AIRPORT MASTER PLAN UPDATE

Mansfield Municipal Airport
Mansfield, Massachusetts

AIP #3-25-0028-22-2009

Final Report

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AIRPORT LAYOUT PLAN (ALP)

For reference, a reduced size (11”x17”) ALP set is located at the end of this report before the appendices and contains the following plans:

- Sheet 1: Cover Sheet
- Sheet 2: Existing Facilities Plan
- Sheet 3: Ultimate Airport Layout Plan
- Sheet 4: Pavement History Plan
- Sheet 5: Terminal Area Plan
- Sheet 6: Approach Plans and Profiles
- Sheet 7: FAR Part 77 Surfaces

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1. INTRODUCTION

Mansfield Municipal Airport (the Airport) is a municipally owned, public use, general aviation facility that is located in Mansfield and Norton, Massachusetts. Owned by the Town of Mansfield (the Town), the Airport is subject to the local rules and regulations of both the Towns of Mansfield and Norton. The Mansfield Airport Commission (the Commission) is appointed by the Board of Selectmen and is responsible for control, care, custody, and management of the Mansfield Municipal Airport.

Current membership of the Airport Commission is:

Mr. Louis F. Andrews – Chairman
Mr. Carl Lambrecht – Vice Chairman,
Mr. Philip Finer – Commissioner
Mr. Howard Fiske – Commissioner, Safety and Security Officer
Mr. Robert Andrews – Commissioner

This Airport Master Plan Update (AMPU) was undertaken by the Commission to determine the future role and development needs of the Airport over the next 20 years. The Federal Aviation Administration (FAA) recommends that airport master plans be updated every 5 to 10 years, or when significant changes in the airport environment indicate an update is appropriate. In 2001, a Mansfield Airport Plan Update[1] (the 2001 Update) was completed. Since that time, nearly all of the facility improvements recommended in the 2001 Update have been implemented. The Airport is in need of an updated Airport Master Plan to identify the current conditions on the Airport, document future needs, and develop a schedule of improvements.

This AMPU builds on the findings of the 2001 Update, addresses the changes that have taken place at the Airport over the past eight years, and provides new tools for the Commission to use in meeting the future goals of the Airport. It does so by following the guidelines set forth in FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*. This methodical review of Airport facilities begins with data collection, provides a forecast of future activity levels, presents possible development scenarios, and concludes with a schedule of future improvements and project cost estimates.

1.1 Airport Funding

The FAA, the Massachusetts Department of Transportation Aeronautics Division (MassDOT A/D) and the Commission financed this project. The Airport is eligible to receive Federal funding assistance under the FAA's *Airport Improvement Program* (AIP). AIP program funding is provided through an aviation trust fund, funded through "user fees" paid by passengers on commercial flights, aviation fuel taxes, and over-flight fees. As of the

[1] Mansfield Airport Plan Update, Mansfield Municipal Airport, Mansfield, Massachusetts, prepared by HNTB, Inc., August 2001.

preparation of this report, eligible airport improvement projects receive 95% of total project funding through the AIP program. In Massachusetts, the Commonwealth through the MassDOT A/D pays for an additional 2.5% of total project cost. The Commission finances the final 2.5% of total project costs.

Remaining eligible for AIP funding is critical to the well-being, and at times the continued existence, of an airport. In order to remain eligible for FAA funding assistance, an airport must meet all applicable design standards to the maximum extent practicable. These standards are set forth in numerous FAA Advisory Circulars (AC) and Orders. A primary AC that is referenced in this report is AC150/5300-14, *Airport Design*. This AC is commonly referred to as the "Design AC" and it sets forth many of the standards that apply to the Airport. Where airports receive federal funding assistance, the standards in the Design AC are not advisory, but mandatory. Therefore, failure to meet these standards endangers the Airport's ability to access federal funding assistance for eligible capital improvement projects.

Eligible AIP development projects include facilities or equipment associated with the construction or reconstruction (excluding routine maintenance) of an airport. Typical AIP eligible items include:

- airport planning studies;
- land acquisition;
- site preparation and construction;
- alteration and reconstruction of runways, taxiways, aprons, and roads within the airport boundaries;
- construction and installation of lighting, utilities, navigational aids (NAVAIDS), and aviation-related weather reporting equipment;
- safety equipment required for certification of an airport facility;
- security equipment required of the airport sponsor by FAA;
- snow removal equipment (SRE);
- limited terminal development at commercial service airports; and,
- runway surface friction measuring equipment.

Historically, AIP grants were not awarded for the construction of buildings or parts of buildings that are revenue producing or not available for public use, such as hangars, automobile parking facilities, fuel farms, etc., however this has changed. In general, improvements of this type may be funded at airports that meet all FAA standards, regulatory requirements, as well as all safety standards. Funding for these improvements is limited to the Airport's available non-primary airport AIP entitlement.

In order to be eligible for AIP funding, a project or improvement must be shown on an approved Airport Layout Plan (ALP). The ALP is a plan set consisting of several sheets that graphically depict improvements and conditions at an airport. The Master Plan, which accompanies the ALP, provides analysis and justification for depicted improvements and enhancements. This project will provide the Airport with an updated ALP and an updated Master Plan Report. Throughout this report, the updated ALP and Airport Master Plan will be referred to as the AMPU.

1.2 Airport Description

This section provides a brief description of the Airport locus, and the historical background of the Airport and the Commission.

1.2.1 Airport Locus

The Airport consists of approximately 250 acres of land located in the Towns of Mansfield and Norton, Massachusetts. Approximately 195 acres of the Airport property is located within Mansfield. The Town of Mansfield is located in southern Massachusetts, approximately 28 miles south of Boston, and 19 miles north of Providence, Rhode Island. The Airport is located 4 miles south of the Mansfield Town Center. Airport access is via Fruit Street, roughly 1 mile from Route I-495 (Figures 1-1 and 1-2).

