFR
10R	60.0%	63.0%	30.0%	63.0%
28L	9.5%	26.5%	7.5%	26.5%
14	25.0%	5.0%	25.0%	5.0%
32	5.0%	5.0%	5.0%	5.0%
10L*	N/A	N/A	24.0%	0.0%
28R*	N/A	N/A	8.0%	0.0%
Closed	0.5%	0.5%	0.5%	0.5%
Total	100.0%	100.0%	100.0%	100.0%

**Note: the lack of a connector taxiway has no impact on utilization or capacity rates based upon FAA Demand Capacity criterion.*
Source: The LPA Group Incorporated, 2009.

- **Aircraft Mix Index** – In the *Airport Capacity and Delay AC*, the FAA classifies aircraft operations based on their Maximum Takeoff Weight (MTOW). The mix index is a calculated ratio of the aircraft fleet based upon a weight classification system. As the number of heavier aircraft increases, so does the mix index. The hourly runway capacity decreases as the mix index increases because the FAA requires that heavier aircraft be spaced further apart from other aircraft for safety reasons.

  The mix index for determining airfield capacity is based upon the sum of the percent of Class "C" aircraft operations plus three times the percent of Class "D" aircraft operations. Aircraft fleet mix classifications are outlined in **Table 4-7**.

TABLE 4-7 AIRCRAFT FLEET MIX CLASSIFICATIONS				
Aircraft Classification	**Maximum Takeoff Weight (lbs)**	**Number of Engines**	**Wake Turbulence Classification**	**Sample Aircraft**
A	12,500 or less	Single	Small	Cessna 172, Piper PA-28
B	12,500 or less	Multi	Small	Beechcraft King Air, Eclipse 500, Beech Baron
C	12,500-300,000	Multi	Large	Learjet, Gulfstream, Falcon, Boeing 737
D	Over 300,000	Multi	Heavy	B747, L1011, C-135 and C-141

Sources: FAA Advisory Circular 150/5060-5, Airport Capacity and Delay, The LPA Group Incorporated, 2009.

Operations by Class "D" aircraft are not expected to occur at FPR during the planning period, although a steady increase in Class "C" aircraft operations is expected as the number of corporate jet operations and based aircraft is projected to increase. Based on the forecasts in **Chapter 3**, information from the FAA's ETMSC database, and discussions with the airport's FBOs, the aircraft mix indexes shown in **Table 4-8** were determined for each runway at FPR. Since the indexes are not expected to change significantly year-to-year, the capacity calculations herein assume that the hourly and annual airfield capacities will remain stable throughout the planning period, using the runway mix indexes for 2008 operations; typically, however, as the number of operations by larger aircraft increases, hourly and annual capacities decrease due to greater aircraft separation requirements.

TABLE 4-8 RUNWAY MIX INDEXES FOR CAPACITY CALCULATIONS			
Year	**Runway 10R-28L Mix Index (C+3D)**	**Runway 14-32 Mix Index (C+3D)**	**Runway 10L-28R Mix Index (C+3D)**
2008	3.08%	0.34%	0.00%
2013	3.66%	0.41%	0.00%
2018	4.28%	0.48%	0.00%
2023	5.09%	0.57%	0.00%
2028	6.15%	0.68%	0.00%

Source: The LPA Group Incorporated, 2009.
Notes: Runway mix indexes are the same for both the two-runway and three-runway capacity calculations. 2008 mix indexes used to calculate hourly and annual capacities for every year of the planning period.

- **Percentage of Aircraft Arrivals** – An arriving aircraft occupies a runway longer than a departing aircraft. As such, the hourly runway capacity decreases as the percentage of aircraft arrivals increases. At FPR, the percentage of aircraft arrivals is expected to remain at 50 percent throughout the planning period, or equal to the number of departures.

- **Percentage of Touch-and-Go Operations** – Pilots routinely practice landings and takeoffs by conducting touch-and-go operations, which involves an aircraft landing and then immediately departing without ever coming to a complete stop. This training exercise takes less time to conduct than normal landings where the aircraft departs the runway; therefore, as the number of touch-and-go operations increase, so too does the hourly runway capacity. Touch-and-go operations at FPR are typically limited to small piston-powered GA operations. Based on a review of activity data and the 2005 Noise Study, **Table 4-9** identifies the percentage of operations on each runway that would be considered touch-and-go operations. As shown, with the recent construction of training Runway 10L-28R, the airport intends to shift the majority, if not all, touch-and-go operations away from Runways 10R-28L and 14-32.

TABLE 4-9
PERCENT TOUCH-AND-GO OPERATIONS

Runway	Two-Runway Configuration	Three-Runway Configuration
Runway 10R-28L	32%	N/A
Runway 14-32	32%	N/A
Runway 10L-28R	N/A	100%

Source: The LPA Group Incorporated, 2009.

- **Meteorological Conditions** – During periods of clear weather conditions, with few clouds and mild winds, pilots can operate based upon visual observation of other aircraft. As weather conditions deteriorate (which could include high winds or low visibility due to fog or low clouds), pilots have to rely on instrumentation to operate safely. The *Airport Capacity and Delay AC* considers two operating conditions based upon meteorological conditions – VFR and IFR. During IFR conditions, aircraft are spaced further apart, which lowers the hourly runway capacity. **Chapter 2** included an analysis of historical wind data (years 1998 to 2008) from the airport's on-site Automated Surface Observing System (ASOS). Since the current three-runway airfield configuration was found to provide more than 95% wind coverage during All Weather, VFR, and IFR conditions, it can be assumed that the airfield configuration and location generally provides no limitations to capacity. Further, according to the wind analysis and information in **Table 4-4**, the airport experiences VFR, IFR, and Closed/Inoperable conditions approximately 97.0%, 2.5%, and 0.5% of the time, respectively.

- **Taxiway Configuration** – The number of taxiways impacts the hourly runway capacity by influencing when an arriving aircraft will be able to exit the runway after slowing to a safe taxiing speed. The *Airport Capacity and Delay AC* defines optimum ranges for the distance a taxiway should be from the runway arrival end. Based on the methodology in the *Airport Capacity and Delay AC*, all three runways include a sufficient number of exit taxiways to achieve the maximum "Exit Factor," which is used to calculate capacity. This, however, does not necessarily mean that additional exit taxiways, or parallel taxiways for that matter, would not be necessary to optimize the future capacity of FPR. Any new development such as a taxiway, hold pad, or apron, may have the potential to improve capacity so long as it does not complicate the airfield configuration.

Considering the various input factors above, the methodology in the *Airport Capacity and Delay AC* was used to calculate the hourly capacities for both the two-runway and three-runway airfield configurations at FPR under VFR and IFR conditions, as shown in **Table 4-10.** Then, based on operating conditions in year 2008, the VFR and IFR hourly capacities were used to calculate the weighted hourly runway capacity throughout the twenty-year planning period. The weighted hourly runway capacity takes into account the percent of time each meteorological condition occurs.

TABLE 4-10
CALCULATED HOURLY CAPACITY

Year	Two-Runway Configuration			Three-Runway Configuration		
	VFR	IFR	Weighted	VFR	IFR	Weighted
2008	149	60	130	288	61	239
2013	149	60	130	288	61	239
2018	149	60	130	288	61	239
2023	149	60	130	288	61	239
2028	149	60	130	288	61	239

Source: The LPA Group Incorporated, 2009.

Theoretical Annual Airfield Capacity

Using the calculated weighted hourly capacity, the *Airport Capacity and Delay AC* provides the methodology for determining the theoretical annual airfield capacity or the ASV. For both the two-runway and three-runway airfield configurations under 2008 operating conditions, **Table 4-11** presents the results of the ASV calculations throughout the twenty-year planning period, as indicated by the stable ASV values.

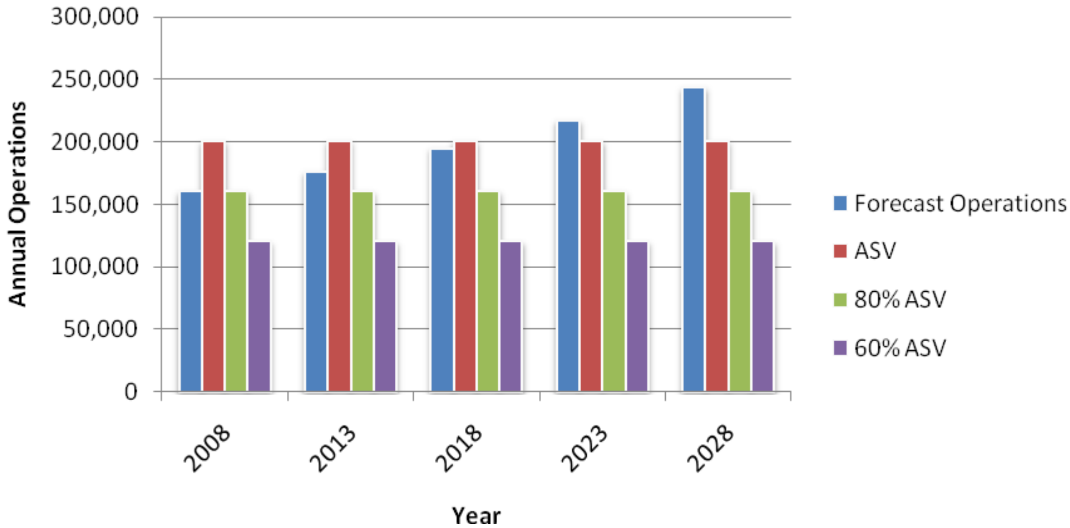
Additionally, **Table 4-11** and **Figures 4-2** and **4-3** show the comparison of projected annual operational demand to theoretical ASV. According to the guidelines in **FAA Order 5090.3B**, *Field Formulation of the National Plan of Integrated Airport Systems*, once the actual demand exceeds 60 percent of the calculated ASV, planning studies should be undertaken to increase airfield capacity, and the construction of capacity improvements should begin once 80 percent of the calculated ASV has been reached. Due to the length of time it may take to implement some airfield improvements, this early planning facilitates the construction of capacity enhancing facilities to meet anticipated demands. As shown, construction of training Runway 10L-28R was necessary because capacity under the two-runway airfield configuration was nearing the 80 percent of ASV threshold. Under the current three-runway airfield configuration, capacity is not expected to exceed 66 percent of ASV during the planning period. Therefore, per **FAA Order 5090.3B**, it is only necessary to plan for capacity improvements at FPR, and alternatives to do so will be investigated in **Chapter 5**.

TABLE 4-11
CALCULATED ANNUAL AIRFIELD CAPACITY

Year	Annual Operations	Annual Service Volume (ASV)	Capacity Level
Two-Runway Airfield Configuration			
2008	160,277	200,538	79.92%
2013	176,111	200,538	87.82%
2018	194,871	200,538	97.17%
2023	217,207	200,538	108.31%
2028	243,599	200,538	121.47%
Three-Runway Airfield Configuration			
2008	160,277	369,192	43.41%
2013	176,111	369,192	47.70%
2018	194,871	369,192	52.78%
2023	217,207	369,192	58.83%
2028	243,599	369,192	65.98%

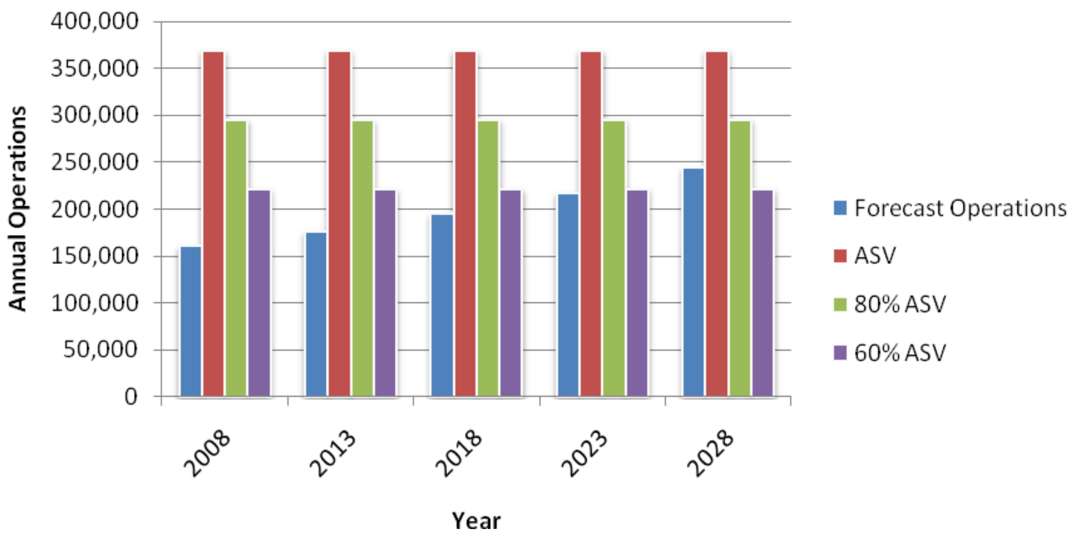
Source: The LPA Group Incorporated, 2009.

Figure 4-2
Calculated Annual Airfield Capacity
Two-Runway Airfield Configuration



Source: The LPA Group Incorporated, 2009.

Figure 4-3
Calculated Annual Airfield Capacity
Three-Runway Airfield Configuration



Source: The LPA Group Incorporated, 2009.

Annual Aircraft Delay

The average anticipated delay is based upon a ratio of the forecasted demand to the calculated ASV. This ratio is used as a guide for planning future airfield improvements. In the *Airport Capacity and Delay AC*, the FAA acknowledges that the level of acceptable delay at one airport may differ from the level deemed acceptable at a similar airport. It is important to note that it is not only the delay time that determines acceptability, but also the frequency of delays.

Several methods exist for estimating anticipated delay levels. One method involves using a variety of charts in the *Airport Capacity and Delay AC* to estimate the average delay per aircraft based upon the ratio of annual demand to ASV. This delay per aircraft would then be used to calculate the annual delay for all operations. Another method utilizes software developed by the FAA *(Airport Design Software, Version 4.2d)* to determine the projected delay values. For this study, the anticipated delay values presented in **Table 4-12** were determined using the FAA software.

TABLE 4-12
CALCULATED ANNUAL AIRFIELD CAPACITY

Year	Average Delay per Aircraft (Minutes)		Minutes of Annual Delay	
	Low	High	Low	High
Two-Runway Airfield Configuration				
2008	0.20	0.70	32,000	112,000
2013	0.30	0.90	53,000	158,000
2018	0.30	1.10	59,000	215,000
2023	0.40	1.50	87,000	326,000
2028	0.60	2.10	146,000	512,000
Three-Runway Airfield Configuration				
2008	0.10	0.40	16,000	64,000
2013	0.20	0.40	35,000	70,000
2018	0.20	0.50	39,000	98,000
2023	0.20	0.60	43,000	130,000
2028	0.20	0.80	49,000	115,000

Source: The LPA Group Incorporated, 2009.

As shown, the recent addition of new training Runway 10L-28R greatly reduced average aircraft delay during the planning period. Under the current three-runway airfield configuration, average aircraft delay is not expected to exceed one minute during normal operating conditions. Therefore, the airfield should be able to function with limited congestion, which means that aircraft should be able to arrive and depart the airport with minimal queue times.

Summary of Capacity and Delay

This chapter has analyzed the existing and future capacity of the airfield system at FPR, as well as illustrated the beneficial role of new training Runway 10L-28 for improving both short-term and long-term capacity. A summary of these results is presented in **Table 4-13** for the current three-runway airfield configuration only. Typically, capacity planning begins when airport demand equals or exceeds 60 percent of ASV. Based upon this criterion, planning for capacity shortfalls would not be required until 2023 (58.83% of ASV). It should be noted that if activity exceeds forecast levels (such as a change in the aircraft fleet mix, airport's service role, etc.), the need for capacity enhancements would be amplified. Facility improvements to address such a capacity shortfall, which could include additional taxiways, hold pads, aprons, etc., are evaluated later in this study. The following section, *Facility Requirements*, identifies the various facilities required to properly accommodate forecast activity levels at FPR. That information, in addition to the capacity analysis, provides the basis for formulating the *Alternatives Analysis* in **Chapter 5**.

TABLE 4-13
SUMMARY OF AIRFIELD CAPACITY ANALYSIS
THREE-RUNWAY AIRFIELD CONFIGURATION

	2008	2013	2018	2023	2028
Hourly Capacity					
VFR Capacity Base	288	288	288	288	288
IFR Capacity Base	61	61	61	61	61
Weighted Hourly Capacity	239	239	239	239	239
Annual Airfield Capacity					
Annual Operations	160,277	176,111	194,871	217,207	243,599
ASV	369,192	369,192	369,192	369,192	369,192
%ASV	43.41%	47.70%	52.78%	58.83%	65.98%
Average Minutes of Delay per Aircraft Operation					
Low	0.10	0.20	0.20	0.20	0.20
High	0.40	0.40	0.50	0.60	0.80

Source: The LPA Group Incorporated, 2009.

4.5 Airside Facility Requirements

This section identifies the airfield facility requirements for FPR based on the results of the previous capacity analysis, FAA-approved forecasts, and representative critical aircraft. Most airfield design criteria is defined in **FAA AC 150/5300-13**, *Airport Design*, or other FAA documents as mentioned throughout this chapter. The following airfield facilities are evaluated herein:

- Runway Length
- Runway Pavement Strength
- Taxiway and Holding Bay requirements

- Airfield Design Standards
- Airfield Lighting, Signage, and Pavement Markings
- Airfield Service Roads
- Navigational Aids (NAVAIDS) and Visual Aids (VISAIDS)

4.5.1 Runway Length Analysis

Today's aircraft may operate on a wide variety of available field lengths. However, the suitability of those runway lengths is often determined by several factors including:

- Airport elevation above mean sea level
- Temperature
- Wind velocity
- Airplane operating weights
- Takeoff and landing flap settings
- Runway surface condition (wet or dry)
- Effective runway gradient
- V_1 Engine Out Procedures
- Operational Use (private, charter, fractional ownership, commuter, scheduled air carrier, etc.)
- Presence of obstructions within the vicinity of the approach and departure path, and
- Locally imposed noise abatement restrictions and/or other prohibitions

Aircraft runway takeoff balanced field length data[21] at International Standard Atmosphere (ISA) conditions was obtained from manufacturer's websites and manufacturer aircraft planning manuals. ISA balanced field takeoff length is based upon 59° Fahrenheit, elevation at sea level, standard flap setting, zero grade change, dry and uncontaminated pavement conditions, and includes aborted takeoff stopping distance.

The 2007 FAA-approved ALP depicts a new, 4,000 by 75 foot training runway (10L-28R) and an 850 foot extension to Runway 14 providing a total available length of 5,605 feet. Based upon the established aircraft fleet mix over the twenty-year planning period, an evaluation of

[21] The unadjusted recommended runway length is based upon the longest of the following three distances:

- Accelerate-Takeoff Distance: The total distance needed for the aircraft to accelerate to the critical takeoff speed (V_1), takeoff, and climb to an altitude of 35 feet above ground level with one engine-out at V_1.
- Accelerate-Stop Distance: The distance needed for the aircraft to accelerate to V_1, and brake to a full stop under wet pavement conditions.
- All-engine takeoff distance: 115 percent of the distance needed to accelerate to V_1, takeoff, and climb to an altitude of 35 feet above ground with all engines operating normally.

the existing and proposed runway length requirements for Runways 10R-28L, 10L-28R, and 14-32 were developed. Further, although a scheduled commercial service forecast was not developed, an overview of commercial runway length requirements based upon potential commercial fleet mix and stage length was also developed. Runway length requirements were established utilizing the guidelines outlined in **FAA AC 150/5325-4**, *Runway Length Requirements for Airport Design*. As shown in **Table 4-14**, the procedure for determining the recommended runway length based upon service role (i.e. general aviation, commuter, or commercial service) is outlined in a different chapter of the *Runway Length AC*.

<table>
<tr><th colspan="5">TABLE 4-14
AIRPLANE WEIGHT CATEGORIZATION FOR RUNWAY LENGTH REQUIREMENTS</th></tr>
<tr><th colspan="3">Airplane Weight Category
Maximum Certificated Takeoff Weight (MTOW)</th><th>Design Approach</th><th>Location of Design Guidelines (in AC)</th></tr>
<tr><td rowspan="4">12,500 pounds or less
(Training Runway 10L-28R Category)</td><td colspan="2">Approach Speed less than 20 knots</td><td>Family Grouping of Small Airplanes</td><td>Chapter 2;
Paragraph 203</td></tr>
<tr><td colspan="2">Approach Speeds of at least 30 knots but less than 50 knots</td><td>Family Grouping of Small Airplanes</td><td>Chapter 2;
Paragraph 204</td></tr>
<tr><td rowspan="2">Approach Speeds of 50 knots or more</td><td>With Less than 10 Passengers</td><td>Family Grouping of Small Airplanes</td><td>Chapter 2;
Paragraph 205; Figure 2-1</td></tr>
<tr><td>With More than 10 Passengers</td><td>Family Grouping of Small Airplanes</td><td>Chapter 2;
Paragraph 205; Figure 2-2</td></tr>
<tr><td colspan="3">Over 12,500 pounds but less than 60,000 pounds
(Crosswind Runway 14-32 Category)</td><td>Family Grouping of Large Airplanes</td><td>Chapter 3;
Figure 3-1 or 3-2 and Tables 3-1 or 3-2</td></tr>
<tr><td colspan="3">60,000 pounds or more or Regional Jets
(Primary Runway 10R-28L Category and Commercial Service Evaluation)</td><td>Individual Large Airplane</td><td>Chapter 4; Airplane Manufacturer Websites</td></tr>
<tr><td colspan="5">Source: FAA AC 150/5325-4B, Table 1-1.</td></tr>
</table>

In determining the recommended runway length for FPR, a five step procedure and rationale as outlined in **FAA AC 150/5325-4B** was used. Using 2008 data, a summary of each step is provided below.

1. Identify the list of critical design airplanes that will make regular (500 annual operations) use of the proposed runway for an established period of at least five years.
2. Identify airplanes or family of airplanes that will require the longest runway lengths at maximum certified takeoff weight (MTOW).
3. Using *Table 1-1,* shown as **Table 4-14**, of **AC 150/5325-4B** and the airplanes identified in Step #2, determine the method that will be used for establishing the recommended runway length based upon useful load and service needs of critical design aircraft or family of aircraft.

4. Select the recommended runway length from among the various runway lengths generated in Step 3 using the process identified in the required chapters.
5. Apply any necessary adjustment (i.e. pavement gradient, pavement condition (wet or dry), etc.)
6. The FAA's definition of "critical design airplanes" refers to the listing of airplanes (or a single airplane) that would result in the longest recommended runway length based upon a minimum of 500 annual operations.

FPR is equipped with six runways of varying lengths and pavement strengths. The Primary Runway 10R-28L is 6,492 feet long and 150 feet wide and is equipped with a precision ILS approach to the Runway 10R. Runway 14-32 is 4,755 feet long and 100 feet wide, and is designated, according to AC 150/5325-4B, as a secondary primary runway. Runway 10L-28R is 4,000 feet long and 75 feet wide, and it was designed exclusively for aircraft training.

Key parameters used to determine the adjusted runway length are identified as follows:

- **Airport Elevation Above Mean Sea Level (AMSL)** – 24 Feet AMSL
- **Airport Mean Daily Maximum Temperature of the Hottest Month** – 89.8 degrees Fahrenheit (August)
- **Effective Runway Gradient** – Runway 10R Elevation (23.0 Feet AMSL) – Runway 28L Elevation (21.1 Feet AMSL) – Change of 1.1 Feet Over 6,492 Feet = 0.02% Gradient
- **Average Stage Lengths** – Based on a review of 2008 FAA flight plan data from Fboweb.com, some of the furthest domestic corporate jet destinations from FPR were found to be Seattle, WA (approximately 2,600 NM from FPR), San Francisco, CA (approximately 2,400 NM from FPR), New York, NY (approximately 1,000 NM from FPR), and Dallas, TX (approximately 1,100 NM from FPR). Common international destinations included Mexico, Bahamas, Turks and Caicos, and Canada, although no European or far-reaching international destinations were noticeable. This is because of the FPR's designation as a "Landing Rights Airport" by the U.S. Customs and Border Protection (CBP), which typically only accepts short flights from the Caribbean, Mexico, and Canada.[22]

  Critical Aircraft – According to FAA Headquarters, the critical aircraft is based either upon a single or family of the most demanding aircraft that currently or in the next five years (5) will equal or exceed 500 operations annually for funding eligibility. However, from a planning perspective, the future critical aircraft will need to exceed 500 operations by the end of the twenty-year (20) planning period.

[22] Several information sources/ websites including FBOWeb (www.fboweb.com); Flight Plan (www.fltplan.com); *The CBP Guide for Private Flyers* (http://www.faa.gov/ATs/aat/ifim/GPF/GPFtxt.html) all designate FPR as a "Landing Rights Airport by the U.S. Customs and Border Patrol.

As a result of these criteria, runway length requirements were based not only on the existing and future role of the airport but also on the most demanding aircraft likely to operate at FPR over the twenty-year planning period.

General Aviation/Corporate Aircraft Runway Length Requirements

The critical aircraft evaluation, **Table 4-4**, illustrates that the Learjet 35 is the current critical aircraft for general aviation corporate operations at FPR. Since the Learjet 35 exceeds 18,300 pounds maximum takeoff weight, the runway length evaluation provided in *Chapter 3* of **AC 150/5325-4B** was used to determine the current runway length requirements.

The baseline runway length requirement was determined by the percentage of corporate fleet, useful load factor, airport elevation and mean maximum temperature requirements. The Learjet 35 is included in Table 3-1 of AC 150/5325-4B which represents those airplanes that comprise "75 percent of the fleet". As a result, **Figure 3-1**, was used to determine the baseline runway length requirement.

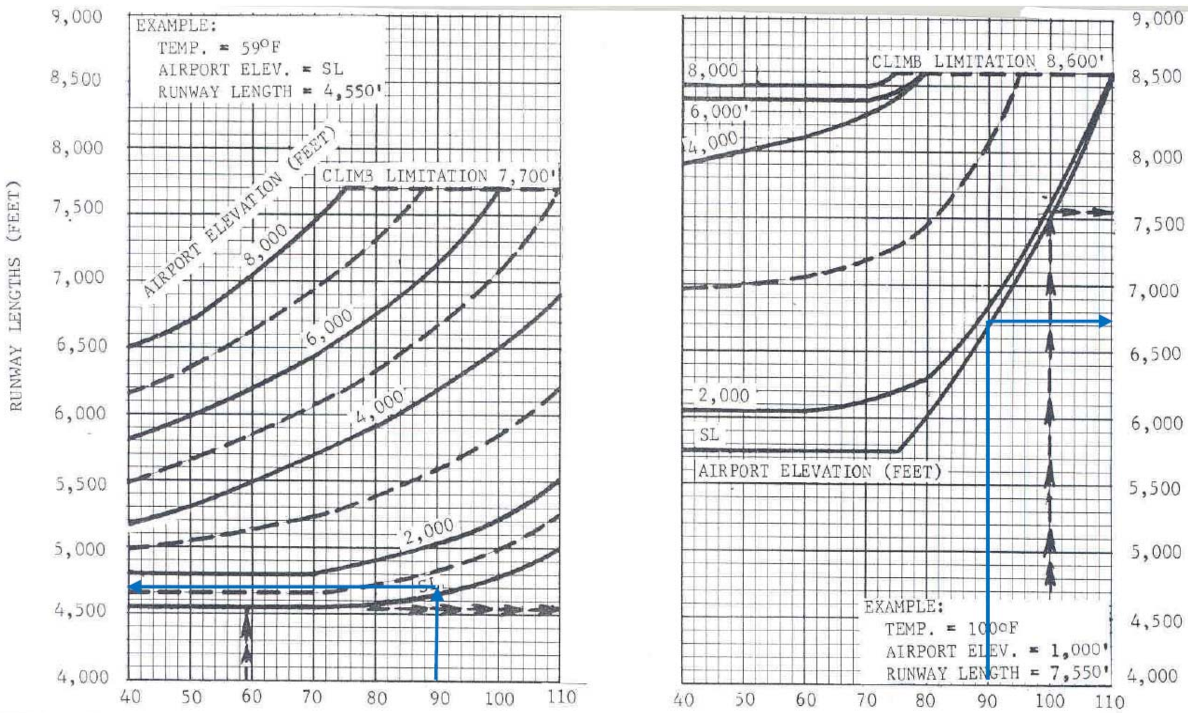
Applying the airport elevation (24 ft AMSL) and mean maximum temperature (89.8 degrees F) to the load factors (60 percent and 90 percent) shown in **Figure 4-4**, a baseline runway length of 4,700 feet and 6,725 at 60 percent and 90 percent load factors, respectively, was determined.

Adjusting the runway length for non-zero effective runway gradient[23] and wet and slippery[24] runways resulted in runway length requirements of **5,420 feet** and **7,000 feet** for 60 percent and 90 percent load factors, respectively.

[23] The runway lengths obtained from **Figure 4-4** are increased at the rate of 10 feet for each foot of elevation difference between the high and low points of the runway centerline (**AC 150/5325-4B, Pg. 10**). Thus using primary Runway 10R-28L, which has an elevation change of 1.1 foot, 11 feet was added to the baseline runway length for both the 60 percent and 90 percent load factors.

[24] The runway lengths for turbojet aircraft are increased by 15 percent up to 5,500 feet and 7,000 feet, respectively, for the 60 percent and 90 percent load factors to account for wet and slippery pavement conditions (**AC 150/5325-4B, Pg. 10**). The AC further recommends rounding the runway length to the nearest tenth (i.e. runway length of 5,418 would be rounded to 5,420).

Figure 4-4
75 Percent of Fleet at 60 and 90 Percent Useful Load



Mean Daily Maximum Temperature of Hottest Month of the Years in Degrees Fahrenheit
60 Percent Useful Load **90 Percent Useful Load**

Source: AC 150/5325-4B, Table 3-1

However, as noted in **Section 4.3.1**, *Aircraft Fleet Mix and Critical Aircraft*, the 2007 Airport Layout Plan designated the existing and future critical aircraft established for Runway 10R-28L as the Gulfstream II and Gulfstream 550, respectively. However, according to the 2008 FAA Enhanced Traffic Management System (ETMS) data, 79 operations were associated with the Gulfstream 300, 48 with the Gulfstream 400, and 14 with the Gulfstream V.

Although historic data does not support 500 operations of aircraft with operating weights greater than 60,000 pounds, both APP Jet Center of Ft. Pierce and Key Air Treasure Coast, the airport's FBOs, are actively marketing to users of these larger corporate aircraft. According to information received from both FBOs, they stated that operations of larger aircraft have almost doubled in 2008 compared to 2007. Further, both FBOs have development plans to accommodate larger corporate jet aircraft in the next five to ten years. Thus, the Gulfstream G550 corporate jet was used to evaluate the long-term runway length requirements.

Since all three Gulfstream corporate aircraft have MTOWs greater than 60,000 pounds, Chapter 4 of the *Runway Length AC* must be consulted for determining the recommended runway length. That chapter recommends the use of Airport Planning Manuals (APMs) from aircraft manufacturers so that specific length requirements can be established with consideration of FPR's conditions (temperature, elevation, runway gradient, etc.) and anticipated aircraft performance characteristics such as stage length and useful load as illustrated in **Table 4-15**.

Based upon this analysis, at least 50 percent of corporate aircraft greater than 60,000 lbs must take some sort of weight penalty to operate from FPR. Therefore, options were considered as part of the Alternatives Analyses for improving the attractiveness of FPR to corporate users, including NetJets, a fractional ownership aircraft company, which currently limits use of its fleet at FPR to mid-range (> 60,000 lbs) corporate aircraft due to pavement strength and runway length[25].

Also, since Runway 10R-28L accommodates a wide range of corporate jets, with those in the table representing the smallest percentage of corporate jet operations currently occurring at FPR, pilots would only operate when conditions permit safe takeoffs and landings. Therefore, with no indication that aircraft stage lengths would surpass destinations on the U.S. west coast, the current 6,492 foot length of Runway 10R-28L should be adequate to serve its intended users during the planning period.

[25] Support data based upon letter and discussion from NetJets Inc. is provided in **Appendix C** of this report.

TABLE 4-15 RUNWAY LENGTH REQUIREMENTS FOR CORPORATE JETS OVER 60,000 POUNDS MTOW						
Aircraft	**ARC**	**MTOW**	**Wheel Configuration**	**ISA[2]**	**Adjusted Dry Takeoff Length**	**Adjusted Wet Takeoff Length**
Gulfstream G300	D-II	72,000	Dual Wheel	4,700	5,445	6,262
Gulfstream G350	D-II	70,900	Dual Wheel	4,700	5,445	6,262
Bombardier Global 5000	C-III	87,770	Dual Wheel	5,000	5,792	6,661
Gulfstream G500	C-III	85,100	Dual Wheel	5,200	6,023	6,927
Dassault Falcon 7X	B-III	69,000	Dual Wheel	5,505	6,376	7,332
Gulfstream G400	D-II	74,600	Dual Wheel	5,700	6,601	7,591
Gulfstream G450	D-II	73,900	Dual Wheel	5,700	6,601	7,591
Gulfstream G550	C-III	91,000	Dual Wheel	5,960	6,902	7,937
Bombardier Global Express	C-III	95,000	Dual Wheel	6,170	7,145	8,217
Gulfstream GV	C-III	90,500	Dual Wheel	6,200	7,179	8,256
Legend						
(yellow)	Aircraft able to takeoff within 6,492 feet					
(blue)	Reduced Takeoff Usable Load Required					
(outlined)	Most demanding corporate aircraft anticipated over twenty-year planning period					

Notes:

[1]Sorted by Takeoff Length Requirement

[2] ISA represents manufacturer's balanced takeoff field length requirements at 59° F, Sea Level, Zero gradient change, dry pavement, etc.

[3]Adjusted (Dry Pavement) refers to balanced takeoff field length adjusted for airport elevation (24 feet), mean maximum temperature (89.8° F), and runway gradient change (1.1-feet)

[4]Adjusted (Wet Pavement) adds additional 15 percent to accommodate wet pavement conditions.

Sources: FAA Central Region Takeoff Length Adjustment Spreadsheet, Aircraft Manufacturer Data, and The LPA Group Incorporated, 2009

Commercial Runway Length Requirements

Recent interest in the potential viability of providing scheduled commuter[26] or limited commercial air service within St. Lucie County required a generalized evaluation of potential runway pavement length requirements in the event that either commercial development occurs at FPR or at another location within the County. The *Runway Length AC* recommends that airports serving aircraft over 60,000 pounds use manufacturer aircraft planning manuals to determine the most demanding runway length requirements.

Typically, runway landing length requirements are less than takeoff weight requirements. However, based upon FAA Rule published in the Federal Register June 2006, Safety Alert for Operators (SAFO 06012) dated 08/31/06, AC 150/5325-4B, Table 5-1, FAR Part 135 Section 135.387, Part 121 Section 121.187 and confirmed with FAA Headquarters Flight Standards Service and Air Transportation Divisions, a mandatory 40 percent landing distance safety margin is required for all FAR Part 91K (Fractional Ownership certification)[27], 125 Corporate/Travel Club Certificate)[28], 135 (Air Taxi/Commuter and On-demand Certification)[29]

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[26] Commuter or Regional service typically provides passenger air service to communities without sufficient demand to attract mainline service, and aircraft are limited to less than 100 seats. There are two types of regional service defined as either "feeder airline" or "independent airline". Both use aircraft with less than 100 seats, but the feeder airline operates under the mainline carrier's brand name and provides services to the mainline air carrier's hubs. The independent airline provides point to point service under its own brand, and typically operates within communities with limited mainline service.

[27] As of November 2003, a fractional ownership certification (FAR Part 91.1001K) was to provide oversight for fractional ownership operations created by individuals and corporations that share ownership of aircraft that are scheduled and maintained by a management company, and furnished trained flight crews. Under FAR Part 91.1001K, any person piloting a fractionally owned aircraft, whether they are a professional pilot or a fractional owner/pilot must meet the following requirements:

- Total Flight Time for all Pilots:
  - PIC = 1500 hours
  - SIC = 500 hours
- For Multi-engine turbine-powered aircraft:
  - PIC = ATP and applicable type rating
  - SIC = Commercial and instrument rating

[28] Refers to an aircraft that carries MORE THAN 19 passengers and/or MORE THAN 6,000 pounds of cargo. However, you CANNOT receive money for each individual flight. In other words, the company/group owns the aircraft and they are not "renting" it out to anyone outside the company/group - the aircraft is for their own private use. Corporations that have their own private aircraft for business purposes, whether flying its employees or customers (without direct compensation); Travel Clubs with members that pay annual dues as well as the additional cost to fly to different locations organized by the travel club; Sky Diving Clubs that own their own aircraft. In other words, any group that "jointly" owns an aircraft that carries more than 19 passengers and/or more than 6,000 pounds of cargo can operate under FAAs Part 125.

and Part 121(Scheduled Air Carrier[30]) turbojet operations. Therefore, turbojet aircraft must come to a full stop within 60 percent of the effective runway length[31].

Since a commercial service forecast was not developed as part of this Master Plan Update process, the intent of this runway length evaluation is merely to determine the runway length requirements necessary to support commuter or scheduled air carrier service. For air carrier and regional jet aircraft, runway length requirements were calculated based upon potential nonstop markets: short (500 NM); short-medium (1,000 NM); and Medium to Long range (1,500 NM). Since the current runway length of 6,500 feet is adequate to accommodate most short-haul markets (500 NM or less), an evaluation of short to mid range (1,000 NM) for commuter aircraft and mid to long-range (1,500 NM) for narrow/wide-body commercial aircraft stage lengths was evaluated to determine the ultimate pavement length needs.

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[29] Air Taxi Certification (Commuter and On-Demand Operations) applicability: Each certificate holder that was issued an air carrier or operating certificate and operations specifications under the requirements of part 135 of this chapter or under SFAR No. 38–2 of 14 CFR part 121 before January 19, 1996, and that conducts scheduled passenger-carrying operations with:

(i) Nontransport category turbopropeller powered airplanes type certificated after December 31, 1964, that have a passenger seat configuration of 10–19 seats;

(ii) Transport category turbopropeller powered airplanes that have a passenger seat configuration of 20–30 seats; or

(iii) Turbojet engine powered airplanes having a passenger seat configuration of 1–30 seats.

(2) Each person who, after January 19, 1996, applies for or obtains an initial air carrier or operating certificate and operations specifications to conduct scheduled passenger-carrying operations in the kinds of airplanes described in paragraphs (a)(1)(i), (a)(1)(ii), or paragraph (a)(1)(iii) of this section.

[30] FAR Part 121 refers to Domestic, Flag and Supplemental Scheduled Air Carrier operators carrying more than thirty passengers.