Figure 1-1
Town of Mansfield Locus

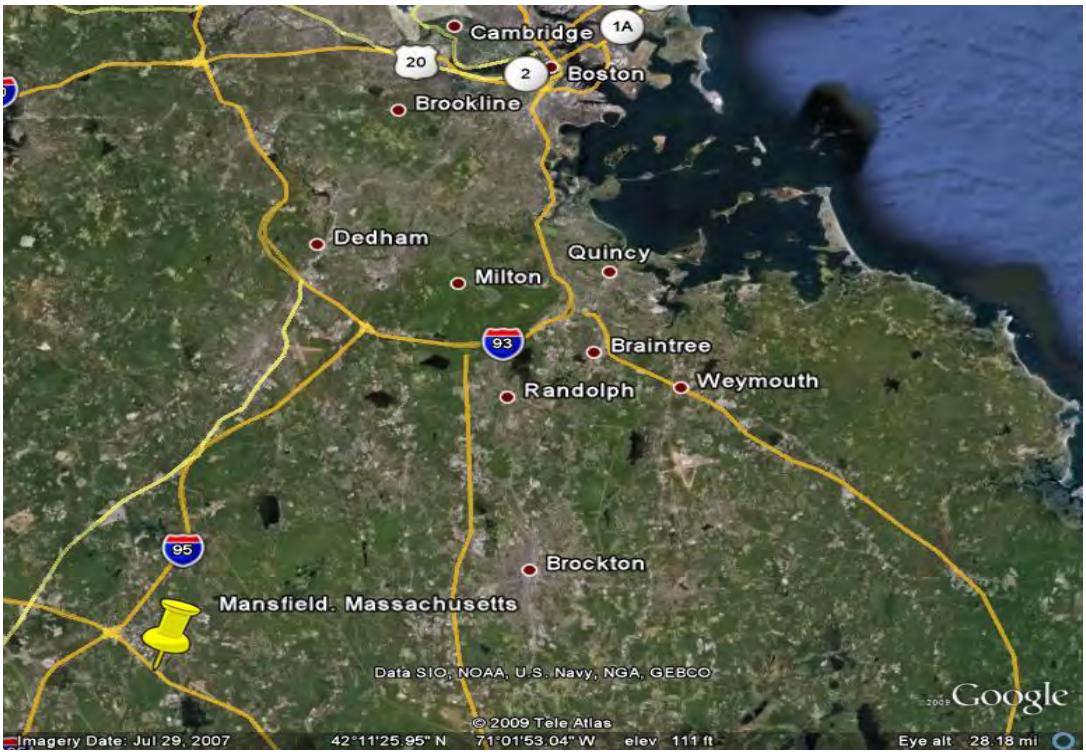
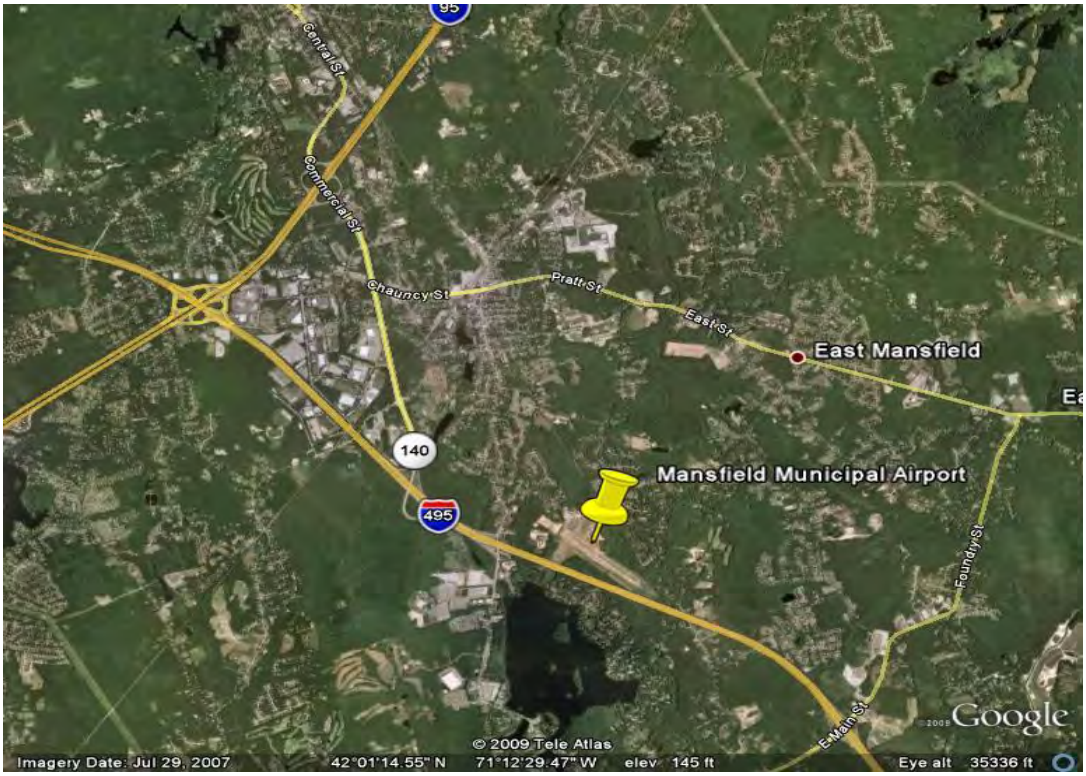


Figure 1-2
Mansfield Municipal Airport Locus



1.2.2 Airport History

The Airport property was originally an equestrian facility known as the "Old Trotting Track" before being developed into an airport by private interests in the 1920s and 1930s. Like many other airport facilities at that time, it was donated to the U.S. government for use as a flight training facility for U.S. Naval cadets during World War II. In 1947, the Town of Mansfield acquired the Airport under the War Surplus Act of 1944.

Record keeping of airport improvements did not begin until 1946, at which time the FAA funded the clearing, grubbing, drainage improvements and installation of turf on the landing strip, as well as construction of the access road and installation of landing strip markers. The Airport remained a mostly turf facility during the early 1950's with two hangar buildings and an administration building existing on the property. In 1955, the Airport became eligible for Federal funding and Runway 14-32 was paved to a length of 3,000-feet. Infrastructure improvements consisting of a parallel taxiway with the installation of a medium-intensity runway light system (MIRLs) were completed during the 1960's. An extension of the parallel taxiway was completed in 1969, as well as an extension to Runway 14-32, making their total length 3,500-feet.

The five member Commission was established in 1971 and was charged with overall responsibility for the Airport and its operations. The Commission initiated its first Airport Layout Plan study in 1971. This study identified several capital improvements for a planning horizon of ten-years. At the conclusion of the ten-year planning horizon, a comprehensive Airport Plan Study was completed. The Airport Plan identified existing facilities, forecasted operations, and identified needed capital improvements through the years 1971 to 1990. This plan was updated in 1984, and again most recently in 2001, as necessitated by changes in Airport operations and FAA facility requirements.

1.3 Airport Objectives

When established, the Commission was charged with the following objectives, which are still current today:

- Develop Mansfield Municipal Airport to meet all Federal and State regulations;
- Provide adequate facilities for current and future demand;
- Enhance the level of safety for both Airport users and the surrounding community; and,
- Maintain the Airport's financial self-sufficiency.