[31] The "effective length of the runway for landing means the distance from the point at which the obstruction clearance plane associated with the approach end of the runway intersects the centerline of the runway to the far end thereof. For the purposes of this subpart, *obstruction clearance plane* means a plane sloping upward from the runway at a slope of 1:20 to the horizontal, and tangent to or clearing all obstructions within a specified area surrounding the runway as shown in a profile view of that area. In the plan view, the centerline of the specified area coincides with the centerline of the runway, beginning at the point where the obstruction clearance plane intersects the centerline of the runway and proceeding to a point at least 1,500 feet from the beginning point. Thereafter the centerline coincides with the takeoff path over the ground for the runway (in the case of takeoffs) or with the instrument approach counterpart (for landings), or, where the applicable one of these paths has not been established, it proceeds consistent with turns of at least 4,000 foot radius until a point is reached beyond which the obstruction clearance plane clears all obstructions. This area extends laterally 200 feet on each side of the centerline at the point where the obstruction clearance plane intersects the runway and continues at this width to the end of the runway; then it increases uniformly to 500 feet on each side of the centerline at a point 1,500 feet from the intersection of the obstruction clearance plane with the runway; thereafter it extends laterally 500 feet on each side of the centerline." FAR Part 121.177

City pairs associated with the short to mid-range stage length would include Chicago, Detroit, Houston, New York, Cleveland, and all of the Caribbean as shown in **Figure 4-5**. A 1,500 NM stage length would further include Denver, Minneapolis-St. Paul, Toronto, etc. as shown in **Figure 4-6**. It is important to note that this range is based upon nautical miles from St. Lucie County International Airport as well as the median range of several aircraft.

The fleet mix included typical commercial/commuter service aircraft including: Boeing 737-300, 400, 500, 700 and 800 models; Boeing 757-200 and 300 models, Airbus 321, 320 and 319 models, the MD-88, and regional jets (i.e. CRJ-700 and ERJ-145). Runway length requirements are provide in **Tables 4-16 through 4-20**. The viability of commercial service and potential alternative development at FPR will be evaluated in more detail in **Chapter 5**, *Airport Alternatives Analysis*.

Figure 4-5
1,000 NM Stage Length
St. Lucie County International Airport

Source: The Great Circle Mapper (http://gc.kls2.com/), 2008

Figure 4-6
1,500 NM Stage Length
St. Lucie County International Airport

Source: The Great Circle Mapper (http://gc.kls2.com/), 2008

TABLE 4-16 REGIONAL/COMMUTER AIRCRAFT TAKEOFF LENGTH REQUIREMENTS									
Aircraft	ARC	Wheel Configuration	MTOW (Lbs)	Seats	Maximum Range (NM)	Adjusted Runway Takeoff Length Requirements			
						ISA @ MTOW[1]	75% Load Factor	90% Load Factor	100% Load Factor
DH-8 Q-300	B-III	Dual Wheel	43,000	50-56	841	3,865	2,600	3,530	4,479
CRJ 200 ER	C-II	Dual Wheel	51,250	50	1,345	5,800	3,750	5,450	6,717
CRJ 200 LR	C-II	Dual Wheel	53,000	50	1,700	6,290	3,900	5,650	7,284
CRJ 701	C-II	Dual Wheel	72,750	70	1,434	5,130	3,600	4,600	5,942
CRJ 700 LR	C-II	Dual Wheel	77,000	70-78	2,046	5,657	3,900	5,100	6,552
CRJ 705 ER	C-III	Dual Wheel	82,500	75	1,963	6,105	4,100	5,570	7,070
CRJ 900 ER	C-III	Dual Wheel	82,500	86	1,593	6,105	4,100	5,570	7,070
CRJ 900	C-III	Dual Wheel	80,500	88	1,304	5,833	4,100	5,400	6,755
CRJ 1000	C-III	Dual Wheel	90,000	100	1,491	6,549	4,400	5,970	7,583
ERJ 140 LR	C-II	Dual Wheel	46,517	44	1,650	6,070	4,080	5,540	7,029
ERJ 145 LR	C-II	Dual Wheel	48,501	50	1,550	7,450	5,010	6,790	8,625
ERJ170LR	C-III	Dual Wheel	82,011	70 to 80	2,100	5,220	3,510	4,760	6,046
ERJ190LR	C-III	Dual Wheel	110,892	98-114	2,400	6,680	4,490	6,090	7,735
				Average	**1,647**	**5,904**	**3,965**	**5,386**	**6,837**

Legend:
- (light blue) *Aircraft Able to Takeoff within 6,492 Feet*
- (green) *Reduced Takeoff Usable Load Required*

Notes: (1) ISA is based upon Manufacturer maximum takeoff weight, dry pavement, 59° F, sea level, and zero effective runway gradient.

Sources: Aircraft Manufacturer Planning Manuals – FAR and JAR Aircraft Performance Charts adjusted for mean maximum temperature (89.8° F), Airport Elevation (24 ft AMSL) and effective runway gradient (1.1 ft), AC 150/5325-4B, NOAA Temperature Data, and The LPA Group Incorporated, 2009

TABLE 4-17 REGIONAL/COMMUTER AIRCRAFT LANDING LENGTH REQUIREMENTS			
Aircraft	Regulatory Landing Field Lengths (FAR Part 121/135)		
	ISA @ MLW[1]	FAR Part 135/121 Adjusted Operating Length[2,3] Dry Pavement	FAR Part 135/121[4] Wet Pavement
DH-8 Q-300	3,415	3,949	4,541
CRJ 200 ER	4,850	5,608	6,450
CRJ 200 LR	4,850	5,608	6,450
CRJ 701	5,090	5,886	6,769
CRJ 700 LR	5,119	5,919	6,807
CRJ 705 ER	5,235	6,054	6,962
CRJ 900 ER	5,235	6,054	6,962
CRJ 900	5,235	6,054	6,962
CRJ 1000	5,756	6,656	7,654
ERJ 140 LR	4,530	5,238	6,024
ERJ 145 LR	4,590	5,308	6,104
ERJ170LR	4,180	4,834	5,559
ERJ190LR	4,490	5,192	5,971
Average	**4,813**	5,566	6,400

Legend:

Legend colour	Meaning
(purple)	Aircraft Able to Land within 6,492 feet
(green)	Reduced Landing Usable Load Required Per FAR 135 and 121

Notes:

(1) ISA is based upon 59° F, Flaps at 40 degrees, dry pavement, and sea level. Further, according to FAA AC 150/5325-4B, must use flap settings which provide shortest runway length requirements.

(2) Runway length adjusted per AC 150/5325-4B based upon airport elevation of 24 feet above mean sea level

(3) FAR 135.387, FAR 121.187 and AC 150/5325-4B, Table 5-1, states that for planning purposes domestic, flag and supplemental carriers must stop within 60 percent of the effective runway length.

(4) FAR 135.387, FAR 121.187, AC 150/5325-4B all require a 15% adjustment of dry pavement length to account for wet non-contaminated pavement conditions.

Sources: AC 150/5325-4B, Aircraft Manufacturers Planning Manuals - FAR and JAR Runway Performance Data, FAR Part 121 and 135, and The LPA Group Incorporated, 2009

TABLE 4-18
REGIONAL/COMMUTER AIRCRAFT LANDING LENGTH REQUIREMENTS
1000 NAUTICAL MILE STAGE LENGTH

Aircraft	Estimated Regulatory Landing Field Lengths (FAR Part 121/135)				
	Est. Landing Weight (lbs)	FAR Length Dry Pavement[1, 3]	FAR Length Wet Pavement[1, 3]	Adjusted Operating Length[2] Dry Pavement	Adjusted Operating Length[2] Wet Pavement
DH-8 Q-300	42,000	3,415	3,927	3,949	4,541
CRJ 200 ER	42,870	4,424	5,087	5,116	5,883
CRJ 200 LR	40,371	4,166	4,791	4,817	5,540
CRJ 701	59,888	4,550	5,232	5,261	6,051
CRJ 700 LR	59,873	3,980	4,577	4,602	5,293
CRJ 705 ER	61,387	4,285	4,927	4,955	5,698
CRJ 900 ER	63,728	4,539	5,220	5,249	6,036
CRJ 900	67,380	4,799	5,519	5,549	6,382
CRJ 1000	71,489	5,049	5,806	5,838	6,714
ERJ 140 LR	35,240	3,872	4,453	4,477	5,149
ERJ 145 LR	36,928	3,984	4,581	4,607	5,298
ERJ170LR	58,846	3,402	3,912	3,934	4,524
Average	**55,047**	**4,157**	**4,781**	**4,807**	**5,528**
Legend:					
(purple)	*Aircraft Able to Land within 6,492 feet*				
(green)	*Reduced Landing Usable Load Required Per FAR 135 and 121*				

Notes:
(1) ISA is based upon 59° F, Flaps at 40 degrees, dry pavement, and sea level. Further, according to FAA AC 150/5325-4B, must use flap settings which provide shortest runway length requirements. ISA Field Landing Lengths provided in Manufacturer Planning Manuals already incorporate 60 percent FAR Part 135/121 information per manufacturer.
(2) Runway length based upon manufacturer planning performance manual landing lengths (dry and wet) based upon highest flap settings (30 and 40), maximum landing weights and airport elevation (24 feet)
(3) FAR 135.387, FAR 121.187 and AC 150/5325-4B, Table 5-1, states that for planning purposes domestic, flag and supplemental carriers must stop within 60 percent of the effective runway length.
Sources: AC 150/5325-4B, Aircraft Manufacturers Planning Manuals - FAR and JAR Runway Performance Data, FAR Part 121 and 135, and The LPA Group Incorporated, 2009

TABLE 4-19
COMMERCIAL AIRCRAFT TAKEOFF LENGTH REQUIREMENTS

Aircraft	ARC	Wheel Configuration	MTOW (Lbs)	Seats	Maximum Range (NM)	Adjusted Runway Takeoff Length Requirements[1]			
						ISA @ MTOW[2]	75% Load Factor	90% Load Factor	100% Load Factor
B737-500	C-III	Dual Wheel	133,500	110	1,230	8,100	4,751	7,295	10,420
B737-400	C-III	Dual Wheel	150,000	147	1,657	9,500	4,925	7,469	8,678
B737-300	C-III	Dual Wheel	138,500	126	1,421	9,800	4,751	7,411	10,720
B737-800	D-III	Dual Wheel	174,200	162-89	2,940	7,800	4,867	6,833	8,150
B737-700	C-III	Dual Wheel	154,500	126	2,924	6,800	4,173	5,907	7,379
B757-200	C-IV	Dual Tandem Wheel	255,000	200	3,389	9,500	4,867	7,179	10,245
B767-300	C-IV	Dual Tandem Wheel	351,000	200	4,062	8,500	5,676	7,758	9,164
A320	C-III	Dual Wheel	162,000	150	2,650	5,900	4,444	5,809	6,833
A321-200	C-III	Dual Wheel	166,500	185	1,999	6,300	4,745	6,202	7,295
A319-100	C-III	Dual Wheel	166,500	124	3,215	4,800	3,618	4,728	5,561
MD-88	D-III	Dual Wheel	160,000	143	2,181	6,650	5,214	6,948	8,198
MD-90-30	C-III	Dual Tandem Wheel	156,000	153	2,542	7,200	4,635	6,486	9,164
				Average	**2,518**	**7,571**	**4,722**	**6,669**	**8,484**

Legend:

Colour	Meaning
Purple	*Aircraft Able to Takeoff within 6,492 Feet*
Green	*Reduced Takeoff Usable Load Required*

Notes:
(1) Runway Length was adjusted to account for mean maximum temperature (89.8° F), airport elevation (24 ft AMSL), effective runway gradient (1 ft), dry pavement, and highest flap setting for shortest runway length requirements per manufacturer data.
(2) Manufacturer Runway Length at ISA and maximum takeoff weight refers to 59° F, Sea Level, zero effective runway gradient, dry pavement, etc.
Sources: AC 150/5325-4B, Manufacturer Planning Data FAR and JAR Takeoff Runway Length Requirements, NOAA data, and The LPA Group Incorporated, 2009

TABLE 4-20
COMMERCIAL AIRCRAFT LANDING LENGTH REQUIREMENTS

Aircraft	Regulatory Landing Field Lengths (FAR Part 121/135)			
	ISA @ MLW Dry Pavement[1, 3]	ISA @ MLW Wet Pavement[1, 3]	Adjusted Operating Length[2] Dry Pavement	Adjusted Operating Length[2] Wet Pavement
B737-500	4,500	5,100	5,204	5,984
B737-400	5,000	5,900	5,782	6,649
B737-300	4,600	5,250	5,319	6,117
B737-800	5,400	6,300	6,244	7,181
B737-700	4,700	5,900	5,435	6,250
B757-200	5,050	5,950	5,840	6,716
B767-300	4,950	5,700	5,724	6,583
A320	4,800	5,520	5,551	6,383
A321-200	5,200	5,980	6,013	6,915
A319-100	4,700	5,405	5,435	6,250
MD-88	4,900	5,600	5,666	6,516
MD-90-30	5,300	6,050	6,129	7,048
Average	**4,925**	**5,721**	5,695	6,549

Legend:

Legend colour	Meaning
(purple)	*Aircraft Able to Land within 6,492 feet*
(green)	*Reduced Landing Usable Load Required Per FAR 135 and 121*

Notes:

(1)ISA is based upon 59° F, Flaps at 40 degrees, dry pavement, and sea level. Further, according to FAA AC 150/5325-4B, must use flap settings which provide shortest runway length requirements.

(2) Runway length based upon manufacturer planning performance manual landing lengths (dry and wet) based upon highest flap settings (30 and 40), maximum landing weights and airport elevation (24 feet) and 89.8 degrees Fahrenheit (mean max temperature)

(3) FAR 135.387, FAR 121.187 and AC 150/5325-4B, Table 5-1, states that for planning purposes domestic, flag and supplemental carriers must stop within 60 percent of the effective runway length.

Sources: AC 150/5325-4B, Aircraft Manufacturers Planning Manuals - FAR and JAR Runway Performance Data, FAR Part 121 and 135, and The LPA Group Incorporated, 2009

TABLE 4-21
COMMERCIAL AIRCRAFT LANDING LENGTH REQUIREMENTS
1,500 NAUTICAL MILE STAGE LENGTH

Aircraft	Regulatory Landing Field Lengths (FAR Part 135/121)				
	Est. Landing Weight (lbs)	ISA @ MLW Dry Pavement[1,3]	ISA @ MLW Wet Pavement[1,3]	Adjusted Operating Length[2] Dry Pavement	Adjusted Operating Length[2] Wet Pavement
B737-500	110,000	4,500	5,100	5,204	5,984
B737-400	119,465	4,900	5,600	5,666	6,516
B737-300	116,600	4,600	5,250	5,319	6,117
B737-800	119,540	4,450	5,150	5,146	5,918
B737-700	107,386	4,000	4,600	4,625	5,319
B757-200	165,654	4,100	4,800	4,741	5,452
B767-300	224,819	3,800	4,450	4,394	5,053
A320	122,626	4,050	4,650	4,683	5,386
A321-200	155,283	4,710	5,410	5,446	6,263
A319-100	111,767	3,810	4,380	4,406	5,067
MD-88	129,130	4,500	5,300	5,204	5,984
MD-90-30	119,937	4,500	5,250	5,204	5,984
Average	**133,517**	**4,327**	**4,995**	**5,004**	**5,754**

Legend:

(purple)	*Aircraft Able to Land within 6,492 feet*
(green)	*Reduced Landing Usable Load Required Per FAR 135 and 121*

Notes:
(1) ISA is based upon 59° F, Flaps at 40 degrees, dry pavement, and sea level. Further, according to FAA AC 150/5325-4B, must use flap settings which provide shortest runway length requirements. Note: Already includes 60 percent landing length requirements under FAR Part 121/135
(2) Runway length based upon manufacturer planning performance manual landing lengths (dry and wet) based upon highest flap settings (30 and 40), maximum landing weights and airport elevation (24 feet)
(3) FAR 135.387, FAR 121.187 and AC 150/5325-4B, Table 5-1, states that for planning purposes domestic, flag and supplemental carriers must stop within 60 percent of the effective runway length.
Sources: AC 150/5325-4B, Aircraft Manufacturers Planning Manuals - FAR and JAR Runway Performance Data, FAR Part 121 and 135, and The LPA Group Incorporated, 2009

Runway 14-32 Length Requirements

In **Chapter 2** of this study, it was shown that Runway 10R-28L and Runway 14-32 each exceed the 95 percent all weather wind coverage. Also, according to airport management, small aircraft prefer Runway 14-32 particularly during the winter when winds are out of the northwest. Based upon this information and the findings of both the capacity analysis and previous planning efforts, Runway 14-32 is needed to maintain acceptable levels of current and future airfield capacity. In fact, a third runway, training Runway 10L-28R was deemed necessary since the previous two-runway airfield configuration capacity was nearing 80 percent of ASV even with the loss of some flight training operations.

According to the 2005 Noise Study and associated recommendations of the NCP, both Runways 14-32 and 10L-28R are also needed for airport noise purposes. Specifically, NCP Operational Measure 3 recommends that training operations be conducted on Runway 14 during calm wind conditions to prevent noise exposure to residential development to the east of the airport. However, since there are residences to the south of Runway 14-32, the potential impacts of proposed development must be considered. This was evaluated as part of the Alternative Analyses within **Chapter 5** of this report.

Due to these factors, according to **AC 150/5325-4B**, Runway 14-32 is technically considered an additional primary runway at FPR and its recommended runway length should be determined based on one of the procedures shown in **Table 4-22**.

TABLE 4-22
RUNWAY LENGTH FOR ADDITIONAL PRIMARY RUNWAYS

Runway Service Type, User	Runway Length for Additional Primary Runway Equals
Capacity Justification, Noise Mitigation, Regional Jet Service	100% of the Primary Runway
Separating Airplane Classes – Commuter, Turboprop, General Aviation, Air Taxis	Recommended Runway Length for the Less Demanding Airplane Design Group or Individual Design Airplane

Source: FAA AC 150/5325-4B, Table 1-2.

Runway 14-32 is currently 4,755 feet long by 100 feet wide and the previous FAA-approved ALP depicts an 850 foot extension to the Runway 14 end for a total length of 5,605 feet.
The primary Runway 10R-28L is designed for long-range corporate jets, which currently represent a fraction of total airport operations. Those larger jets are not necessarily considered constraints to capacity or noise producers due to their low frequency. As such, it was determined that Runway 14-32 should be designed for the less demanding design group, which at FPR consists of the more frequent operations by small and medium corporate jets.

This aircraft category has MTOWs of over 12,500 pounds but less than 60,000 pounds, therefore, their runway length requirement is determined based upon procedures in Chapter 3 of the *Runway Length AC*. That chapter contains runway length curves for 60 and 90 percent aircraft load factors, which in combination with the previously-defined temperature, elevation, and runway gradient conditions at FPR, provide the recommended runway length requirements.

The corporate jets that best represent the identified ARC C-II criteria for Runway 14-32 are the "airplanes that make up 75 percent of fleet" within the 12,500 to 60,000 pound MTOW range as identified in the *Runway Length AC (Table 3-1).* As such, the runway length curves shown in **Figure 4-4** must be used to determine the baseline length requirement for Runway 14-32 prior to the application of runway gradient and wet pavement factors.

Based upon the availability of primary Runway 10R-28L, and the furthest reaching destinations previously observed, it was determined that Runway 14-32 would not necessarily be required to accommodate 90 percent of the useful load of small and medium corporate jets, but should accommodate at least 60 percent of their useful load. Therefore, as shown in **Figure 4-4**, using the mean maximum temperature of 89.8 degrees Fahrenheit and the airport elevation of 21.1 feet AMSL, the baseline runway length requirement for Runway 14-32 was approximately 5,400 feet. According to the *Runway Length AC*, this value would typically be increased by 15 percent to 6,210 feet to account for wet and slippery runway conditions, but the *Runway Length AC* only permits the value to be increased to a maximum length of **5,500 feet**. Since there is essentially no difference in the Runway 14 and 32 end elevations, there is no need to apply a gradient factor to the runway length calculation.

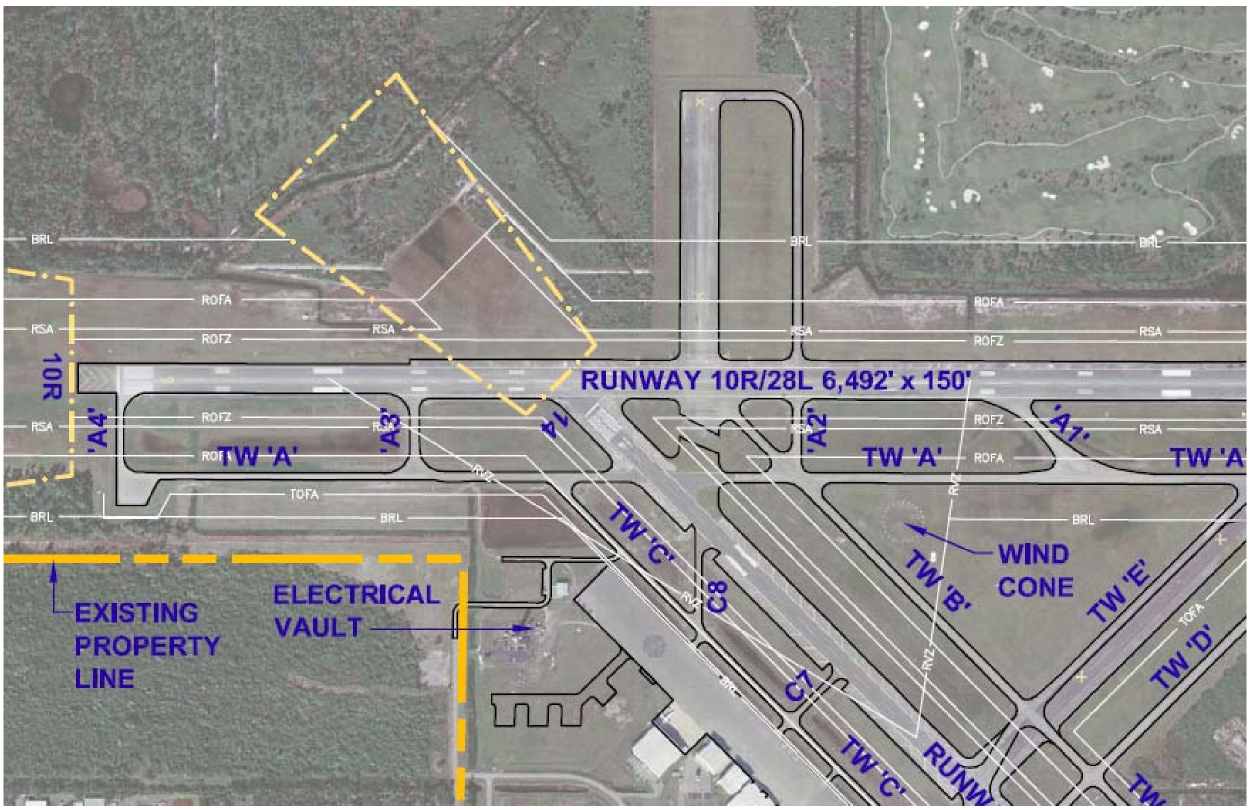
Besides the benefits of extending Runway 14-32 to better accommodate the operational demands of existing airport users, there may be a safety benefit associated with correcting what the FAA considers a potentially complex airfield configuration. According to the FAA brochure, *Improving Runway Safety through Airfield Configuration*, the configuration of an airfield can contribute to runway incursions,[32] and layouts should be avoided "that will result in aircraft taxiing or back taxiing on runways. …. Anytime an aircraft uses a runway for purposes other than landing or takeoff, the chances of a runway incursion increase."[33] As shown in **Figure 4-7** in order for aircraft to takeoff from Runway 14, they must currently either taxi to the Runway 14 threshold by taxiing along primary Runway 10R-28L or by back

[32] *"The FAA defines a runway incursion as "Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and takeoff of aircraft."*

[33] *Improving Runway Safety through Airfield Configuration – Reducing the Risk of Runway Incursions, FAA Office of Runway Safety.*

taxiing along Runway 14-32. Further, the Runway 14 end is located within the Runway Safety Area (RSA) of primary Runway 10R-28L. Although current air traffic control procedures and operational demand do not warrant the simultaneous use of both Runways 10R-28L and 14-32, this may impact airport capacity if operations increase. Therefore, in an effort to improve airport capacity while eliminating the runway incursion potential, an extension of Runway 14 and its associated parallel taxiway (Taxiway B) is recommended. The feasibility of extending Runway 14 to correct this issue will be evaluated as part of the *Alternatives Analysis* presented in **Chapter 5** of this report.

Figure 4-7
Non-Conforming Runway Intersection

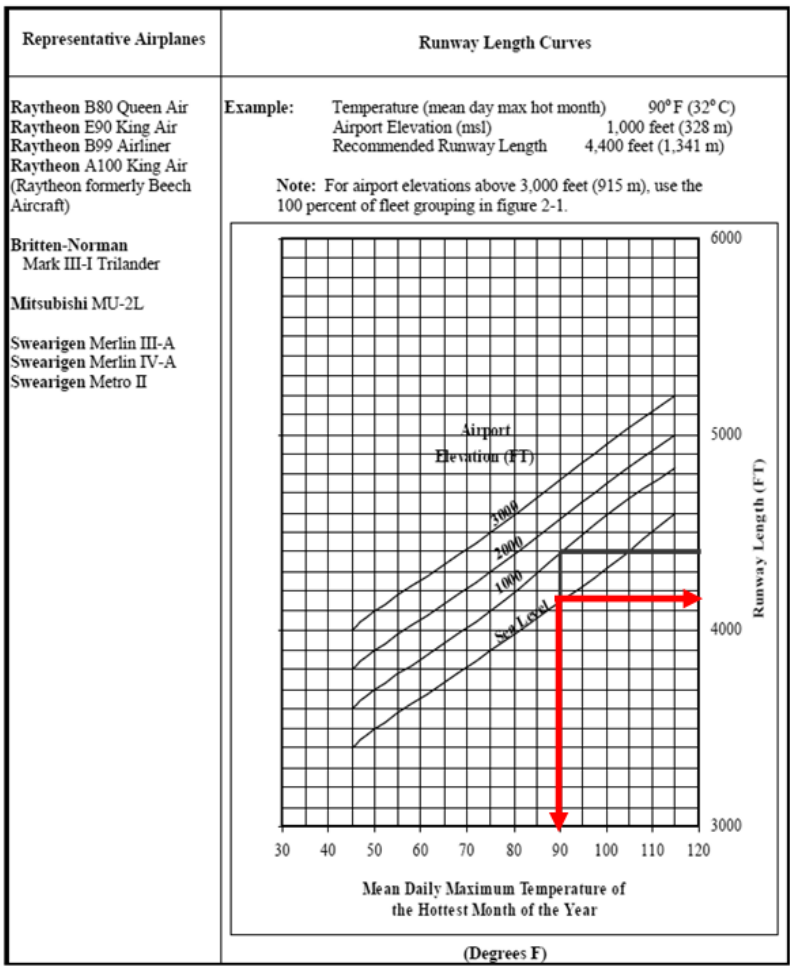


Source: The LPA Group Incorporated, 2009

<u>Training Runway 10L-28R Length Requirements</u>

Training Runway 10L-28R is currently 4,000 feet long by 75 feet wide and is located 2,500 feet from primary Runway 10R-28L on a parallel orientation. The runway is designed to ARC B-II design standards and was recently constructed to help relieve capacity and noise concerns. Since the runway is primarily intended for piston and turboprop aircraft training operations (i.e., touch-and-go operations), the procedure in the *Runway Length AC* that best fits these aircraft is found in Chapter 1 for aircraft 12,500 pounds or less. It is noted that the critical aircraft for Runway 10L-28R was previously identified as the King Air 350 turboprop which has a MTOW of 15,000 pounds, although it is highly unlikely that this aircraft would be conducting touch-and-go operations on this runway at MTOW with a full passenger load. Therefore, the runway length curve for determining the length requirement for similar turboprop aircraft was applied to Runway 10L-28R as shown in **Figure 4-8**. The subsequent analysis produced a runway length requirement of approximately 4,150 feet. However, since it is unlikely that these aircraft would be conducting training operations at MTOW, the current 4,000 foot length should be adequate to accommodate training requirements throughout the remainder of the planning period.

Figure 4-8
Airplanes Having 10 or More Passenger Seats



Source: FAA AC 150/5325-4B, Figure 2-2.

Runway Extension Funding[34]

According to FAA Office of Safety and Standards in Washington D.C., the following is required to obtain federal funding for a runway extension:

- **FAA AC 150/5325-4B** is a design document; therefore, for funding, only aircraft operations that equal or exceed 500 operations within the first five years can be used to determine the runway length requirements.
- The critical aircraft can be based upon a family as well as combination of aircraft (i.e. ARC B-II and C-I) as designated in the *Airport Improvement Program Handbook*, **Order 5100.38C** – June 28, 2005, Pages 56-57, **FAA Order 5090.3C**, *Field Formulation of NPIAS*, and **FAA AC 150/5325-4B**, *Runway Length Requirements for Airport Design*. However, the most demanding aircraft within the category that is estimated to equal or exceed 500 operations by year five for each family of aircraft would be designated as the most critical for runway length purposes.
- If these aircraft appear in **Table 3-1** and **not in Table 3-2 of AC 150/5325-4B**, then **Figure 3-1** is to be used[35].
- The critical runway length is based upon the 60 percent load factor and the mean maximum temperature.
- If the critical aircraft or family of aircraft exceeds 60,000 lbs MTOW, then Aircraft Manufacturer FAR Planning Manuals must be used to determine the appropriate runway length based upon airport elevation, temperature, flap setting, etc.
- Runway length is then adjusted for difference in the high and low points as well as wet pavement conditions.

Summary of Runway Length Requirements

The analysis in this section determined the following runway length recommendations for FPR:

- **Primary Runway 10R-28L –** The existing runway length should be adequate to serve the majority of large corporate jet operations at their anticipated stage length demands. No change in runway length is recommended, unless at some point in the future commercial jet operations are desired.

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[34] Information obtained from Mr. George Legarreta, Civil Engineer and Author of AC 150/5325-4B, who works within FAA Headquarters Office of Safety and Standards, during phone conversation on July 30, 2008.

[35] Note if the critical aircraft's takeoff length at ISA over a 50 ft obstacle is less than 5,000 feet, then Figure 3-1 must be used, even if aircraft is not listed in the tables. If, however, the critical aircraft's takeoff length (according to manufacturer statistics) is 5,000 feet or greater at ISA over a 50 ft obstacle, then Figure 3-2 must be used to calculate runway length. (Source: FAA Headquarters, Airport Engineering and Airport Safety Standards (AAS 100), July 31, 2008.

- **Runway 14-32** – The runway should be extended to a minimum of 5,500 feet to accommodate the takeoff demands of corporate jets with MTOWs of up to 60,000 pounds. This is not only needed to better accommodate aircraft operational demands, but also to correct a potentially complex airfield configuration that requires aircraft to taxi along primary Runway 10R-28L or back taxi along Runway 14-32 to reach the Runway 14 threshold.
- **Training Runway 10L-28R** – No change in runway length is required based upon current aircraft use.
- **Potential Commercial Service** – A general runway length evaluation was prepared based upon typical commuter/regional and mainline commercial air carrier aircraft and stage lengths of similarly sized commercial airports within the South Florida region. Commuter/regional service is associated with 100-seat or less aircraft passenger capacity. In evaluating the runway length requirements identified in **Table 4-17 through 4-19**, 85 percent of typical commuter aircraft at a 90 percent load factor can operate at FPR at its current runway length. However, based upon Part 135 and 121 landing requirements, the CRJ 1000 cannot operate at FPR during hot and wet conditions.

  In evaluating the typical mainline carrier fleet mix based upon an estimated 1,500 NM stage length, the required runway length ranged from a low of 3,618 (Airbus 319-100) to a high of 6,516 (B737-400) feet. Since, at this time, it is unknown if scheduled commercial service will be pursued at FPR, the purpose of the commercial runway length evaluation was to identify likely runway lengths needed to accommodate commuter and mainline commercial service demand. Identification of potential commercial service airfield requirements allows St. Lucie County the flexibility to preserve airport property for future commercial aviation use. However, if or when commercial service is ultimately pursued, runway length requirements should be evaluated at that time based upon the anticipated fleet mix.

4.5.2 Runway Pavement Maintenance and Strength Analysis

As mentioned in **Chapter 2**, runway pavement strength is a major concern of current airport tenants and the TAC. Specifically, the existing 60,000 pound dual-wheel weight bearing capacity of primary Runway 10R-28L is inadequate to accommodate the operational demands at MTOW of many common long-range corporate jets and their associated insurance company requirements. In **FAA AC 150/5070-6B**, *Airport Master Plans*, it states that "The required pavement design strength is an estimate based on average levels of activity, and is expressed in terms of aircraft landing gear type and geometry (i.e., load distribution). The pavement design strength is not the maximum allowable weight. Limited operations by heavier aircraft than the critical aircraft may be possible."[36] In other words, the runway pavement strength should be at least equal to the MTOW of the critical aircraft, but a limited amount of heavier aircraft may still operate on the runway.

The current strength of primary Runway 10R-28L is published at 30,000 pounds for aircraft in a single-wheel configuration and 60,000 pounds for aircraft in a double-wheel configuration (i.e., two wheels side-by-side). As shown in **Figure 4-9**, most corporate jets and narrow-body commercial aircraft have a double-wheel configuration including the Gulfstream G550, CRJ-700 and Boeing 737-700. According to airport records, there is currently at least one Gulfstream II and one Gulfstream III jet based at FPR on a regular basis, with respective MTOWs of 65,300 pounds and 70,200 pounds. Although the MTOWs of these jets exceed the published runway strength, they typically only operate below MTOW and infrequently operate at weights greater than 60,000 pounds. According to FAA filed flight plan data from Fboweb.com, FPR experienced a peak of 304 operations in 2006 by aircraft with MTOWs greater than 60,000 pounds as shown in **Table 4-23**.

Figure 4-9
Gulfstream G550 Double-Wheel Configuration

Source: Gulfstream G550 Brochure.

TABLE 4-23 RUNWAY LENGTH FOR ADDITIONAL PRIMARY RUNWAYS				
Year	**Arrivals**	**Departures**	**Total Over 60K Ops.**	**Aircraft Ops. Mix**
2006	141	163	304	GII (87), GIII (168), GIV (45), GV (4)
2007	104	128	232	GII (109), GIII (73), GIV (34), GV (10), Global (6)
2008	55	97	152	GII (42), GIII (60), GIV (38), GV (10), Global (2)
Source: Fboweb.com FAA Filed Flight Plan Database.				

[36] *FAA AC 150/5070-6B, Airport Master Plans, pg. 52.*

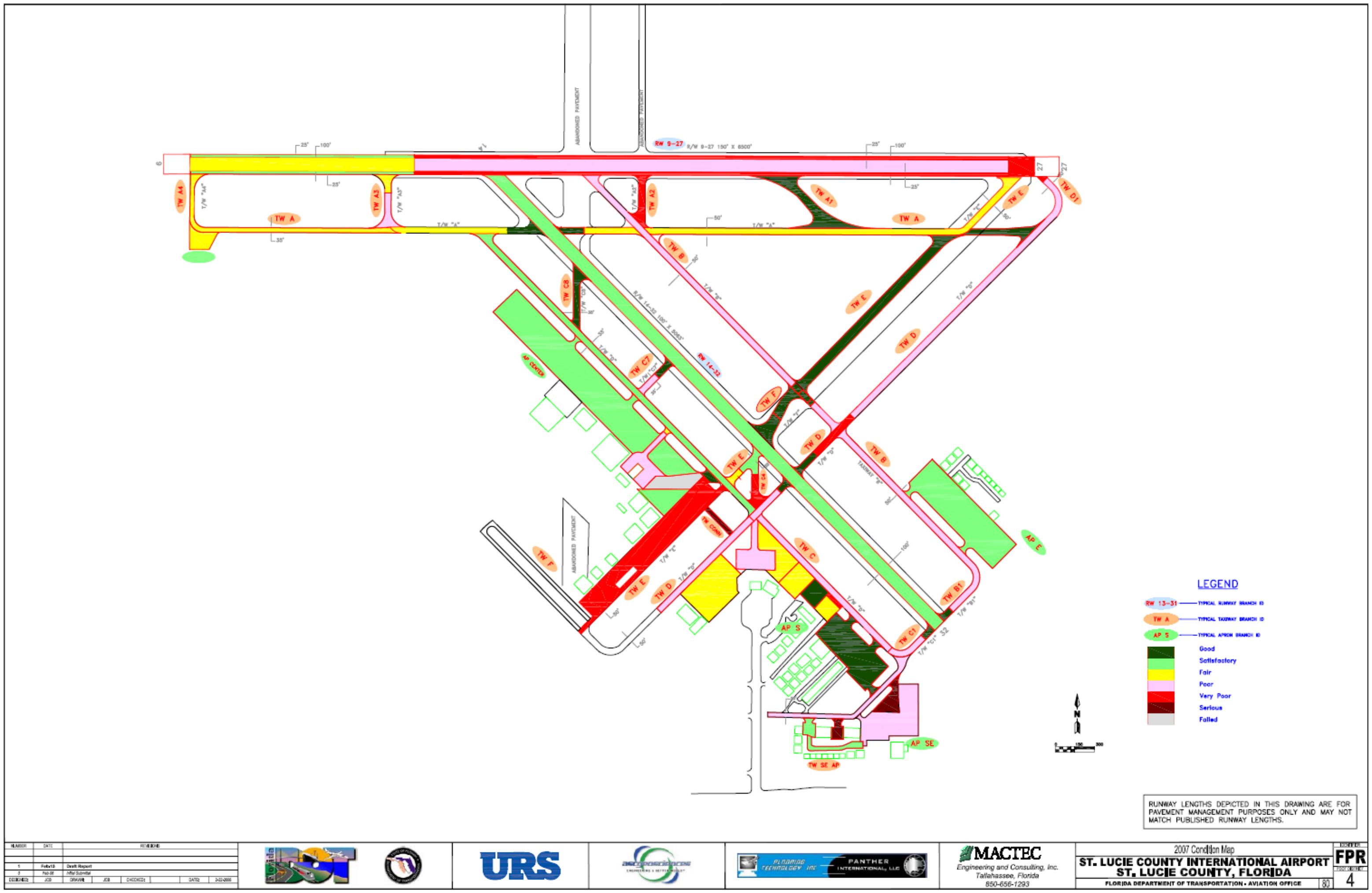
However, according to a recent evaluation, Runway 10R-28L pavement is in fair to very poor condition (**Figure 4-10**). Thus, an overlay of Runway 10R-28L has already been planned for 2009.