To that end, this report will review existing Airport facilities, establish a forecast of the type and number of operations projected to occur at the Airport during the course of the planning period, identify those Airport facilities that do not meet Federal and State regulations, and develop a proposed schedule of improvements to bring the Airport into compliance with applicable regulations and which will meet the forecasted demand for the Airport.

1.4 How to Use This Report

This Study includes a report consisting of five chapters organized in a progressive format plus a series of plans called the *Airport Layout Plan* (ALP) set that depicts various aspects of the Airport and its proposed future improvements.

Tables: All tables are located in the Chapters and sections to which they apply. At times, cross-references to tables are necessary, but these have been kept to minimum. The tables are identified in numerical sequence starting with the Chapter number so that the third table in Chapter 3 is identified as Table 3-3, etc.

Figures: All figures are found in the Chapters and report sections to which they apply and are numbered sequentially starting with the Chapter number so that the second figure in Chapter 5 is identified as Figure 5-2.

Sheets: "Sheets" refers to the plan sheets contained in the Airport Layout Plan. All sheets are located at the end of this report before the appendices.

Following is a listing of the sheets included in the ALP:

- Sheet 1: Cover Sheet
- Sheet 2: Existing Facilities Plan
- Sheet 3: Airport Layout Plan
- Sheet 4: Pavement History Plan
- Sheet 5: Terminal Area Plan
- Sheet 6: Approach Plans and Profiles
- Sheet 7: FAR Part 77 Surfaces

Table 1-1 provides a brief description of the contents of each ALP plan sheet.

Table 1-1
ALP Sheet Descriptions

Sheet Number	Sheet Title	Description
1	Cover Sheet	Contains basic information identifying the Airport and the plan set.
2	Existing Facilities Plan	Indicates all Airport facilities inventoried for the master plan. All other plan sheets are based on the information shown on this plan.
3	Airport Layout Plan	Indicates potential improvements planned for implementation between 2010 and 2030. This is the official plan sheet referred to by the Commission and funding agencies in making funding decisions.
4	Pavement History Plan	This plan provides general information of the condition and history of the Airport's paved surfaces.
5	Terminal Area Plan	This plan indicates the terminal area improvements shown on Sheet 3 except at a larger, easier to read scale.
6	Approach Plan and Profiles Plan	Shows each runway approach, in plan and profile views, for easier analysis of the condition of the runway approach surfaces with respect to FAA requirements
7	FAR Part 77 Surfaces Plan	Indicates the Airport's Part 77 surfaces in plan view. The plan also shows areas of natural or man-made obstructions to the various surfaces, and indicates where "obstruction lighting" is recommended.

Appendices are attached at the back of the report and include supporting documentation or explanations pertinent to the Study.

2. EXISTING CONDITIONS

Documenting and assessing the existing inventory and condition of Airport facilities provides a solid basis from which facility requirements and improvement recommendations can be made. An on-site inventory of Airport facilities was conducted in June 2009 to supplement information previously obtained through a review of Airport drawings, previous reports, and interviews with airport management and tenants.

2.1 Airside Facilities

The airport facilities required for the movement of aircraft are generally considered to be airside facilities, and include runways, taxiways, navigational aids, and airfield lighting systems. This section will review the existing airside facilities at the Airport.

2.1.1 Runways

The Airport has two runways, Runway 14-32 and Runway 4-22, which are fully described in the following sections. Tables 2-1 and 2-2 present the runway data for both runways.

Table 2-1
Runway Data

	Runway 14-32		Runway 4-22	
Runway Length	3,500'		2,316'	
Runway ARC	B-I		A-I	
Runway Surface	Bituminous Concrete		Turf	
Runway Width	75'		100'	
Runway Condition	Fair		Good	
Pavement Strength	25,000 LB (single-wheel)		N/A	
Runway Lighting	Medium Intensity Runway Lighting System (MIRLS)		None	
Runway Markings	Runway 14: Visual	Runway 32: Non-Precision	Boundary Markers	
Visual Aids	None	Runway 32: PAPI	None	
NAVAIDS	NDB, GPS		None	
Approach Type	Runway 14: Visual	Runway 32: Non-Precision	Runway 4: Visual	Runway 22: Visual
Runway Safety Area Width	120'		120'	120'
Runway Safety Area Length Beyond Runway End	240'		240'	120'
Wind Coverage (10.5 knot crosswind)	86.1%		90.5%	

Table 2-2
Runway End Data

	Runway 14	Runway 32	Runway 4	Runway 22
Latitude **Longitude**	42°00'06.41"N 71°12'07.11"W	41°59'50.79"N 71°11'28.06"W	41°59'58.52"N 71°12'08.53"W	43°00'18.70"N 71°11'55.68"W
Elevation	121.5' MSL	119.5' MSL	117.8' MSL	123.2' MSL
Displaced Threshold **Latitude** **Longitude**	42°00'06.71"N 71°12'01.45"W	41°59'52.05"N 71°11'30.70"W	N/A	N/A
Displaced Threshold Elevation	120.75' MSL	119.5' MSL	N/A	N/A
Threshold Displacement	507.7'	236.6'	N/A	N/A

2.1.1.1 Runway 14-32

The Airport's primary runway, Runway 14-32, has a total paved length of 3,500 feet. Additionally, there is a 75' paved overrun at the Runway 14 end. The Runway has a 508 foot displaced threshold on the Runway 14 end, and a 236 foot displaced threshold on the Runway 32 end. These threshold displacements are caused by obstructions at either end and reduce the landing length available to aircraft using the runway. This runway was last reconstructed in 1993 with 3 inches of bituminous pavement over 8 inches of granular base, and is currently in fair condition with some minor pavement cracking.

There are two Non-Precision Instrument (NPI) approaches to the Airport that provide horizontal navigation information to aircraft using the runway. Runway 32 has a straight-in Non-Directional Beacon (NDB) approach, as well as a Global Positioning System (GPS) approach. Runway 14 has a visual, circling approach only.

Runway 14-32 has standard runway centerline markings. Runway 14 has pavement markings indicating a visual approach and a displaced threshold. Runway 32 has pavement markings indicating a NPI approach and a displaced threshold.

The 1981 Airport Plan (the 1981 Plan) estimated that Runway 14-32 provides 86.1% wind-coverage, assuming a 10.5 knot maximum crosswind.

2.1.1.2 Runway 4-22

The Airport's crosswind runway, Runway 4-22, is a turf runway that is 2,316 feet in length. The runway is well maintained through routine mowing and rolling to foster a safe ground level and compaction rate. The Runway 4-22 thresholds are marked by reflective boundary markings which were replaced in 2009.