According to AECOM who designed the overlay, the existing Runway 10R-28L has a highly variable base and asphalt surface course thickness and quality. The proposed asphalt overlay design considered this fact, and the overlay was designed to account for this variable. The pavement overlay was designed based upon a maximum 60,000 pound dual-gear aircraft weight. Utilizing the FAARFIELD Pavement Design software,[37] a net 2 inch additional asphalt thickness on the western portion of the runway would be required, but the overlay thickness would fluctuate on the east end because of variations in the existing pavement. Further, AECOM evaluated adding 1,200 annual operations of an 80,000 pound dual-gear aircraft, which increased the net 2 inches additional asphalt thickness on the west end from 2 inches to 2.04 inches. This was essentially covered under the existing design, and therefore the change was considered negligible. However, the strength of the pavement for taxiway ingress and egress to the runway must also be considered. To accommodate use by heavier aircraft may require an analysis of the taxiway pavement ingress and egress to satisfy FAA prior to allowing an increase in the published dual wheel weight for the runway. While strengthening every connecting taxiway would not be necessary, some consideration would need to be made to allow for an aircraft of this loading weight to maneuver and operate safely.[38]

However, when the aircraft weight was increased to 90,000 pounds or greater, the margin built into the design to account for variability in material thickness and quality was eroded. Multiple fleet mix scenarios using the FAA design software were run by AECOM to determine the requirements for 90,000 pound and 100,000 pound dual gear aircraft weight. Based upon this information, 1,200 annual operations of a 90,000 pound dual-gear aircraft increases the net 2 inch additional asphalt thickness from 2 inches to 2.43 inches. Alternately, adding 1,200 annual operations of 100,000 pound dual-gear aircraft increases the net 2 inch additional asphalt thickness from 2 inches to 3.13 inches. Thus, even a limited number (approximately 200) of 90,000 pound and 100,000 pound dual-gear operations at the currently designed overlay of 2 inches could lead to premature pavement failure and distress in the areas where these aircraft exit and enter the runway, which may signify the need to adequately plan for their anticipated activity growth at FPR.

[37] *FAARFIELD – Airport Pavement Design (V 1.203, 07/31/08) design software, Federal Aviation Administration.*
[38] *AECOM Tampa, Runway 9-27 (10R-28L) Pavement Evaluation and Design, 2008*

Figure 4-10
Existing Pavement Conditions



Source: MACTEC Pavement Evaluation, 2009

Therefore, based upon airport management's discussion with the FAA Airports District Office, any change to the published pavement strength will require an environmental assessment (EA). An EA is required to evaluate the potential impacts associated with a change in aircraft fleet mix related to the pavement strengthening of Runway 10R-28L.

Still, in previous years, FPR has shown higher numbers of corporate jet traffic with MTOWs greater than 60,000 pounds. Further, the fleets of both FBOs include larger corporate jets like the Gulfstream V and the Global Express, but their ability to operate those aircraft at FPR is limited because of the inadequate pavement strength and associated insurance requirements. With the anticipation of a greater number of these aircraft coming onto the market during the next ten years, and high prices for hangar space at nearby PBI, the airport could become economically disadvantaged when compared to nearby airports VRB and SUA who have historically experienced more corporate jet traffic of 60,000 pounds or greater as a result of their higher pavement strengths in conjunction with available hangar and land lease opportunities. Thus, to accommodate the entire array of ARC C-III category ultra-long corporate jets (i.e. Gulfstream G650 and Global Express), a dual-gear weight bearing capacity of 100,000 pounds would be required.

The current strength of crosswind Runway 14-32 is published at 15,000 pounds for aircraft in a single-wheel configuration. Due to the status of Runway 14-32 as an additional primary runway for both capacity and noise, there is a need to increase the pavement strength to at least 60,000 pounds dual-wheel to adequately accommodate medium ARC C-II category corporate jets. The 2005 Noise Study and specifically NCP Operational Measure 3, which refers specifically to training operations, recommend that operations be conducted on Runway 14 during calm wind conditions to prevent noise exposure to residential development to the east of FPR. By extending and increasing the overall strength of Runway 14-32 to at least 60,000 pounds, the noise benefits can be better achieved by allowing more medium-sized jet departures to occur to the south. As part of the Alternative Analyses, Chapter 5, the viability of extending and strengthening Runway 14-32 was evaluated in addition to the potential environmental impacts, including noise, associated with this runway alternative. The current strength of training Runway 10L-28R is published at 15,000 pounds for aircraft in a single-wheel configuration and should be sufficient to accommodate anticipated demands throughout the planning period.

4.5.3 Taxiway and Holding Bay Analysis

Based on the criteria presented in the *Airport Capacity and Delay AC*, no airfield capacity concerns were identified related to the current availability and configuration of taxiways at

FPR. However, since the capacity determination is theoretical in nature and does not account for every runway and taxiway configuration, this section presents specific taxiway and holding bay improvements that could be considered at FPR to improve the overall efficiency of airport operations.

Taxiway Requirements

As shown in **Figure 4-2**, the airport's FBO facilities are located on both sides of Runway 14-32 in the southeast corner of the airfield. In order to provide for the safe navigation of ARC C-III category aircraft between the FBO facilities and either end of primary Runway 10R-28L, all taxiways within the main airfield area should be designed to a standard ADG III width of 50 feet, with the exception of those used exclusively for operations on crosswind Runway 14-32. This would necessitate the following taxiway upgrades:

- **Taxiway A and Connector Taxiway A4** – The western 1,900 feet of Taxiway A (including connector Taxiway A4) between the threshold of Runway 10R and connector Taxiway A3 is currently 35 feet wide. Since Runway 10R is the primary runway end for jet departures, this section of Taxiway A should be upgraded from 35 to 50 feet to meet the ADG III design criteria like the remainder of Taxiway A and its associated connector taxiways.
- **Taxiway C** – The width of Taxiway C and associated connector taxiways range from 35 feet to 60 feet:
    - Taxiway C from Taxiway C-1 to Taxiway D is 50 feet;
    - Taxiway C from Taxiway D to Taxiway A is 35 feet;
    - Taxiways C-8 and C-7 are 35 feet;
    - Taxiway C-4 is 50 feet, and
    - Taxiway C-5 is 60 feet.

  Since Taxiway C provides access to Runway 10R (via Taxiway A) without having to perform a runway crossing and also provides access to the airport administration apron and FBO facilities, it is recommended that the entire taxiway and associated connectors be upgraded to a standard 50 foot wide width in conformance with Airport Design Group III requirements.
- **Taxiway E** – The section of Taxiway E to the east of Runway 14-32 recently underwent rehabilitation and is 50 feet wide, although the section of Taxiway E between Runway 14-32 and Taxiway C appears to be 35 feet wide. The width of that section of Taxiway E should be increased to 50 feet in the future, and the reconfiguration of the intersection of Taxiway E, connector Taxiway C4, and Runway 14-32 should also be considered to provide a less complex operating environment. Specifically, according to the FAA Brochure, *Improving Runway Safety through Airfield Configuration*, complex airfield configurations have the potential to be more

> susceptible to runway incursions. Layouts should be avoided "that include complex intersections. Generally, a complex intersection involves three or more crossing pavements, such as three taxiways, two runways and a taxiway, or two taxiways and a runway."[39]

All other taxiways that have widths less than 50 feet within the main airfield area are primarily utilized for Runway 14-32 operations only, and thus designed to accommodate ARC II aircraft only. Airport management has also indicated that the FBOs future development plans call for removing the majority of parallel Taxiway D. The *Alternatives Analysis* in **Chapter 5** investigates these taxiway upgrades and removals at FPR in conjunction with other proposed developments.

Further, as mentioned in **Chapter 2**, there is currently no taxiway connection between the main airfield area and training Runway 10L-28R. This means that all touch-and-go operations must still begin and end from either primary Runway 10R-28L, crosswind Runway 14-32, or some other airport. However, a partial perimeter road was constructed parallel to Taylor Dairy Road, which connects the training runway to the main airfield facilities. Although the previously approved master plan update stated that "it is necessary that the runway be connected to the remainder of the airfield"[40], depending upon existing and future runway use, a connector may no longer be required. Therefore, based upon airports with similar configuration (i.e. Orlando-Sanford), if the runway remains strictly for touch and go training, is equipped with a holding pad or taxiway, and alternative method(s) can be used to access the main airfield (either via aircraft operations or a controlled access road) then a connector taxiway will not be required. If, however, the operation of Runway 10L-28R changes or the capacity of this runway decreases due to demand, then a connector taxiway would be justified. Therefore, as part of the Alternative Analyses, an evaluation of the need and orientation of a connector taxiway between Runway 10R-28L and 10L-28R was assessed. If determined necessary based upon recent FAA guidance (**FAA 150/5300-13 Change 14**) and consultation with FAA Airports District Office, such a taxiway connection must satisfy ADG II criteria and thereby be designed to a minimum width of 35 feet.

Also as part of planned commerce park development within the southwest corner of the existing airport property, an extension of Taxiway A to provide egress and ingress to potential aviation facilities within the commerce park will also be evaluated. Since such an extension would provide direct access to Runway 10R, it should be designed to ARC III requirements.

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[39] *Improving Runway Safety through Airfield Configuration – Reducing the Risk of Runway Incursions, FAA Office of Runway Safety.*

[40] St. Lucie County International Airport Master Plan Update, Chapter 4, Airport Alternatives, Hoyle, Tanner & Associates, Inc., August 2002, page 4-4.

Chapter 5 considers all relevant factors in the selection of a preferred taxiway development, including cost, operational efficiency, environmental impacts, as well as compatibility with future developments.

Holding Bay Requirements

According to **FAA AC 150/5300-13**, *Airport Design*, "Holding bays provide a standing space for airplanes awaiting final ATC clearance and to permit those airplanes already cleared to move to their runway takeoff position. A holding bay should be provided when runway operations reach a level of 30 per hour." As illustrated in **Figure 4-1**, FPR is equipped with two holding bays primarily serving Runway 10R-28L. Current and forecast activity levels illustrate the need to provide a holding bay at each runway end that is used extensively for takeoff, including 10R, 14, and 10L. However, the current airfield configuration does not allow the placement of a holding bay at the Runway 14 end, nor does it make sense to add a holding bay to the Runway 10L end at this time. If in the future the Runway 14 end is extended to better accommodate departures to the south, a holding bay could be provided along an extended parallel taxiway. Also, until a time when development might occur around training Runway 10L-28R, or until a taxiway connection to the main airfield area is constructed, aircraft taxiing should be minimal along parallel Taxiway F and thus there is no immediate need for a holding bay at the Runway 10L end.

4.5.4 Airfield Design Standards

FAA AC 150/5300-13, *Airport Design*, defines the airfield design criteria based on the specific ARC for the subject runway and other airfield facilities. **Table 4-24** identifies FPR's current airfield design configuration in comparison to FAA standard requirements. Where deficiencies exist, items are identified and highlighted in blue in the table. Since this Master Plan Update must show consistency with FAA design standards, opportunities for correcting these non-standard features are further investigated in **Chapter 5**, as are recommendations that were coordinated with airport management, FAA and FDOT personnel.

4.5.5 Airfield Lighting, Signage, and Pavement Markings

Airfield Lighting

All three runways at FPR are currently provided with Medium Intensity Runway Lights (MIRLs) along the runway edges. According to **FAA AC 150/5340-4**, *Design and Installation Details for Airport Visual Aids*, MIRLs are recommended for runways with either visual or non-precision instrument approaches, whereas High Intensity Runway Lights (HIRLs) are generally recommended for runways with precision instrument approaches.[41] Since primary

[41] *FAA AC 150/5340-4, Design and Installation Details for Airport Visual Aids, page 3.*

Runway 10R-28L is considered a precision instrument runway with an ILS approach to Runway 10R, the MIRLs should be upgraded to HIRLs.

Runway 10R is currently the only runway end equipped with Runway End Identifier Lights (REILs). According to the *Visual Aids AC*, REILs are typically provided for runways with a circling or non-precision approach, and should therefore be provided on Runway ends 28L, 14, and 32, which all have circling and non-precision approaches, to help aid in identification of the runway ends. However, per **FAA AC 150/5300-13**, *Airport Design (Appendix 16)*, since Runway 10R currently has a precision ILS approach with visibility minimums as low as three-quarters of a mile, an approach lighting system such as an omni-directional approach lighting system (ODALS) or medium approach lighting system (MALS) are required on Runway 10R. Runway 10L-28R accommodates a visual approach (>1-mile visibility) only, and, therefore, should be equipped with both REILs and precision approach path indicator lights (PAPIs). If, however, the approach to either Runway 10R or 10L changes in the future, relocation of the FPL power lines may be required as well as additional navigational aids, lighting, markings and signage. Airfield development alternatives and associated impacts were considered as part of the *Alternatives Analyses* evaluation provided in **Chapter 5** of this document.

Medium Intensity Taxiway Lights (MITLs) are currently provided along all taxiway edges at FPR and should be adequate throughout the remainder of the planning period. Specifically, the *Visual Aids AC* identifies MITLs as the standard taxiway edge lighting system for visual, non-precision, and precision instrument runways. With regards to the airport rotating beacon, if the lighting along primary Runway 10R-28L is ultimately upgraded to HIRLs, an upgraded high intensity rotating beacon (L-802A) should also be provided.

Airfield Signage

In conjunction with construction of training Runway 10L-28R and the remarking of Runway 10R-28L, changes to the existing lighted runway signage, the addition of new identification signage related to Runway 10L-28R, and upgrades to the existing electrical vault facility were in progress as the time of this writing. Any additional airfield improvements recommended as part of this master plan update are anticipated to require either the addition of or improvements to airfield signage. Thus, all existing and proposed improvements will be conducted in accordance with **FAA AC 150/5340-18**, *Standards for Airport Sign Systems*.

TABLE 4-24
AIRFIELD DESIGN STANDARD ANALYSIS

Design Standard	Primary Runway 10R-28L		Crosswind Runway 14-32		Training Runway 10L-28R	
	ARC C-III Criteria	Existing Condition	ARC C-II Criteria	Existing Condition	ARC B-II Criteria	Existing Condition
Runway Width	150 Feet	150 Feet	100 Feet	100 Feet	75 Feet	75 Feet
RSA Width	500 Feet	10R – RSA contains ditch beyond runway end	500 Feet	500 Feet	150 Feet	150 Feet
RSA Length Beyond Runway End	1,000 Feet		1,000 Feet	1,000 Feet	300 Feet	300 Feet
ROFA Width	800 Feet	ROFA contains trees and a ditch	800 Feet	14 – ROFA contains trees beyond runway end	500 Feet	500 Feet
ROFA Length Beyond Runway End	1,000 Feet		1,000 Feet		300 Feet	300 Feet
Runway Visibility	10R (3/4-Mile) 28L (1-Mile)		14 (1-Mile) 32 (1-Mile)		10L (Visual) 28R (Visual)	
RPZ Inner Width	10R/28L (1,000 Feet / 500 Feet)		500 Feet	32 – RPZ extends off the airport property beyond runway end	500 Feet	500 Feet
RPZ Outer Width	10R/28L (1,510 Feet / 1,010 Feet)		1,010 Feet		700 Feet	700 Feet
RPZ Length	10R/28L (1,700 Feet / 1,700 Feet)		1,700 Feet		1,000 Feet	1,000 Feet
Runway Blast Pad Width	140 Feet	10R (150 Feet) 28L (150 Feet)	120 Feet	None	95 Feet	95 Feet
Runway Blast Pad Length	200 Feet	10R (200 Feet) 28L (200 Feet)	150 Feet		150 Feet	150 Feet
Runway Shoulder Width	20 Feet	25 Feet	10 Feet	50 Feet	10 Feet	10 Feet
Runway Centerline to Parallel Taxiway Centerline	400 Feet	500 Feet	300 Feet	400-500 Feet	240 Feet	400 Feet
Runway Centerline to Holdine	250 Feet	250 Feet	250 Feet	250 Feet	200 Feet	200 Feet

Source: FAA AC 150-5300/13, Airport Design, The LPA Group Incorporated, 2009.
Note: Airfield design standard deficiencies are highlighted in blue.

Pavement Markings

FAA AC 150/5340-1, *Standards for Airport Markings*, identifies the requirements for airport markings. Airport pavements are marked with reflective painted lines and numbers which aid in the identification of runways from the air and provide information to pilots during the approach phase of flight. At FPR, primary Runway 10R-28L is marked precision, crosswind Runway 14-32 is marked non-precision, and training Runway 10L-28R is marked visual, and all runway markings are standard as are the diagonal shoulder and blast pad markings. As cited in **Chapter 2**, the primary runway was remarked as Runway 10R-28L to correspond with the current magnetic heading. Periodic remarking (typically every 10 years) of all pavement markings should be conducted during the planning period to maintain their visibility and the safety of airport operations.

According to the *Markings* AC, "all taxiways should have centerline markings and runway holding position markings whenever they intersect a runway. Taxiway edge markings should be installed wherever there is a need to separate the taxiway from a pavement that is not intended for aircraft use or to delineate the edge of the taxiway that is not otherwise clearly visible."[42] Based upon visual inspection, all taxiway centerline and runway holding position markings were found to be standard. However, some taxiway edge markings may not be standard per the *Markings AC*. As shown in **Figure 4-11**, there are two types of taxiway edge markings – "Continuous" and "Dashed." Continuous edge markings consist of a double-solid yellow line and are "used to delineate the taxiway edge from the shoulder or some other contiguous paved surface not intended for use by aircraft. However, when an operational need exists, the continuous taxiway edge markings may be used to delineate the edge of the taxiway from a contiguous non-paved surface'.[28] Dashed edge markings consist of a double-dashed yellow line and are used to delineate the edge of the taxiway from a contiguous apron. Where current taxiways at FPR do not include the appropriate edge markings, upgrades should be planned as part of the next remarking and pavement overlay project.

[42] *FAA AC 150/5340-1J, Standards for Airport Markings, page 8.*

Figure 4-11
Standard Taxiway Edge Markings

Figure B-3. Continuous Taxiway Edge Line Marking

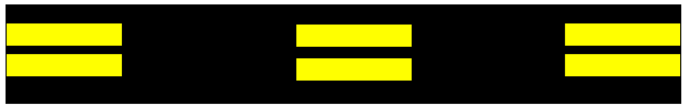
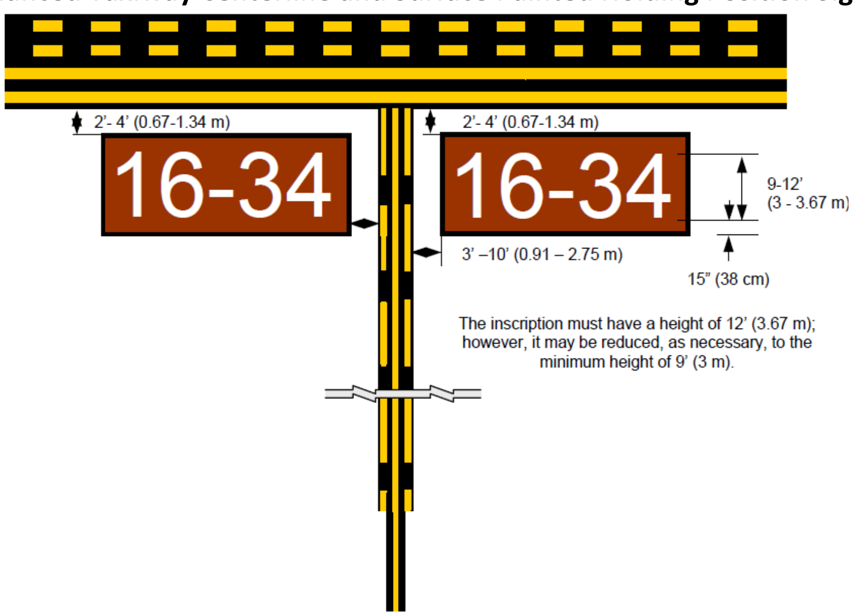


Figure B-4. Dashed Taxiway Edge Line Marking

Source: FAA AC 150/5340-1J, Figures B-3 and B-4.

Also, if the airport pursues Part 139 Commercial Service Certification, the *Markings AC* indicates that enhanced taxiway centerline and surface painted holding position signs are standard for Part 139 airports. As shown in **Figure 4-12**, enhanced taxiway centerline markings help to improve pilot awareness of an upcoming holding position by providing highly-recognizable taxiway markings starting 150 feet before the holding position. Surface painted holding position signs serve a similar purpose to reduce the potential for aircraft runway incursions and accidents.

Figure 4-12
Enhanced Taxiway Centerline and Surface Painted Holding Position Signs



Source: FAA AC 150/5340-1J, Figure C-4.

4.5.6 Airfield Service Roads

FAA AC 150/5210-20, *Ground Vehicle Operations on Airports*, identifies the general criteria for airfield service roads and also provides instructions for airports to develop training programs for safe ground vehicle operations and pedestrian control on the airside of an airport. According to FAR Part 139, *Certification of Airports*, airports certified under Part 139 for commercial service operations must "Establish and implement procedures for the safe and orderly access to, and operation in, movement areas and safety areas by pedestrians and ground vehicles, including provisions for identifying the consequences of noncompliance with the procedures by and employee, tenant, or contractor."[43] Although FPR is not currently certified under Part 139, the *Airport Rules and Regulations, adopted December 4, 2007*, includes procedural requirements for ground vehicle operations on the airfield (i.e., movement areas such as taxiways), and even requires individuals to attend a training class before they are permitted to drive on the airfield. As such, airport management has already instituted many of the ground vehicle controls required under Part 139.

However, since FPR does not currently have an inclusive system of airfield service roads, airfield safety could be improved through the addition of airfield service roads to separate ground vehicle and aircraft traffic. Ground vehicles must currently utilize the taxiways to navigate around the airport, or they use the lengthy public roadways that are located far from the airfield area. According to the *Ground Vehicle Operations AC*, "Vehicles on the movement area should be limited to those necessary for the inspection and maintenance of the movement areas and emergency vehicles responding to an aircraft emergency on the movement area. Vehicles should use service roads or public roads in lieu of crossing movement areas whenever possible."[44] Consequently, it may be beneficial to provide a system of airfield service roads within the airport property so that ground vehicles can safely navigate the airfield without having to utilize taxiways, cross runways, and interrupt aircraft operations.

4.5.7 Navigational Aids (NAVAIDS) and Visual Aids (VISAIDS)

The term NAVAIDS generally refers to ground- or satellite-based equipment that is able to communicate position information, approach guidance, and surface weather conditions to aircraft while in-flight. This includes all non-precision and precision instrument approach procedures to runways, as well as weather equipment such as an Automated Surface Observation System (ASOS). The term VISAIDS generally refers to ground-based equipment that the pilot can see while in-flight to determine the correct approach slope to a runway and also wind conditions.

[43] *FAR Par 139, Certification of Airports, Section 139.329(b).*
[44] *FAA AC 150/5210-20, Ground Vehicle Operations on Airports, page 2.*

Navigational Aids (NAVAIDS)

As previously mentioned, the following instrument approaches are provided at FPR:

- **Runway 10R**
  - Precision ILS approach (3/4-mile visibility)
  - Non-precision RNAV (GPS)/LNAV approach with lateral navigation only (1-mile visibility)
- **Runway 28L**
  - Non-precision RNAV (GPS)/LNAV approach with lateral navigation only (1-mile visibility)
  - Non-precision Non-Directional Beacon (NDB) straight-in approach (1-mile visibility)
- **Runway 14**
  - Non-precision RNAV (GPS)/LPV approach with vertical guidance (1-mile visibility)
  - Non-precision VOR approach based on the VOR at VRB (1-mile visibility)
- **Runway 32 (to be published by the end of 2009)[45]**
  - Non-precision RNAV (GPS) approach (1-mile visibility)

There are currently no published instrument approaches to training Runway 10L-28R, nor is a procedure recommended for that runway at this time due to the availability of approaches to the other runway ends. Further, no upgrades to the existing instrument approaches need to be considered at this time, such as reduced visibility minimums, except for the installation of an approach lighting system (e.g., MALSR) for the precision ILS approach to Runway 10R and REILs for the non-precision approaches to Runways 28L, 14, and 32. In fact, the RNAV GPS approaches to Runways 10R-28L and 14-32 were recently developed in conjunction with the FAA's NextGen airspace modernization plan and are flown using satellite-based signals from the FAA's Wide Area Augmentation System (WAAS). Much like a precision approach, some RNAV GPS procedures provide both horizontal and vertical course guidance to aircraft (i.e., LPV or LNAV/VNAV approaches), although they have higher visibility minimums and decision altitudes. The FAA is currently testing the Local Area Augmentation System (LAAS), which uses a combination of ground- and satellite-based equipment to fly precision instrument approaches. As LAAS technology evolves, the FAA may implement a LAAS-based precision instrument approach at FPR if conditions permit. However, this may require the installation of additional approach lighting and meteorological equipment (runway visual range) as well as the removal or relocation of potential obstructions to air navigation associated with Runways 10R-28L, 14-32 and 10L-28R.

[45] Runway 32 was did have a vertical guidance survey done as part of the FAA evaluation, but unknown at the time of this writing if this approach will have lateral and vertical guidance (LPV) or lateral guidance only (LNAV).

As mentioned, the ASOS is also considered part of the NAVAID system at FPR since it transmits surface weather information to aircraft while in-flight. The existing ASOS is located on the airfield just northeast of the Runway 10R threshold and should be adequate during the planning period. At the time of this writing, the National Oceanic and Atmospheric Administration is working with both FAA and airport management to install an emergency power generator to support the ASOS during emergency conditions. However, if development should occur in that location, relocation of the ASOS elsewhere on the airfield could be necessary.

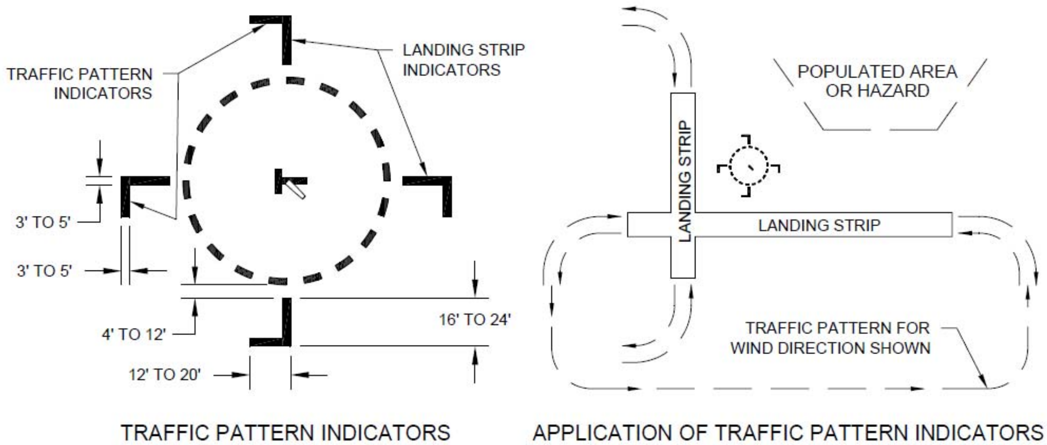
Visual Aids (VISAIDS)

This section includes an evaluation of the existing wind cones and segmented circle, and also the Visual Approach Slope Indictors (VASIs) at FPR. A lighted wind cone is centrally located near the intersection of Taxiways A and B and is enclosed within a segmented circle for easy navigation by pilots while in-flight. Some questions have been raised as to whether this segmented circle will be sufficient for the current three-runway airfield configuration. According to **FAA AC 150/5340-4**, *Design and Installation Details for Airport Visual Aids*, there are "Primary" and "Supplemental" wind cones that can be provided at airports. A "Primary" wind cone is typically located near the center of an airfield within a segmented circle, whereas several "Supplemental" wind cones may be located near each runway end. Relocation of the "Primary" wind cone and segmented circle north of Runway 10R-28L and east of Taxiway B-4 could provide a better location for aircraft utilizing the training Runway 10L-28R as well as both runways in the main airfield area. However, if a suitable location cannot be found which provides adequate visibility for all runways, an additional segmented circle adjacent to the new training runway may become necessary. Further, depending upon future traffic patterns, it may be possible to identify preferred flight patterns using landing strip indicators and traffic pattern indicators as shown in **Figure 4-13**, per the guidelines in **FAA AC 150/5340-5**, *Segmented Circle Airport Marker Systems*.

Airport tenants have also requested that "Supplemental" wind cones be provided at each runway end, and are therefore recommended where possible. The *Visual Aids AC* indicates that a supplemental wind cone must be located near the runway end but outside the RSA, ROFA, and Obstacle Free Zone (OFZ), although it may be located within the ROFA if there is a documented need and FAA approval.

Additionally, the *Visual Aids AC* provides the siting requirements for VASI systems. Runway ends 10R, 28L, 14, and 32 are currently equipped with older VASIs that the FAA is in the process of phasing-out and replacing with more reliable, less complex Precision Approach Path Indicators (PAPIs).[46]

Figure 4-13
Segmented Circle Marker Systems



Source: FAA AC 150/5340-5C, Figure 1.

4.6 General Aviation (GA) Facility Requirements

The term general aviation essentially implies non-commercial and non-military aircraft activity, which would apply to the majority of aviation-related facilities at FPR. Landside GA facilities are required to accommodate aircraft and passengers on the ground while providing an interface between air and ground transportation. This section evaluates the capacities of existing GA facilities including aircraft hangar and apron tie-down storage, FBO terminal facilities, automobile parking, aircraft fueling, and vehicle parking and access against forecast demand. As a result, requirements are identified for key years of the planning period.

4.6.1 Based Aircraft Storage Requirements

Based aircraft storage requirements are determined for conventional hangars, T-hangars, and apron tie-down areas, and are used to identify the amount of future GA development that will be necessary to satisfy forecast demand. Due to the wide range of aircraft types and sizes, it can often be challenging to select realistic aircraft sizing requirements for an airport. Fortunately, FPR's *General Aviation Minimum Standards, adopted December 4, 2007*, contain minimum requirements for aircraft storage which were used in the evaluation herein. The steps for determining based aircraft storage requirements consists of the following:

[46] *FAA to Install More PAPIs at Airports, FAA Aviation News, May/June 2009 Issue.*

1. Identification of existing storage capacities for conventional hangars, T-hangars, and apron tie-down area.
2. Determination of based aircraft storage preferences by aircraft type (i.e., if available and affordable, what storage method would based aircraft owners prefer to utilize?).
3. Projection of based aircraft storage requirements per the requirements in the *Minimum Standards*, or other applicable source.
4. Identification of any existing and future aircraft storage deficits or surpluses.

Step 1 – Identification of Existing Storage Capacities

The identification of FPR's existing storage capacities is somewhat challenging because of the manner in which various airport tenants store aircraft. For example, there are two FBOs that lease hangar and apron tie-down space to individual based aircraft owners, whereas there are also flight schools and some tenants that exclusively provide storage space for their aircraft. Other tenants occupy hangars for non-aviation purposes such as equipment storage or maintenance. As such, it would not be appropriate to consider all of the existing storage capacities in the requirements analysis herein, particularly for conventional hangars and apron tie-downs. Based on information from the FBOs and airport management, existing storage capacities were determined as follows:

- **Apron Tie-down Area** – As previously shown in **Table 2-6**, FPR has four primary aircraft parking aprons that include space for based aircraft tie-down storage. The majority of these aprons are not only used for based aircraft storage, but are also used for transient aircraft (i.e., visiting aircraft) parking and aircraft staging. Overall, the existing space allotted to based aircraft storage was determined to be approximately 200 tie-downs at 100,000 square yards or 500 square yards per based aircraft tie-down.
- **T-Hangars** – 18 T-hangar bays or 20,000 square feet.
- **Conventional Hangars** – As previously summarized in **Table 2-8**, there are over 70 hangar facilities located at FPR with over 600,000 square feet of total area. It was determined that approximately half of the total hangar area was unusable in the storage calculations since it was being used for offices, maintenance, equipment storage, flight instruction, etc. Therefore, the existing conventional hangar storage availability was determined to be approximately 300,000 square feet.

Step 2 – Determination of Aircraft Storage Preferences

Aircraft storage preferences differ by aircraft type, utilization rate, and age, as well as the aircraft owner's willingness to pay. Apron tie-downs are the least expensive storage option since the planes are parked on the apron with no protection from bad weather; although many aircraft owners prefer tie-downs because they offer quick access to the airfield without having to maneuver in-and-out of a hangar. Therefore, tie-downs are most frequently occupied by single-engine and multi-engine pistons. In climates like Florida, T-hangar bays are generally the most popular storage option for single-engine and multi-engine pistons, and sometimes small helicopters, due to their protection from bad weather and personal storage capability. However, at FPR many of these aircraft are owned by flight schools that need quick access to the airfield and subsequently prefer apron tie-down storage.

Turboprops and jets are more expensive aircraft that are generally owned by businesses that can afford conventional hangar storage and professional management. Therefore, it was determined that all based turboprops and jets prefer conventional hangar storage at FPR. In considering the based aircraft characteristics above, the storage preferences shown in **Table 4-25** were applied for each year of the planning period.

TABLE 4-25
AIRCRAFT STORAGE PREFERENCES

Storage Type	Single-Engine	Multi-Engine	Turboprop	Jet	Helicopter
Apron Tie-down	50%	25%	0%	0%	0%
T-Hangar	25%	50%	0%	0%	25%
Conventional Hangar	25%	25%	100%	100%	75%
Total	100%	100%	100%	100%	100%

Source: The LPA Group Incorporated, 2009.

Step 3 – Projection of Based Aircraft Storage Requirements

By applying the based aircraft forecasts by type (**Table 3-25**) to the storage preferences in **Table 4-25**, the storage demands presented in **Table 4-26** were determined. As can be seen, by total aircraft count there is a relatively even demand for the various storage types at FPR, particularly in earlier years of the planning period. The only factor that currently presents an issue is the low number of T-hangars. Unlike some GA airports in Florida where the airport owner may construct T-hangars with funding assistance from the FDOT, historically, the FBOs have provided this service in order to limit additional competition. As a result, the airport provides land leases to the FBOs and other tenants that subsequently develop and lease new facilities.

This information must also be quantified in terms of area so that it can be compared to the existing availability at FPR. As shown at the bottom of **Table 4-26**, the *Minimum Standards* was consulted to determine sizing requirements for conventional hangars and T-hangars, whereas an apron tie-down requirement of 500 square yards per aircraft was determined based on an estimation of current practices and spacing.

TABLE 4-26 AIRCRAFT STORAGE DEMAND						
Storage Type	**Single-Engine**	**Multi-Engine**	**Turboprop**	**Jet**	**Helicopter**	**Total**
2008 Aircraft Storage Demand						
Apron	61	15	0	0	0	76
T-Hangar	31	30	0	0	1	61
Conventional	31	15	12	14	3	74
Total	**122**	**59**	**12**	**14**	**4**	**211**
2013 Aircraft Storage Demand						
Apron	68	15	0	0	0	83
T-Hangar	34	30	0	0	1	65
Conventional	34	15	13	20	4	85
Total	**137**	**59**	**13**	**20**	**5**	**233**
2018 Aircraft Storage Demand						
Apron	77	15	0	0	0	92
T-Hangar	39	30	0	0	1	70
Conventional	39	15	14	26	4	98
Total	**155**	**59**	**14**	**26**	**6**	**260**
2023 Aircraft Storage Demand						
Apron	88	15	0	0	0	102
T-Hangar	44	30	0	0	2	75
Conventional	44	15	15	34	5	113
Total	**175**	**59**	**15**	**34**	**7**	**291**
2028 Aircraft Storage Demand						
Apron	99	15	0	0	0	114
T-Hangar	50	30	0	0	2	81
Conventional	50	15	17	46	6	132
Total	**199**	**59**	**17**	**46**	**8**	**327**
Per Aircraft Storage Requirement						
Apron	500 SY	500 SY				
T-Hangar	1,250 SF	1,250 SF			1,250 SF	
Conventional	2,500 SF	2,500 SF	5,000 SF	7,500 SF	2,500 SF	
Source: The LPA Group Incorporated, 2009. *Note: Numbers may not add due to rounding.*						

Step 4 – Identification of Existing and Future Surpluses or Deficits

Table 4-27 combines the previous steps to calculate the aircraft storage requirements in terms of area. This was then compared to the current storage capacities at FPR to identify any existing and future surpluses or deficits. The analysis determined that the current availability of apron tie-downs should be sufficient for based aircraft demand throughout the planning period, but there is a significant demand for T-hangar development in the short-term, and approximately 300,000 square feet of new conventional hangars may be needed to accommodate the forecast growth in based jets and other aircraft. However, due to the current deficit of T-hangars, apron tie-downs are more heavily utilized than illustrated, and are therefore needed until a sufficient number of T-hangars can be constructed at FPR. The long-term demand for conventional hangar development is consistent with Honeywell's anticipated growth in deliveries of large corporate jets.

TABLE 4-27 AREA SURPLUS (DEFICIT) DETERMINATION				
Year	**Aircraft Requirement**	**Area Requirement**	**Current Availability**	**Surplus (Deficit)**
Apron Tie-down Requirement				
2008	76	37,875 SY	100,000 SY	62,125 SY
2013	83	41,625 SY	100,000 SY	58,375 SY
2018	92	46,125 SY	100,000 SY	53,875 SY
2023	102	51,125 SY	100,000 SY	48,875 SY
2028	114	57,125 SY	100,000 SY	42,875 SY
T-Hangar Requirement				
2008	61	76,250 SF	20,000 SF	(56,250 SF)
2013	65	81,250 SF	20,000 SF	(61,250 SF)
2018	70	87,188 SF	20,000 SF	(67,188 SF)
2023	75	93,750 SF	20,000 SF	(73,750 SF)
2028	81	101,563 SF	20,000 SF	(81,563 SF)
Conventional Hangar Requirement				
2008	74	285,625 SF	300,000 SF	14,375 SF
2013	85	346,875 SF	300,000 SF	(46,875 SF)
2018	98	410,000 SF	300,000 SF	(110,000 SF)
2023	113	489,375 SF	300,000 SF	(189,375 SF)
2028	134	606,250 SF	300,000 SF	(306,250 SF)

Source: The LPA Group Incorporated, 2009.
Note: Numbers may not add due to rounding.

4.6.2 Transient Aircraft Apron Requirements

It is also important to reserve apron space for transient aircraft parking. Since these visiting aircraft can range in size from small single-engine pistons to large jets, and also need to be able to quickly maneuver under their own power, they require more space than based aircraft. Transient aircraft operations at FPR may include corporate jet charters conducting passenger drop-offs and pick-ups, or a vacationing family leaving their plane for multiple days. However, the majority of transient aircraft only require apron space for a short amount of time.

The current availability of transient apron space at FPR is approximately 65,000 square yards and is located directly in-front of each FBO's terminal area and also at the Airport Administration Building and U.S. CBP facility. Because of varying aircraft sizes, it was determined that the requirement per transient aircraft should equal twice that of a based aircraft, or 1,000 square yards per aircraft. The itinerant peak hour operations forecast in **Table 3-28** represents the maximum number of transient aircraft operations that would be expected at FPR during any given hour of the planning period. Since each operation represents a landing and a takeoff, parking requirements were based upon half of the peak hour operations. Those values were applied to determine the transient apron requirements presented in **Table 4-28**.