Runway 4-22 has visual, circling approaches to both runway ends. Assuming a maximum 10.5 knot crosswind, the 1981 Plan estimated that Runway 4-22 provides 90.5% wind coverage.

2.1.1.3 Runway Safety Areas

A Runway Safety Area (RSA) is typically a turf surface surrounding the runway that is suitable to reduce the risk of damage to an aircraft in the event of undershoot, overshoot, or excursion from the runway. The Design AC requires that RSA must be cleared, graded, and have no potentially hazardous ruts, humps or other surface variations. The RSA must be kept free of obstructions and under most conditions, be capable of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft.

The current Airport Reference Code (ARC) of B-I dictates that the Airport maintain its turf RSA that are 120 feet wide, and extend 240 feet beyond the end of the runway. The Runway 14-32 RSA are compliant with FAA standards. The Runway 14 end RSA is in close proximity to Back Bay Brook. This area is severely eroded and may present a safety concern.

The RSA for Runway 4-22 is required to be 120 feet wide and extend 240 feet beyond each runway end. The existing RSA at the Runway 22 end is not in compliance with FAA standards as it extends only 120 feet beyond the runway end.

2.1.1.4 Navigational and Landing Aids

Aids to navigation provide pilots with information to assist in locating the airport, and to provide guidance during landing. Additionally, navigational aids (NAVAIDs) permit access to the airport during poor weather conditions. This section describes the NAVAIDs at the Airport.

2.1.1.4.1 Non-Directional Beacon

A Non-Directional Beacon (NDB) is a radio system that transmits an airport-specific signal and provides horizontal guidance for an aircraft attempting to land at the Airport. The NDB at the Airport consists of two wooden utility poles 30-feet in height with two antennae wires strung between the poles and an electronics shed on the ground. The NDB is located in Quadrant Four of the Airport, adjacent to the Quadrant Four apron.

Through a statewide maintenance NAVAID contract, the Massachusetts Department of Transportation/ Aeronautics Division maintains the NDB.

2.1.1.4.2 Precision Approach Path Indicator

A Precision Approach Path Indicator (PAPI) is a light system located near the runway end that consists of light boxes that provide a visual indication of an aircraft's position on the glidepath for the runway.

The Airport has a PAPI on Runway 32 which is owned and maintained by the FAA. The PAPI is in good condition.

2.1.1.4.3 Rotating Beacon

A tower-mounted, rotating beacon is located to the north of the Administration Building parking lot. The rotating beacon is used to indicate the location of the Airport at night or during periods of low visibility to pilots. The beacon is controlled by a photo sensor and typically operates from dusk to dawn. The beacon was last serviced in 2006.

2.1.1.4.4 Windsock

A windsock provides visual information on wind direction and speed. The Airport has one lighted windsock, located near the intersection of the two runways, east of the parallel taxiway.

A non-lighted, supplemental windsock is located adjacent to the PAPI at the Runway 32 end.

Windsock

2.1.1.5 Runway Lighting

Runway 14-32 has a Medium Intensity Runway Lighting system (MIRL). The MIRL system is a pilot-activated light system consisting of white, red, amber and green stake-mounted lights. The white lights mark the edges of the runway, and the amber lights identify the last 1,000 feet of the runway for pilots using the non-precision instrument approach. The green lights identify the runway threshold, or the beginning of pavement usable for landing. The red lights identify the displaced threshold and the ends of the runway. The MIRL system was rehabilitated in 1983 and the runway lighting system is currently in fair condition.

2.1.2 Taxiways

This section describes the several taxiways which facilitate aircraft movement on the Airport. Table 2-3 presents a summary inventory of the taxiways on the Airport.

2.1.2.1 Taxiway "A"

Runway 14-32 has a full-length parallel taxiway, designated as Taxiway "A". This taxiway is 30 feet wide and approximately 3,800 feet long, including the stub portions of the taxiway that connect it to Runway 14-32. Taxiway "A" is located approximately 160 feet east of Runway 14-32, measured centerline to centerline. Taxiway "A" is lighted with a Medium Intensity Taxiway Lighting system (MITL). The MITL system, which was installed in 1998, identifies the edge of the taxiway with blue lights.

Table 2-3
Taxiway Inventory

	Taxiway "A"	Taxiway "B"	Taxiway "C"	Taxiway "D"	Taxiway "E"	Taxiway "G"
Type	Parallel taxiway	entrance/exit taxiway, access taxiway	entrance/exit taxiway, access taxiway	access taxiway	entrance/exit taxiway	entrance/exit taxiway, bypass taxiway
Use	provides access to Runway 14-32	used to enter and exit Runway 14-32 near the Runway 14 end; provides access to the Main Terminal Apron	used to enter and exit Runway 14-32 near midfield; provides access to the Quadrant Four Apron	provides access to Quadrant Four from the parallel taxiway	used to enter and exit Runway 14-32 near the Runway 32 end	used to enter and exit Runway 14-32 near the Runway 32 end; bypasses Taxiway "A" at the Runway 32 end
Length	3,811'	approx. 675'	approx. 400'	approx. 700'	257'	230'
Width	30'	30'	30'	30'	30'	30'
Surface Type	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt	Asphalt
Surface Condition	fair with minor cracking	good to fair with minor cracking	Good	good	fair with minor cracking	fair with minor cracking
Edge Lights	MITLS	MITLS	MITLS	MITLS	MITLS	MITLS
Pavement Markings	centerline	centerline	Centerline	centerline	Centerline	centerline

Portions of the taxiway were recently reconstructed and are in good condition, including the segment at the Runway 14 end, north of the Runway 4-22 intersection, and the Taxiway "A" stub at the Runway 32 end. The remaining length of Taxiway "A" is exhibiting signs of aging and is in fair condition, with minor cracks that have been repaired by the Airport.

2.1.2.2 Taxiway "B"

Taxiway "B" includes an entry/exit taxiway stub near the Runway 14 end, and extends to provide access to the Main Terminal Apron. This taxiway is approximately 675 feet long and is 30 feet wide. The stub portion of this taxiway was recently reconstructed and is in good condition. The access portion of this taxiway, east of the parallel taxiway, is in fair condition with some minor cracking.

2.1.2.3 Taxiway "C"

Taxiway "C" includes an entry/exit taxiway near midfield of Runway 14-32, and also provides access to the Quadrant Four Apron. This taxiway is 30 feet wide and approximately 400 feet long. Constructed in 2005, this taxiway is in good condition.