TABLE 4-28
TRANSIENT APRON REQUIREMENT

Year	Itinerant Peak Hour Operations	Area Requirement Per Aircraft	Total Area Requirement[1]	Current Availability	Surplus (Deficit)
2008	56	1,000 SY	28,000 SY	65,000 SY	37,000 SY
2013	61	1,000 SY	30,500 SY	65,000 SY	34,500 SY
2018	66	1,000 SY	33,000 SY	65,000 SY	32,000 SY
2023	73	1,000 SY	36,500 SY	65,000 SY	28,500 SY
2028	81	1,000 SY	40,500 SY	65,000 SY	24,500 SY

Source: The LPA Group Incorporated, 2009.
Notes:
(1) Total area required is ½ peak itinerant operations multiplied by 1,000 SY
(2) Numbers may not add due to rounding.

As shown, the transient apron area is sufficient to handle current demands throughout the planning period unless limited commercial service occurs. However, as mentioned earlier, the large availability of based aircraft apron should be able to accommodate any overflow demands of transient aircraft throughout the planning period if new hangars were constructed. In any event, the FBOs should still consider these transient apron requirements as a guideline for their long-term development initiatives.

4.6.3 Fixed Base Operator (FBO) Facilities

The airport's *General Aviation Minimum Standards* defines the minimum requirements of the airport's FBO facilities including sizes of the leased premises, staffing, rates and charges, insurance, services provided, etc. This section presents the sizing requirements for the FBOs' terminal facilities based on forecasts of peak hour passengers. According to **FAA AC 150/5070-6**, *Airport Master Plans*, "General aviation terminal buildings range from very modest structures with little more than a waiting room and a telephone to multi-story buildings with extensive amenities such as pilot briefing rooms, restaurants, gift shops, pilot's lounges, conference and training rooms, and rental car counters."[47]

[47] *FAA AC 150/5070-6B, Airport Master Plans, page 55.*

The *FDOT's Guidebook for Airport Master Planning* indicates that terminal planning should consider a factor of between 40 square feet to 100 square feet per pilot and passenger during the peak hour, which represents the highest anticipated use of the terminal at any given time. To estimate the peak hour pilots and passengers, the following assumptions were made:

- Only itinerant operations would be counted in the terminal demand. Local operations would not necessarily be using the FBO's terminals since they are typically associated with touch-and-go training operations.
- Since arriving and departing pilots and passengers could use the FBO facilities at the same time, the number of itinerant peak hour operations was not adjusted.
- Total pilots and passengers per itinerant peak hour operation equals 5. This is assumed to represent a high value considering the current mix of itinerant operations at FPR which tend to be smaller aircraft. However, with the anticipated increase in larger corporate jets, a pilot/passenger value of 5 was determined to best represent the future itinerant mix.
- An area of 75 square feet for each pilot/passenger was used to determine space requirements. This value per pilot/passenger incorporates all functions of a full service terminal building including FBO counter, waiting area, snack room, pilot's lounge, restrooms, etc. The FDOT's maximum recommendation of 100 square feet for each pilot/passenger is typically reserved for terminals that experience high passenger volumes every day rather than the seasonal variation currently experienced at FPR.

Accordingly, the itinerant peak hour forecast in **Table 3-28** were applied to the assumptions above to calculate the FBO terminal requirements presented in **Table 4-29**. The FBOs should review these requirements against their own terminal development plans and respective market shares at FPR to sufficiently provide for future facilities. The ability to expand is always an important consideration for terminal development; therefore, areas around their existing or proposed terminals should be reserved for that purpose.

TABLE 4-29 FBO TERMINAL REQUIREMENT				
Year	Itinerant Peak Hour Operations	Pilots/Passengers Per Operation	Size Requirement Per Pilot/Passenger	FBO Terminal Requirement
2008	56	5	75 SF	21,000 SF
2013	61	5	75 SF	22,875 SF
2018	66	5	75 SF	24,750 SF
2023	73	5	75 SF	27,375 SF
2028	81	5	75 SF	30,375 SF

Source: The LPA Group Incorporated, 2009.
Note: Numbers may not add due to rounding.

4.6.4 Vehicle Access and Parking

Vehicle Access

Previous studies such as the *Economic Development Strategic Plan for FPR, Fiscal Years 2003-2008*, prepared by Indian River Community College, identify access issues to FPR from major highways primarily because of a lack of signage for identifying the airport location. In the years since that report, efforts have been undertaken to better identify the airport location, including the installation of signs at Interstate 95 and major intersections around the airport. As mentioned in **Chapter 2**, the *St. Lucie County Annual Capital Improvements Element Update*, dated November 26, 2008, identifies several improvement projects for county, state, and federal roadways within the vicinity of FPR that are slated for the five-year period 2009-2013, including improvements to Kings Highway, Indrio Road, and St. Lucie Boulevard. Further, the *St. Lucie County Comprehensive Plan*, revised January 6, 2004, indicates that the widening of both Kings Highway and Indrio Road from two lanes to four[48] lanes will ultimately be necessary to accommodate anticipated service levels by 2025. As such, the county has taken proactive steps for enhancing access to FPR and accommodating future growth in the area.

While general access improvements have been undertaken and are planned for FPR, there are still some on-airport circulation issues that should be addressed. First, upgraded signage may be beneficial so that the location of specific airport tenants can be better identified. Additionally, the on-airport roadway configuration is not designed to provide easy access to every airport tenant; rather, the airport is divided into three distinct development areas that are not interconnected. This requires vehicles to exit the airport property and then travel along St. Lucie Boulevard to access the three areas, which may not be ideal due to long travel

[48] *According to Table 2-8 of the 2025 St. Lucie/County Transportation Plan, St. Lucie County Comprehensive Plan, Transportation Plan– March 5, 2002 and Revised January 2004.*

lengths. Where possible, the *Alternatives Analysis* in **Chapter 5** investigates opportunities for providing on-airport connections between these areas.

Vehicle Parking

Vehicle parking requirements for St. Lucie County are defined in the *Land Development Code, St. Lucie County, adopted May 19, 2009*. Chapter 7 of the *Land Development Code* identifies requirements for "Off-Street Parking and Loading." The use category that most appropriately fits airport tenant operations is "General Business or Personal Service Establishments," which includes a requirement of 5 vehicle parking spaces per 1,000 square feet of floor area. It is anticipated that this requirement is sufficient for most tenant operations, although the FBOs may require additional space for rental cars and service vehicles, and restaurants such as the Airport Tiki may require as much as 16 vehicle parking spaces per 1,000 square feet.[49] Further, if commercial airline service were initiated at FPR, the need to accommodate overnight parking and rental car parking would need to be considered, which are not defined in the *Land Development Code*. Compliance with these vehicle parking guidelines would be required for the development of any new facilities at FPR. **Table 4-30** identifies the requirements for handicapped vehicle parking spaces.

TABLE 4-30
HANDICAPPED PARKING REQUIREMENTS

Total Number of Required Parking Spaces	Number of Required Handicapped Parking Spaces[1]
0 – 15	1
16 – 25	2
26 – 50	2
51 – 75	3
76 – 100	4
101 – 150	5
151 – 200	6
201 – 300	7
301 – 400	8
401 – 500	9
501 – 1,000	2% of total required parking
1,000+	Minimum of 20, plus 1 additional space for each 100 parking spaces over 1,000

Source: Land Development Code, St. Lucie County, Table 7-20.
Note:
(1) The number of required handicapped parking spaces may be included within the gross number of required parking spaces.

[49] *Land Development Code, St. Lucie County, adopted May 19, 2009, Chapter 7.06.00.*

These vehicle parking requirements will be used to identify parking areas for new facilities identified in **Chapter 5**. Further, many existing facilities do not have sufficient vehicle parking due to their development prior to the establishment of the *General Aviation Minimum Standards* on December 4, 2007. For example, the parking area adjacent to the Airport Administration Building and APP Jet Center of Ft. Pierce currently serves various tenants and most likely does not conform to the *Land Development Code*. Other tenant facilities have no direct vehicle or pedestrian access without having to enter the apron areas, which is an awkward layout that should be corrected. Correction of these vehicle access and parking areas will also be investigated in **Chapter 5**.

4.6.5 Aircraft Fueling

According to the *Minimum Standards,* the "FBO shall construct or install and maintain an on-airport aboveground fuel storage facility at the airport…Fuel storage facility shall have total capacity for three (3) days peak supply of aviation fuel for aircraft being serviced by FBO." The *Minimum Standards* requires the FBOs to maintain the following fuel storage capacities for Jet-A and Avgas (100LL):

- Jet-A – 20,000 gallons total storage (including tanks and trucks)
- AvGas – 15,000 gallons total storage (including tanks and trucks)
- Adequate secondary containments
- Demonstrated ability for future expansion capability
- Two Jet-A refueling vehicles
- Two AvGas refueling vehicles

As described in **Chapter 2**, the airport's two FBOs provide self-service AvGas fueling as well as full-service AvGas and Jet-A fueling. APP Jet Center of Ft. Pierce has one 20,000-gallon AvGas tank and one 20,000-gallon Jet-A tank; Key Air has one 12,000-gallon AvGas tank and two Jet-A tanks with a total Jet-A capacity of 24,000 gallons. Per the requirements of the *Minimum Standards*, each FBO also has trucks to provide aircraft curbside fueling. The Ari Ben Aviator flight school also stores AvGas specifically for their training operations. Therefore, through a combination of aboveground fuel tank and fuel truck storage, both APP Jet Center of Ft. Pierce and Key Air currently comply with the minimum storage requirements for AvGas and Jet-A as outlined in the *Minimum Standards*.

In order to determine if the FBOs current fuel storage facilities could accommodate the three day peak supply requirement of the *Minimum Standards*, it was necessary to conduct a forecast of AvGas and Jet-A flowage from historical fuel data from the airport. The forecast effort included an evaluation of historical AvGas flowage to historical AvGas operations (i.e., piston-powered aircraft) as well as historical Jet-A flowage to historical Jet-A operations (i.e., turbine-powered aircraft). That evaluation provided the following ratios of average gallons per AvGas and Jet-A operations which were then applied to the forecasts of activity by aircraft type (**Table 3-26**) to determine the future annual flowages shown in **Table 4-31**:

- **Jet-A Gallons/Operation Ratio** – 88 Gallons/Operation
- **AvGas Gallons/Operation Ratio** – 4 Gallons/Operation
- **Average Peak Day Percent of Annual Operations** – 0.43%

TABLE 4-31
FUEL STORAGE REQUIREMENTS

Year	Jet-A			AvGas		
	Annual Operations	Annual Flowage	3-Day Peak Supply	Annual Operations	Annual Flowage	3-Day Peak Supply
2008	12,195	1,073,123	13,877	148,082	592,330	7,659
2013	15,162	1,334,219	17,253	160,949	643,797	8,325
2018	18,651	1,641,306	21,224	176,220	704,878	9,115
2023	23,465	2,064,880	26,701	193,742	774,969	10,021
2028	30,193	2,656,965	34,357	213,406	853,623	11,038

Source: Airport fuel records, The LPA Group Incorporated, 2009.

By utilizing the percentage of average day peak month (ADPM) operations to annual operations in **Table 3-28**, (i.e., 0.43 percent), the fuel storage requirement for a three-day peak supply was calculated as shown in **Table 4-31**. Subsequently, it was determined this supply requirement could be satisfied by the FBO's current fuel storage facilities throughout the twenty-year planning period. However, the FBOs may wish to have additional fuel storage on-hand to accommodate a longer duration (e.g., one week), depending upon their individual needs, delivery requirements, and unexpected demand. For this reason, the requirement of the *Minimum Standards* for the fuel farms to have demonstrated ability for future expansion capability should be strictly adhered to.

4.7 Airport Support Facilities

Airport support facilities provide a broad set of functions that ensure the smooth, efficient, and safe operation of the airport.[50] There are many different airport facilities that could fit this evaluation category, including some discussed in previous sections. For FPR, the support facilities were identified as the ATCT, the U.S. Customs CBP facility, and the ARFF facility. Based on FPR's existing and anticipated activity and role, these facilities are considered vital for the continued operation of the airport in a safe and effective manner.

[50] *FAA AC 150/5070-6B, Airport Master Plans, page 57.*

4.7.1 Air Traffic Control Tower (ATCT)

As described in **Chapter 2**, the existing ATCT was constructed in 1985 and is located on the west side of the airport. With the recent construction of training Runway 10L-28R, there was initially some line-of-sight concerns because of tall trees and brush which impacted ATCT visibility. However, at the time of this writing, the trees and other obstructions to ATCT visibility were being removed. Still the ATCT's age and condition may require rehabilitation in the short-term. Considering these factors, as well as the potential for future commercial service at the airport, the *Alternatives Analysis* in **Chapter 5** evaluates the current location of the ATCT, as well as potential alternative locations for a new ATCT on the airport property. Based on the FAA criteria established in **FAA AC 150/5300-13**, *Airport Design*, the ATCT site should range between one and four acres and must meet the following clearance requirements:

1. "There must be maximum visibility of the airport's traffic patterns.
2. There must be a clear, unobstructed, and direct line of sight to the approaches, to all runways or landing areas, and to all runways and taxiway surfaces.
3. Most ATCTs penetrate Part 77 Imaginary Surface. A tower penetrating a Part 77 Imaginary Surface is an obstruction to air navigation. As such, it is presumed to be a hazard to air navigation until an FAA study determines otherwise.
4. The ATCT must not derogate the signal generated by any existing or planned electronic NAVAID or an ATC facility.
5. The proposed site must be large enough to accommodate current and future building needs, including employee parking spaces."[51]

4.7.2 U.S. Customs and Border Protection (CBP)

The primary mission of the U.S. CBP is the prevention of terrorists and terrorist weapons into the United States and the processing of passengers and goods. In an effort to improve efficiency, U.S. CBP and Federal Inspection Stations (FIS) were combined in 2003. Due to the age and mission of the U.S. CBP at FPR, relocation and/or reconstruction of existing facilities were considered as part of the *Airport Alternatives Analyses*, **Chapter 5**. Utilizing U.S. CBP Airport Technical Design Standards for Passenger Processing[52], general facility requirements were identified for FPR based upon current operations and anticipated limited commercial service (i.e. greater than 20 passengers and crew).

The current US CBP facility, which is adjacent to the Airport Administration Building, is approximately 8,000+ square feet. According to US Custom's personnel, the facilities are old

[51] *FAA AC 150/5300-13, Airport Design, page 65.*

[52] US Department of Homeland Security, US Customs and Border Protection, *Airport Technical Design Standards for Passenger Processing Facilities*, August 2006 (http://www.dhsprojects.com/SAS-DO-SO/CBPAirportTechnicalDesignStandards.pdf).

and outdated. Further, processing is limited to a total of 20 passengers and crew. If FPR plans to service larger aircraft operating outside the United States, than the U.S. Customs facility would need to be updated to accommodate commercial service. Due to increased border control requirements, customs and border protection preclearance in foreign countries may be allowed to facilitate the movement of passengers and cargo. This option is being considered if limited commercial service to and from the Bahamas is initiated at FPR in the short-term. General Aviation standards prior to 2003 are no longer considered acceptable; therefore, the US CBP requirements for a GA airport must now comply with stricter requirements similar to a commercial airport processing facility.

According to U.S. CBP guidance, the size of the passenger processing facilities is dependent upon the number of passenger processed at the peak hour operation and by the number of aircraft arriving during a set time period. The criterion is as follows:

US CBP Designation	*Passenger Per Hour*
General Aviation Facilities	20 passengers or less per aircraft (Refer to Chapter 8 for GAF standards)
Small Airports	Less than 800 passengers per hour
Low volume mid-size airports	800 to 1,400 passengers per hour
High volume mid-size airports	1,400 to 2,000 passengers per hour
Large airports	2,000 passengers or more per hour
Source: U.S. Customs and Border Protection, ***Airport Technical Design Standards for Passenger Processing Facilities****, August 2006, Page 2-1*	

Based upon this criterion, the minimum spacing requirements are shown in **Table 4-32.** Airport authorities considering the construction of a new or the renovation of an existing passenger processing facility should involve CBP during the early stages of project planning.

TABLE 4-32 U.S. CUSTOMS AND BORDER PROTECTION MINIMUM SPACE REQUIREMENTS	
US CBP Designation	**Minimum Spacing Requirements (SF)**
General Aviation	1,474
Small Airports	
200 passenger per hour	15,412
400 passenger per hour	18,933
600 passenger per hour	22,514
Low Volume Mid-Size Airports	
800 passengers per hour	30,384
1200 passengers per hour	38,461
High Volume Mid-Size Airports	
1400 passengers per hour	44,445
1800 passengers per hour	54,627
Large Airports	
2000 passengers per hour	64,445
3000 passengers per hour	87,052
4000 passengers per hour	106,377
5000 passengers per hour	125,258

Source: U.S. Customs and Border Protection, ***Airport Technical Design Standards for Passenger Processing Facilities,*** *August 2006, Pages 51 and 52*

4.7.3 Aircraft Rescue and Firefighting (ARFF)

The FAA assigns specific ARFF requirements for commercial airports in **FAR Part 139**, *Certification of Airports*. The ARFF requirements are contingent upon the largest air carrier aircraft operating at the airport (in terms of length and wingspan) with at least five average daily departures, which determines the ARFF Index as shown in **Table 4-33**. Since no air carrier aircraft currently operate at FPR, the Part 139 ARFF requirements are not applicable even though there is currently an ARFF facility at FPR. However, this is a joint-use firefighting facility for St. Lucie County and the airport, and as such is equipped with many of the vehicle, equipment and chemical agent requirements as required under Part 139. If commercial operations are ultimately pursued at FPR, it is anticipated that an ARFF Index of B or greater would be necessary to satisfy most common air carrier aircraft.

TABLE 4-33 ARFF INDEX DETERMINATION		
ARFF Index	**Air Carrier Aircraft Length**	**Sample Commercial Aircraft**
Index A	< 90 Feet	Q300 Turboprop, ERJ 135
Index B	≥90 Feet <126 Feet	Embraer 175, Boeing 737-700
Index C	≥126 Feet <159 Feet	Boeing 737-800, Airbus A321-200
Index D	≥159 Feet <200 Feet	Boeing 767-300ER, Airbus A300-600
Index E	>200 Feet	Boeing 747-400, Airbus A380-800
Source: FAR Part 139, The LPA Group Incorporated, 2009.		

4.8 Potential Commercial Service Terminal Requirements

As mentioned throughout this chapter, the potential exists for FPR to attract commercial airline operations at some point during the twenty-year planning period. This stems from the growing capacity problems at commercial airports like PBI, as well as mutual interest between the St. Lucie County Tourism Development Council and the Grand Bahamas Chamber of Commerce. Therefore, the St. Lucie County BOCC recently requested the potential reconfiguration of the existing Airport Administration Building to accommodate limited commercial service, with the intent of encouraging job growth, airport development, and tourism. In addition, airport staff is preparing the Airport Certification Manual (ACM) and working on a security plan in the event that the BOCC recommends proceeding with FAR Part 139 service.

Thus, in an effort to accommodate limited commercial service in the short-term, two limited terminal options as shown in **Table 4-34** were developed based upon the existing Airport Administration Building footprint (3,380 SF) and anticipated peak hour passenger demand assuming one daily flight (two operations) of the DH8 300Q aircraft.

TABLE 4-34 LIMITED COMMERCIAL TERMINAL OPTIONS		
Minimum Design Criteria		
Design Aircraft		DH8 300Q
Peak Hour Passenger Enplanements*		48
Estimated Terminal Design Requirements		
Facilities	**Option 1**	**Option 2**
Mechanical	~105 SF	~105 SF
Utility	~315 SF	~315 SF
Circulation	~180 SF	~240 SF
Passenger and Security Facilities	~3,000 SF	~3,000 SF
Training/conference room (10 people)		~250 SF
Work area (storage/copy)		~210 SF
Four (4) offices (130 SF each)		~520 SF
Net Total Requirements	**~3,600 SF**	**~4,640 SF**
Source: The LPA Group Incorporated, 2009. *Notes: *Assumes 95% load factor of 50 seat aircraft*		

Although reuse of the existing Airport Administration building is a viable option for limited scheduled commercial service, it is recommended that long-term commercial terminal requirements reflect the requirements outlined in **FAA AC 150/5360-13**, *Planning and Design for Airport Terminal Facilities*, and **FAA AC 150/5360-9**, *Planning and Design for Airport Terminal Buildings at Nonhub Locations*.