2.1.2.4 Taxiway "D"

Taxiway "D" is a taxiway located south of runway intersection that provides access from Taxiway "A" to Quadrant Four. This taxiway is 30 feet wide and approximately 700 feet long. Constructed in 2005, this taxiway is in good condition.

2.1.2.5 Taxiway "E"

Taxiway "E" is a stub taxiway located near the Runway 32 end. This taxiway is 30 feet wide and approximately 250 feet long, and is used to enter and exit Runway 14-32. This taxiway is in fair condition, and some minor cracks have been repaired by the Airport.

2.1.2.6 Taxiway "G"

Taxiway "G" is a bypass stub taxiway located near the Runway 32 end. This taxiway is 30 feet wide and 230 feet long and is used as a bypass taxiway to enter and exit Runway 14-32. This taxiway is in fair condition, and some minor cracks have been repaired by the Airport.

2.2 Airside Structures & Aircraft Parking

This section documents the aircraft parking and storage facilities on the Airport. The Airport has aircraft parking aprons which provide outdoor storage of aircraft, as well as several hangars which provide indoor aircraft storage.

2.2.1 Aircraft Parking Aprons

The Airport has three aircraft parking aprons which are fully described in this section. Table 2-4 includes an inventory of the aircraft parking aprons on the Airport.

Table 2-4
Aircraft Parking Aprons

Apron	Surface Type	# Tie-Downs	Condition
Main Terminal Apron	Asphalt	65	Good
East Apron	Asphalt	10	Good
Quadrant Four Apron	Asphalt	25	Good

2.2.1.1 Main Terminal Apron

The Main Terminal Apron is located adjacent to the Terminal Building and is approximately 25,400 square yards. This apron can accommodate approximately 65 aircraft and is accessed via Taxiway "B". The Main Terminal Apron was reconstructed in 2000 and is in good condition.

2.2.1.2 East Apron

The East Apron is located east of the Main Terminal Apron and is approximately 2,500 square yards. This apron can accommodate approximately 10 aircraft. The East Apron was reconstructed at the same time as the Main Terminal Apron, in 2000, and is in good condition.

East Apron

2.2.1.3 Quadrant Four Apron

The Quadrant Four Apron is located east of Taxiway "A" and south of Runway 4-22. This apron is accessed via Taxiway "C" and Taxiway "D" and can accommodate approximately 25 aircraft. The Quadrant Four Apron was constructed in 2005 and is in good condition.

2.2.2 Aircraft Hangars

There are several T-hangars, storage hangars, and maintenance hangars on the Airport. This section will address hangars that provide indoor storage of Aircraft. Maintenance facilities will be discussed later in this document. Table 2-5 provides an inventory of the aircraft storage hangars on the Airport. The building identification letters in the table correspond to the building letters on site and also to the identification letters listed in the Facility Legend on Sheet 2, *Existing Facilities Plan,* of the Airport Layout Plan Set (ALP).

Table 2-5
Aircraft Storage Hangar Inventory

Building ID	Building Name	Owner	Storage Capacity	Size (SF)	Condition	Use
C	T-Hangar (Quadrant 1)	Airport Commission	10	11,600	Poor	Aircraft Storage
D	T-Hangar (Quadrant 1)	Airport Commission	10	10,800	Poor	Aircraft Storage
F	Green Hangar	Airport Commission	3	3,600	Fair	Aircraft and Equipment Storage
J	Mansfield Landing Corporate Hangar	Mansfield Landing, LLC.	3	4,050	Good	Corporate Hangar
K	Mansfield Landing Corporate Hangar	Mansfield Landing, LLC	3	4,050	Good	Corporate Hangar
L	Mansfield Landing T-Hangar	Mansfield Landing, LLC	6	7,700	Good	Aircraft Storage
M	Mansfield Landing T-Hangar	Mansfield Landing, LLC	6	7,700	Good	Aircraft Storage
N	Mansfield Landing T-Hangar	Mansfield Landing, LLC	6	7,700	Good	Aircraft Storage

2.2.2.1 T-Hangars

The Airport owns two 10-unit T-hangars (Buildings C and D) which are leased through the Airport's Fixed Base Operator (FBO), King Aviation. These T-hangars are wood framed, metal-skinned hangars that are accessible through multi-panel, sliding metal doors. The T-hangars have no electrical service. According to the 2001 Report, the hangars have asphalt floors that have become uneven and cracked in some areas. Uneven settling has lead to many of the hangar doors hanging unevenly, resulting in

gaps between the doors and the pavement surface. These hangars are currently in poor to fair condition.

The T-hangar taxilanes were repaved in 2007 and the taxilane pavement is in good condition.

2.2.2.2 Green Hangar

The Green Hangar (Building F) is a 60 foot by 60 foot corrugated sheet metal storage hangar located adjacent to the Airport Terminal Building. This hangar is used by the Airport FBO, King Aviation. This building is approximately 3,600 square feet and houses numerous small aircraft and miscellaneous equipment. The building was repainted in 2006 and is currently in fair condition.

Building F – Green Hangar

2.2.2.3 Mansfield Landing Hangars

Mansfield Landing, LLC owns several hangar buildings in Quadrant Four of the Airport. Two corporate hangars (Buildings J and K) are 60 foot by 60 foot buildings that can accommodate approximately 3 aircraft. Three T-hangar buildings (Buildings L, M and N) are approximately 150 feet by 50 feet and accommodate 6 aircraft each. These buildings were constructed in 2005 and are currently in good condition.

Building K – Corporate Hangar

The Mansfield Landing Hangars are accessed by the Quadrant Four taxilanes, which were also constructed in 2005 and are in good condition.

2.2.3 Miscellaneous Airside Structures

2.2.3.1 Maintenance Hangar

Aircraft maintenance at the Airport is provided by Casey Aviation (Building B). Casey Aviation owns and occupies a 32 foot wide by 192 foot long hangar building, located near the FBO hangar, east of the T-hangars. This building is constructed of cinderblock with an asphalt-shingle roof. This building has three hangar bays, each with a multi-panel sliding metal door, and includes a small office area. The Maintenance Hangar is in fair condition.

Building B – Maintenance Hangar

The Maintenance Hangar is accessed via the T-hangar taxilane, which was repaved in 2007 and is in good condition.

2.2.3.2 Other Airside Structures

The Eastern Massachusetts Amateur Radio Group, LLC (EMARG) and the Experimental Aircraft Association (EAA) each own single-wide mobile home trailers at the Airport (Buildings A and E respectively). These structures are each in fair condition.

A Remote Transmitter Receiver (RTR) facility, owned by the FAA, was commissioned in 2000. The RTR provides for ground-to-ground communications between the Airport, FAA, ATCT, and pilots when delivering en-route clearances, issuing departure authorizations, and acknowledging departure and landing times or flight plan cancellations. This structure is located adjacent to the EAA trailer.

Table 2-6
Airport Structure Inventory

Building ID	Building Name	Owner	Size (approx. SF)	Condition	Use
A	EMARG Building	EMARG	600 SF	Fair	CAP Operations
B	Casey Aviation Hangar	Airport Commission	6,000 SF	Fair	Aircraft Maintenance
E	EAA Building	Experimental Aircraft Association (EAA)	600 SF	Fair	EAA Operations

2.3 Landside Facilities

Airport facilities not required for the movement of aircraft are considered to be landside facilities, and usually include such facilities as terminal buildings, fuel storage, other support facilities, and automobile parking.

2.3.1 Airport Buildings

This section provides a description of the structures on the Airport. Table 2-7 provides an inventory of Airport buildings. The building identification letters in the table correspond to the building letters on site and also to the identification letters listed in the Facility Legend on Sheet 2, *Existing Facilities Plan,* of the Airport Layout Plan Set (ALP).

Table 2-7
Airport Building Inventory

Building ID	Building Name	Owner	Size (approx. SF)	Condition	Use
G	Airport Terminal Building	Airport Commission	2,000 SF	Fair	FBO Office, Flight School, Pilot Lounge
H	SRE Building	Airport Commission	6,500 SF	Good	SRE Equipment Storage and Maintenance

2.3.1.1 Airport Terminal Building

The Airport Terminal Building (Building G) is a converted two-story house that was relocated to its current position in 1957. The Terminal Building is located northeast of the Main Terminal Apron, and is accessed via Fruit Street. It is currently leased by the FBO, King Aviation and houses office space and a flight instruction classroom on the second floor. On the first floor of the building is an operations desk, pilots' lounge with vending machines, and restroom facilities. The Airport Terminal Building is currently in fair condition.

Building G –Terminal

2.3.1.2 Snow-Removal Equipment Building

The Snow Removal Equipment (SRE) building (Building H) is located adjacent to the East Apron. This facility was constructed in 2005 and provides storage for the Airport's SRE and maintenance equipment. The SRE building also has a meeting room used by the Airport Commission, and provides storage for the Commission's administrative files. The building is metal sided and has three equipment bays for the storage and maintenance of Airport equipment. The SRE building is in good condition.

Building H – SRE Building

2.3.2 Airport Maintenance Equipment

The Airport Commission currently owns and maintains the equipment detailed in Table 2-8 below, which is used by FBO, King Aviation, for Airport maintenance.

Table 2-8
Airport Maintenance Equipment

Year Equipment Purchased	Equipment Make and Model	Condition
2009	John Deere 544K Plow/Tractor	Good
2008	Ford F-650 Plow Truck	Good
2004	John Deere 5420 Brush Mower/Tractor	Good
2004	John Deere Riding Lawn Mower	Good

2.3.3 Fuel Storage

The Airport has one fuel storage facility which was installed in 1994 and is operated by King Aviation. The facility consists of one 8,000 gallon above ground storage tank (AST) and two free-standing gas pumps that dispense 100LL AvGas. The fuel system is located on the Main Terminal Apron, approximately 100 feet south of the Green Hangar. The fuel tank and pumps are installed on a concrete foundation and are surrounded by 9 foot tall steel bollards. Pavement markings around the tank include stop marks and lead-in lines to facilitate consistency and safety during fueling operations. The tank is currently in good condition.

2.3.4 Security Gates and Fencing

Security fencing is installed around the entire perimeter of the Airport property except along Route 495. The security fence is chain link and is 8 feet tall with three strands of barbed wire on top. Along I-495, Mass-Highway maintains a 5 foot chain link fence which is topped with barbed wire.

The Airport has four vehicle access gates, and three pedestrian gates. Two vehicle access gates (Gates A and D) are located on Fruit Street. Gate A is the northernmost gate on Fruit Street and is designated as the Airport's Emergency Response Gate. This gate is equipped with a Knox Box and operates on rollers. Gate D is a hinged gate that provides access from Fruit Street to Quadrant Four. A third hinged, vehicle access gate is located between Buildings B and F. The final hinged, vehicular access gate is located east of the SRE building. One pedestrian access gate is located adjacent to the Airport Terminal Building, a second gate is adjacent to the SRE Building, and the third is located to the right of Gate B as viewed from the parking lot.

2.3.5 Automobile Parking Facilities

There are two automobile parking lots at the Airport. The first is the Airport Terminal Building parking lot, which was repaved and expanded in 1997 and 1998. This parking lot accommodates approximately 60 vehicles. Additional vehicle parking is provided in Quadrant Four adjacent to the Mansfield Landing corporate hangars. This parking lot was constructed in 2005 and accommodates approximately 20 vehicles.

2.3.6 Airport Utilities

The Airport has a number of utility services available on-site. The Airport has electric, phone, public sewer, water and cable services. Electricity is provided by the Mansfield Municipal Electric Company via underground conduit from Fruit Street to a pad-mounted transformer located between the Storage Hangar and the Terminal Building. Cable, phone, water and sewer service are also provided from Fruit Street to the various terminal area buildings. New phone lines were installed underground in 1998.

2.4 Environmental Resources

The following section includes a summary of environmental resources on the Airport.

2.4.1 Wetland Resources

There are several wetland resource areas located throughout the Airport property. Back Bay Brook is a highly meandering, perennial stream that runs along the Airport's northern property boundary and flows to the Norton Reservoir. Wetland systems are located to the east and west of Runway 14-32 and to the south of Quadrant Four. Wetland areas include scrub/shrub and red maple swamps.

2.4.2 Rare, Endangered and Threatened Species

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) MassGIS data layer indicates that neither rare species priority habitat nor estimated habitat is present on the Airport.

2.4.3 Archaeological Resources

According to the 2001 Report, archeological investigations were performed in accordance with Section 106 of the National Historic Preservation Act and M.G.L., Chapter 9, Section 26-27c, as amended by Chapter 254 of the Acts of 1988 (950 CMR 71.00). The Phase 1a archeological reconnaissance performed as part of conceptual design studies in the 2001 Report evaluated the archeological sensitivity and likelihood of encountering artifacts in the areas of proposed construction. The results from the Phase 1a investigation included the recommendation for no further investigation through a Phase 1b intensive survey. The Massachusetts Historical Commission (MHC) concurred with the results of these studies and determined that "given the disturbed context, low density, and limited range of materials, the prehistoric archeological materials identified in the intensive survey are not likely to produce additional information if they

were subject to additional archeological testing. Therefore, the MHC found that existing materials do not constitute a significant archeological resource, and are not eligible for listing on the National Register of Historic Places.