As previously shown in **Table 4-1**, if commercial service is pursued, it is likely that FPR would be considered a "primary – nonhub" or "non-primary" commercial airport in the NPIAS. These types of airports typically do not experience high levels of annual passenger enplanements, but must still provide all facilities and services necessary to effectively process passengers. According to the *Nonhub AC*, "Approximately 10 to 12 acres are needed to accommodate a minimum-size terminal, a roadway system, and aircraft and auto parking. Terminal facilities can be housed in approximately 6,000 to 8,000 square feet, exclusive of mechanical, utility, or building maintenance areas."[53] This should be considered the ultimate minimum requirement for a commercial passenger terminal facility at FPR.

Further the *Airport Terminal AC* recommends consideration the following siting characteristics:

- **Runway Configuration** – The runway configuration needs to be considered when determining an appropriate terminal location. Further, runway usage and traffic flow are important factors. A centralized location is preferred to limit taxiing times and

[53] *FAA AC 150/5360-9, Planning and Design for Airport Terminal Buildings at Nonhub Locations, page 50.*

potential conflicts with non-commercial airport operations. Therefore, a centralized location to primary Runway 10R-28L should be selected which does not require long taxiing distances for aircraft operations.

- **Access to Transportation Network** – Access to the terminal and main travel roadways in the vicinity is also important. At FPR this includes U.S. Interstate 95, U.S. Route 1, St. Lucie Boulevard, Kings Highway, and Indrio Road. Also, as mentioned earlier, signage improvements for identifying the airport location were recently implemented. Further improvements may be necessary if commercial service is pursued at FPR.
- **Expansion Potential** – To allow for a phased development plan and unexpected growth, all terminal components should incorporate future expansion capability. This is particularly important considering frequent changes in Transportation Security Administration (TSA) and FAA policies, as well as upgraded equipment, which may require building alterations or expansions.
- **FAA Geometric Design Standards** – Separation criteria for all airfield and apron components is critical. Adequate clearances are needed for airline parking and the terminal building itself. Adherence to other FAA criteria for obstructions, security, etc. is also necessary.
- **Existing and Planned Facilities** – Where possible, impacts to existing facilities should be avoided. However, if a favorable layout necessitates the relocation of existing facilities then it may be worthwhile to investigate the associated costs and impacts. This also applies to planned facilities. At FPR, many of the open land areas around the airfield are currently leased by airport tenants with long-term development plans for those properties. If a preferred passenger terminal concept enters their leasehold, then the airport may want to discuss options for land swaps, renegotiation of lease, etc., with the airport tenant, if appropriate.
- **Terrain** – Consideration of the physical characteristics of the land, including elevation, drainage, etc. is also important. Further, the availability of utilities should be evaluated.
- **Environmental Impacts** – Much of FPR's property contains wetland areas and mitigation areas that were required from previously-constructed projects. Impacts to wetlands and other environmental features have the potential to require extensive environmental analysis and mitigation costs.

Since federal funding assistance for a commercial terminal facility at FPR would not be expected and FDOT funding may be limited to only 50 percent of the total cost, it is particularly important for the St. Lucie County BOCC to carefully consider these siting characteristics. It may be possible to make use of existing developed areas and apron to limit overall costs and impacts, depending upon the ability for those areas to accommodate aircraft parking requirements and the anticipated number of passenger enplanements. As such,

Chapter 5 identifies potential opportunities for terminal development in both existing developed and undeveloped areas around the airport in order to accommodate potential commercial service.

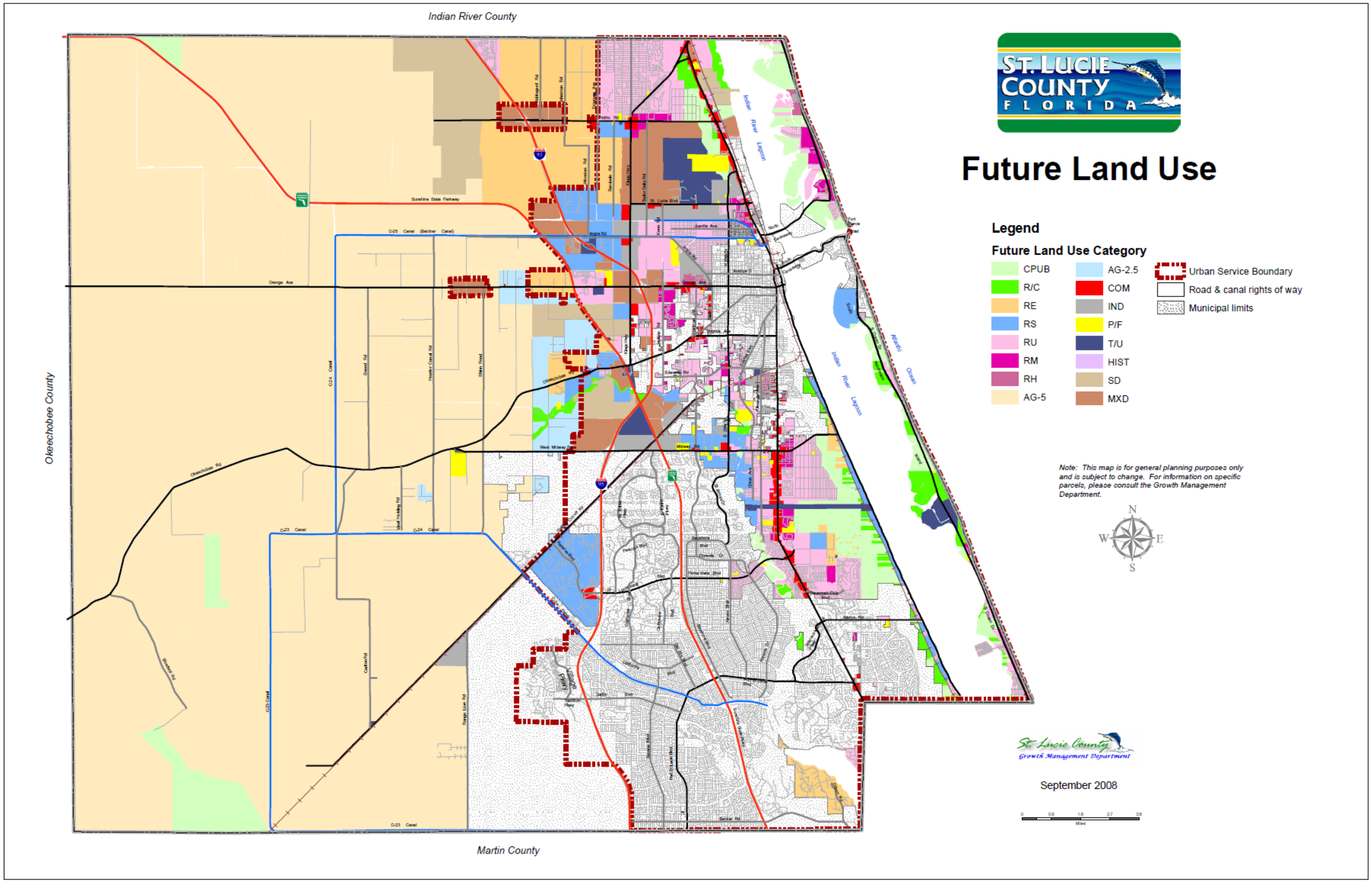
4.9 Land Use

FPR encompasses approximately 3,844 acres which is owned by St. Lucie County. Of this property, approximately half is currently used for aviation. The property is surrounded by a combination of residential, agricultural, commercial, industrial and conservation type land use as shown in **Figure 4-14**. However, St. Lucie County is currently updating their future land use to incorporate proposed commercial and mixed use development. Zoning codes associated with the existing airport property and contiguous property is detailed with the St. Lucie County Zoning Map, **Figure 4-15**.

Due to the location of residential development northwest, southeast and east of the airfield, a voluntary noise mitigation program was implemented in 2005 as a result of the findings of the 2005 Noise Study. Also, in an effort to further mitigate noise, the airport working with the FAA to complete the construction of a new training runway (Runway 10L-28R) north and west of the primary runway, 10R-28L. This Master Plan Update will not only review the effectiveness of existing noise mitigation measures but also will assess potential impacts associated with fleet mix changes including increased use of business jet aircraft and the potential for commercial aircraft service.

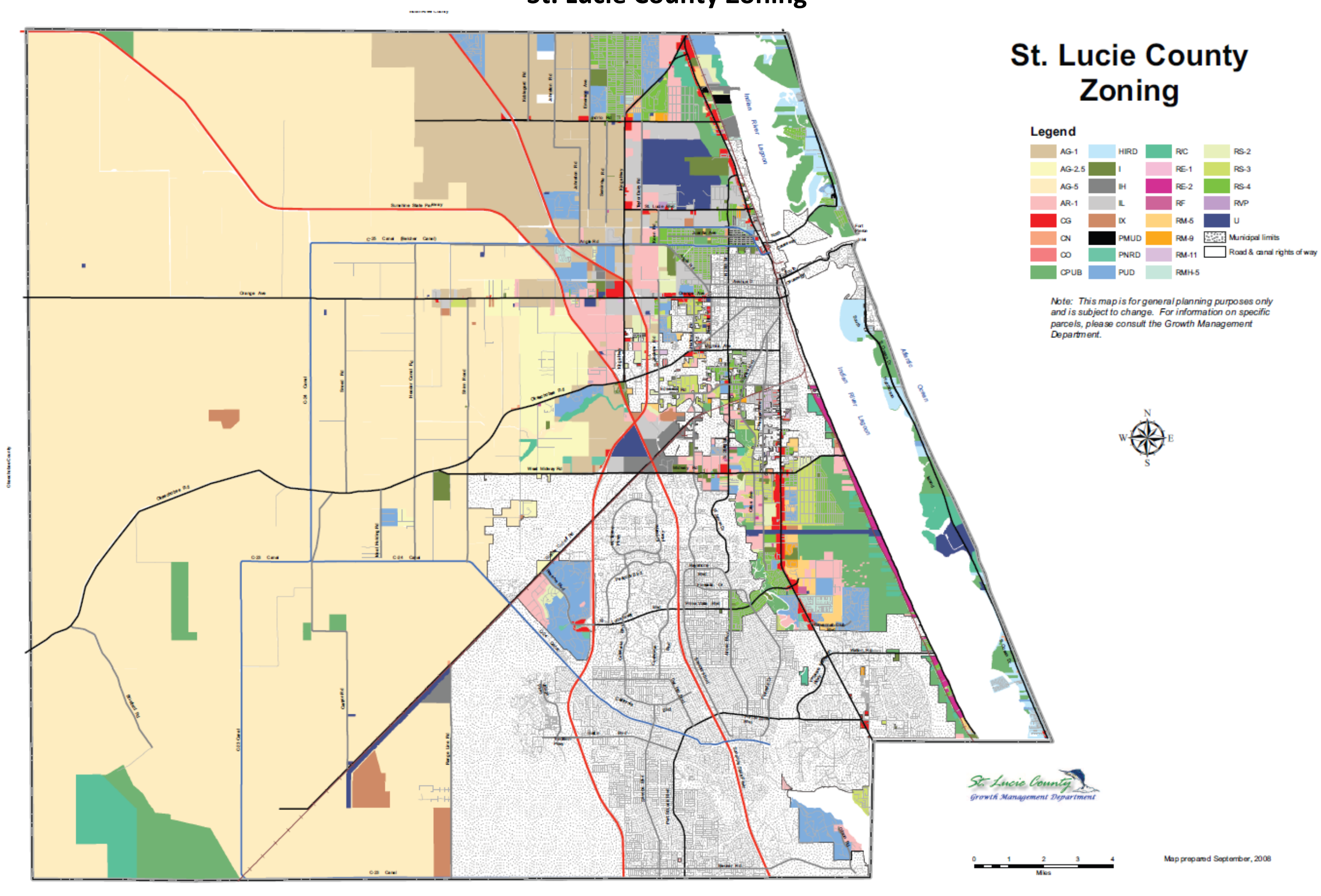
As a result, any recommended development of airport property must consider the impacts to airport operations as well as impacts to the surrounding community. First St. Lucie County must ensure that property is reserved to provide for all airfield, hangar, apron and other aviation support to accommodate the communities' long-term vision beyond the twenty-year planning period as requirements are identified. An analysis of potential land use and proposed airport development is presented in detail in **Chapter 5**, *Airport Alternatives Analysis*.

Figure 4-14
St. Lucie County Future Land Use



Source: St. Lucie County Growth Management, September 2008

Figure 4-15
St. Lucie County Zoning



Source: St. Lucie County Growth Management, September 2008

St. Lucie County should evaluate any remaining property for potential economic use, including commercial and industrial development, to determine if sufficient revenue can be produced to supplement existing and future aviation needs. However, only compatible non-aviation development will be considered. St. Lucie County already has infrastructure in place for industrial and commercial development on airport parcels on the southwestern portion of the airport called Airport West Commerce Park, and the next area planned for development is northwest corner of Curtis King and St. Lucie Blvds. Also, according to the 2007 Airport Layout Plan and draft County land use plan, the northern property adjacent to Indrio Road are designated as industrial or mixed use, respectively. As part of the *Airport Alternatives Analyses*, **Chapter 5**, the highest and best use for existing property will be evaluated. The recommendations of this master plan will be graphically illustrated in the airport layout plan and incorporated into the County's Comprehensive Plan. It, however, should be noted that Florida growth management laws, concurrency requirements, FAA land use compatibility and airports criteria, and St. Lucie County's own ordinances may limit development of these properties.

According to existing *St. Lucie County Comprehensive Plan*, "The County reserves the right to designate specific airport areas in which commercial and non-commercial aeronautical activities may be conducted. Such designation shall be given consideration to the nature and extent of the activities, the land and improvements that area available and the preferred development of the Airport as described in the most recently completed Master Plan, Airport Layout Plan and/or land use plan."[54] As a result, land use development and compatibility will be evaluated in detail as part of the *Airport Alternatives Analysis*.

Further, according to **FAA Order 5100.38**, the sponsor should be strongly encouraged to acquire fee title to all land within the runway protection zone, with first priority given to land within the object free area. However, an easement, lease or restrictive covenant should be required if fee interest in a parcel is infeasible. … "For projects on new runways and extensions, a comprehensive analysis is necessary if it appears likely fee acquisition may not be attainable upon runway completion. In such a case, a study on alternative airport configurations, which may include airport site evaluation, may be necessary. At minimum, this study must identify costs of fee acquisition, legal constraints, and analysis comparing continued present use with potential reuse of the land. This study may result in a determination by the FAA to phase acquisition or approve less-than-fee property interests." [55]

FPR has a non-standard or partially "uncontrolled" RPZ associated with the approach to Runway 32. Therefore, as part of the *Airport Alternatives Analyses*, fee simple acquisition of

[54] *St. Lucie Comprehensive Plan, Section 1-2.3-83, Land Use. 2006.*

[55] FAA Order 5100.38, Airport Improvement Program Handbook, paragraph 581 and Appendix 7

this property will be considered. If this is not a viable option, than other alternatives including easement, displaced landing thresholds, etc will be considered to limit the potential impacts of incompatible land use. Additional land acquisition, if warranted, will be identified as part of the alternative development options evaluated in **Chapter 5** of this report to maintain compatible land use.

St. Lucie County has worked diligently to be a good neighbor to local residents in areas currently designated as residential by instituting voluntary noise abatement procedures at FPR while continuing to maintain a dialogue with local residents to discuss problems and concerns.

4.10 Summary

The facility requirements addressed in this chapter were determined necessary to satisfy the demand of activity projected for FPR over the next twenty years and beyond. Proposed facilities are outlined in **Table 4-35** and do not reflect any priorities. Alternative development options to meet various facility needs are addressed in the following chapters of this report.

TABLE 4-35 SUMMARY OF FACILITY REQUIREMENTS
Runways
✈ Pavement overlay Runway 10R-28L ✈ Strengthen Runway 10R-28L[1] ✈ Extend Runway 14-32 to 5,700 feet to remove from Runway 10R-28L Object Free Area ✈ Strengthen Runway 14-32 to 60,000 lbs dual wheel[1] ✈ Maintain all imaginary and safety related surfaces ✈ Maintain RPZ, RSA and departure surfaces clear of obstacles
Taxiways
✈ Overlay and Remark Taxiways A, B and C and connectors ✈ Widen Taxiways A, C and E including connectors to accommodate ADG III 50 ft requirements ✈ Extend Taxiway B associated with runway development ✈ Extend Taxiway A west to provide access to Airport West Commerce Park and to accommodate commercial runway requirements ✈ Provide run-up pads along Taxiway A, Taxiway E, Taxiway B and adjacent to the Training Runway
Additional Airfield Facilities
Navigational Aids, Lighting and Electrical Vault ✈ Add approach lighting to Runway 10R (ODALS/MALSR)[1] depending upon approach visibility ✈ Upgrade Runway 10R-28L to HIRLs ✈ Add REILs to Runways 28L, 14, 32, 10L and 28R ✈ Replace VASIs and add PAPIs to Runways 28L, 14, 32, 10R, 10L & 28R ✈ Add runway lights associated with proposed improvements ✈ Add taxiway lights associated with proposed improvements ✈ Maintain all runway and taxiway lighting, as needed ✈ Expand existing electrical vault and upgrade vault regulators ✈ Add or relocate primary wind cone and add supplemental wind cones ✈ Upgrade to high intensity rotating beacon (L-802A)
Signage ✈ Add/replace and refurbish airfield signage as necessary ✈ Add distance to go markers and signage on Runways 10R-28L and 14-32
Pavement Markings ✈ Periodic remarking of all pavement surfaces associated with pavement overly and general maintenance. ✈ Add Runway Hold Lines associated with runway extension
GA Facilities
✈ Construct 65 T-Hangars ✈ Construct an additional 300,000+ square feet of Conventional Hangar storage ✈ Provide tie-down space for transient aircraft parking
Commercial Facilities (See Table 5-7, Minimum Commercial Service Requirements)
✈ Reserve property for potential Runway Extension ✈ Upgrade pavement strengths ✈ Upgrade pavement markings ✈ Construct Passenger Terminal Facilities

TABLE 4-35 SUMMARY OF FACILITY REQUIREMENTS
✈ Add interior perimeter road ✈ Develop passenger parking facilities ✈ Implement TSA security requirements ✈ Relocate and expand U.S. Customs and Border Protection Facilities
Support Facilities
✈ Relocate fence line associated with Airport Trail and airport operating area ✈ Reserve property for fuel farm expansion ✈ Provide additional parking facilities ✈ Reconstruct U.S. Customs and Border Protections facilities
Access and Infrastructure
✈ Construct internal perimeter road ✈ Construct additional access roads to provide access to aviation and non-aviation facilities ✈ Provide additional parking as needed
Land Use and Acquisition
✈ Acquire airport property (either via easement or fee simple) within Runway 32 RPZ or evaluate alternative options ✈ Develop airport property northwest corner of Curtis King and St. Lucie Blvds. ✈ Reserve property for future commercial aviation development ✈ Reserve property for future non-aviation/commercial development ✈ Identify, if warranted, additional property acquisition
Notes: [1]Depending upon demand, anticipated to occur in the next 10 years. *Source: The LPA Group Incorporated, 2009.*