2.5 Aircraft Inventory

In 2008, a total of 114 aircraft were based at the Airport. Of these 114 aircraft, 111 are single engine piston aircraft (97.4%), and 3 are twin-engine piston aircraft (2.6%). The details regarding the types of aircraft based at the Airport and their design group category are listed in the following chapter in Table 3-4.

2.6 State and Federal Funding History

Table 2-9 and 2-10 provide a chronological history of Airport projects that have received State and Federal AIP funding assistance.

Table 2-9
History of Federally-Funded Projects

Grant Number	AIP Funding	Year	Project Description
3-25-0028-01-1983	$88,073.00	1983	• Improve Airport Drainage; Install Apron Lighting; Re-habilitate Runway Lighting
3-25-0028-02-1984	$25,020.00	1984	• Conduct Airport Master Plan Study
3-25-0028-03-1986	$0.00	1986	• No Project Assigned
3-25-0028-04-1989	$192,045.00	1989	• Extend Runway 14; Install Perimeter Fencing
3-25-0028-05-1993	$323,921.00	1993	• Construct Runway 14-32
3-25-0028-06-1994	$267, 931.00	1994	• Construct Taxiway; Expand Apron; Rehabilitate Taxiway
3-25-0028-07-1998	$49,996.68	1998	• Conduct Airport Master Plan Study
3-25-0028-08-1998	$120,270.00	1998	• Install Taxiway Lighting
3-25-0028-09-1999	$299,211.00	1999	• Rehabilitate Apron – Rehabilitate Taxiway
3-25-0028-10-2000	$168,790.00	2000	• Remove Obstructions
3-25-0028-11-2001	$121,770.00	2001	• Conduct Airport Master Plan Study
3-25-0028-12-2003	$311,644.00	2003	• Construct Runway Safety Areas – 14-32
3-25-0028-13-2003	$27,096.00	2003	• Install Perimeter Fencing
3-25-0028-14-2004	$502,747.00	2004	• Construct Taxiway; Improve RSA 14-32
3-25-0028-15-2005	$1,272,427.00	2005	• Construct Apron
3-25-0028-16-2005	$577,002.00	2005	• Construct Snow Removal Equipment Building
3-25-0028-17-2006	$81,913.00	2006	• Acquire Snow Removal Equipment
3-25-0028-18-2006	$411,186.00	2006	• Construct Taxiway (Phase II) Remove Obstructions

Grant Number	AIP Funding	Year	Project Description
3-25-0028-19-2007	$371,752.00	2007	• Rehabilitate Taxiway (Phase I Taxilane)
3-25-0028-20-2008	$204,250.00	2008	• Remove Obstructions
3-25-0028-21-2009	$160,403.00	2009	• Acquire Snow Removal Equipment

Table 2-10
Inventory of State Funded Projects

Massachusetts Aeronautics Commission (MAC) Funded Projects		
2000	$106,871.00	• Vegetation Management Plan
2003	$48,000.00	• Tractor/Mower
2008	$18,660.00	• Aviation Fuel Pump Replacement
2008	$11,484.00	• Fuel Oil Tanks Replacement
2008	$9,945.00	• Crack Sealing

3. AVIATION FORECAST

In order to identify Airport facility needs during the planning period, it is necessary to accurately identify the current aviation use of the Airport, and to project future aviation demand levels. This chapter will identify current aircraft usage of the Airport, and will document the projected aviation demand for the Airport during the 20-year planning period of this Study.

3.1 Overview of Aviation Forecasts

Aviation forecasts are based on historic trends or relationships that have been documented by airport management, funding agencies, or an on-site air traffic control tower. At airports that do not have this information, it is necessary to heavily rely upon realistic assumptions for forecasting activity levels likely to be achieved in the future.

The FAA Aerospace Forecast is a national aviation demand forecasting system used to determine various forms of aviation growth by developing econometric models that explain and incorporate assumptions and emerging trends for different segments of the aviation industry. This forecast utilized the FAA Aerospace Forecast for Fiscal Years 2009-2025 in order to determine a baseline growth rate for general aviation in the United States. In the development of a reasonable forecast for years 2008-2028, this national growth rate percentage was applied to known information for the Airport.

Planning airport improvements is a combination of the realization of aviation demand and the ability to fund the project. In other words, funding an improvement project well before a demand exists, wastes limited funding resources. This chapter reviews three time periods in which aviation-demand levels may trigger recommended improvements: short term (five-year), mid-term (6 to 10 year), and long term (11 to 20 year) periods.

The following terms are often used in airport forecasts. For clarification, these terms are defined below.

Based Aircraft –refers to where an airplane makes its home or, in the case of the Airport, an aircraft whose "home" is at the Airport.

Transient Aircraft –refers to an airplane whose home is at an airport other than the airport for which the forecast is being produced. In other words, any aircraft that uses the Airport, but whose home base is at another airport, is a transient aircraft.

Local Operation – refers to an operation where an aircraft operates within 20 nautical miles of an airport for which the forecast is prepared. A local operation can be performed by either a based or a transient aircraft.

Itinerant Operation – is an operation where an aircraft operates at a distance greater than 20 nautical miles of an airport for which the forecast is prepared. Again, either a based or a transient aircraft can perform an itinerant operation.

3.2 Current Aviation Use

This section documents the current aviation use at the Airport. It is essential to accurately document existing aviation activity in order to establish a credible basis for forecasting future demand.

3.2.1 Aircraft Operations

For airport planning, the term "aircraft operation" is defined as an arrival to or a departure from an airport.

Estimating the number of aircraft operations at non-towered airports can be challenging. Unlike towered airports, which have fairly accurate documentation of aircraft operations, non-towered airports must rely more heavily on observations by airport personnel or other more ambiguous data. The 2008 Airport Master Record, which identifies airport operations for a 12 month period ending March 1, 2008, was utilized to determine the most recent annual operations for the Airport. This report, which is typically compiled using data reported by Airport Management, indicated that the Airport experiences approximately 57,000 operations annually.

In order to establish that this is a reasonable number of annual operations for the Airport, this section will compare the reported operations data at the Airport to several other General Aviation (GA) airports in the region, and will also examine based aircraft data and fuel sales to further support reported airport operational levels.

3.2.1.1 Based Aircraft vs. Operation Data Comparison

To provide a comparison between airport operations and based aircraft, the reported operations and based aircraft fleet mix for eight comparable airports in the region were examined. Table 3-1 provides based aircraft fleet mix data for the Airports under review.

Table 3-1
Based Aircraft Fleet Mix Comparison

Airport	Based Aircraft	Single Engine		Multi-Engine		Turboprop/ Jet	
		# of Aircraft	% of Fleet	# of Aircraft	% of Fleet	# of Aircraft	% of Fleet
Bedford (Hanscom)	377	268	71.1%	38	10.1%	71	18.8%
Beverly	115	96	83.5%	19	16.5%	0	0%
Marshfield	51	47	92%	3	6%	1	2%
Nashua	364	318	87.4%	31	8.5%	15	4.1%
Norwood	177	152	86%	14	8%	11	6%
Plymouth	132	109	83%	16	12%	7	5%
Taunton	109	106	97%	3	3%	0	0%
Worcester	100	94	94%	6	6%	0	0%
AVERAGE	*178*	*149*	*83.7%*	*16*	*9%*	*13*	*7.3%*
Mansfield	**114**	**111**	**97.4%**	**3**	**2.7%**	**0**	**0%**

Source: Airport IQ 5010; www.gcr1.com/5010web

Of the total based aircraft fleet mix for the airports surveyed, a majority of the based fleet consists of single-engine piston aircraft. The number of single-engine piston aircraft that comprise the fleet at the Airport is a higher percentage than other airports surveyed. However, in general, the airports reviewed consistently had a based aircraft fleet consisting in the range of 80 percent to 90 percent single-engine piston aircraft.

The remainder of the based fleet at the Airport is comprised of multi-engine piston aircraft. There are no turboprop or jet aircraft based at the Airport, and so they are not represented in the based aircraft fleet mix at the Airport. Other airports surveyed had, on average, a based fleet composed of approximately 9 percent multi-engine aircraft and approximately 7 percent turboprop and jet aircraft. The differences in fleet mix are most likely explained by variations in runway length, type of approach, availability of jet fuel, and other facility-related factors.

In order to make a meaningful comparison between these airports, which offer substantially different facilities and services, the total number of based aircraft and the number of annual operations at each airport was reviewed (see Table 3-2). The analysis provides an average number of annual operations per based aircraft, which can be used to validate the reported annual operations at the Airport. Inclusion of airports with air traffic control towers in the analysis helps to calibrate the operations data reported by the non-towered airports in the analysis.

Table 3-2
Based Aircraft vs. Operations Data Comparison

Airport	Based Aircraft	Total Operations (2008)	Average Operations per Based Aircraft
Bedford (Hanscom)	377	164,300	436
Beverly	115	70,955	617
Marshfield	51	17,700	347
Nashua	364	103,930	286
Norwood	177	99,000	559
Plymouth	132	79,000	598
Taunton	109	110,100	1,010
Worcester	100	58,400	584
AVERAGE	*178*	*87,923*	*554*
Mansfield	**114**	**57,000**	**500**

Source: Airport IQ 5010; www.gcr1.com/5010web

The comparison between airport operations and based aircraft at these eight surveyed airports found that the average total annual operations were 87,923 with the average operations per based aircraft being 554. The Airport had an estimated operations total of 57,000 operations and had 114 based aircraft in 2008, providing an average of 500 operations per based aircraft. This comparison indicates that the Airport's total operations and operations per based aircraft were comparable to that of the average of the eight airports surveyed, leading to the conclusion that 57,000 annual operations is a reasonable estimate of aircraft activity at the Airport, given the levels of activity at other facilities in the region.

3.2.1.2 Based Aircraft vs. Fuel Sales Comparison

Another analysis used to further support reported annual operations at the Airport compared fuel sales to based aircraft. The total AvGas sales for 2008 were collected for five general aviation (GA) airports in the New England region. These AvGas fuel sales were then divided by the number of based *piston* aircraft at each airport to determine the number of gallons used per based aircraft in the year for which the fuel sales were collected. Table 3-3 provides the fuel sales comparison data.

Table 3-3
Fuel Sales Comparison

Airport	Total AvGas Sales Volume (Gal.)	AvGas Sales per Based Piston Aircraft (Gal.)
Airport 1	47,822	383
Airport 2	112,935	982
Airport 3	120,812	966
Airport 4	299,681	858
Airport 5	46,433	929
AVERAGE	*125,536*	*823*
Mansfield	68,920	604

Source: Airport Management
**For confidentiality purposes, specific airports are not identified*

This comparison indicates that the total number of gallons AvGas sold at the airports under review ranged from 383 gallons to 930 gallons per based piston-aircraft. At the Airport, approximately 604 gallons of fuel are sold annually per piston-aircraft based at the Airport. This is within a reasonable range based on the fuel sales volume indicated by other airports, and lends additional support to the conclusion that the current activity levels projected at the Airport are likely to be fairly accurate.

The data collected regarding other area airport operations and fuel sales lead to the conclusion that 57,000 annual aircraft operations is a reasonable estimate to use in developing a forecast of aviation activity for the Airport.

3.2.2 Based Aircraft Fleet

According to Airport records, in 2008 there were 114 based aircraft at the Airport (Table 3-4). Of these aircraft, 111 are single-engine piston and the remaining are multi-engine piston aircraft.

Table 3-4
Based Aircraft – Winter 2008

Aircraft (# Based)	Aircraft Type	Design Group
Beech Baron 58 (1)	Multi-Engine Piston	B-I
Beech C-23 Sundowner (1)	Single-Engine Piston	A-I
Beech Bonanza F-33A (2)	Single-Engine Piston	A-I
Boeing Stearman (1)	Single-Engine Piston	A-I
Cessna 120 (1)	Single-Engine Piston	A-I
Cessna 140 (1)	Single-Engine Piston	A-I
Cessna 150 (7)	Single-Engine Piston	A-I
Cessna 152 (2)	Single-Engine Piston	A-I

Aircraft (# Based)	Aircraft Type	Design Group
Cessna 172 (30)	Single-Engine Piston	A-I
Cessna 177 (1)	Single-Engine Piston	A-I
Cessna 182 (6)	Single-Engine Piston	A-I
Cessna 185 (1)	Single-Engine Piston	A-1
Cessna Birddog (1)	Single-Engine Piston	A-I
Cessna Cardinal (1)	Single-Engine Piston	A-I
Cirrus SR-22 (1)	Single-Engine Piston	A-I
Diamond DA20 (1)	Single-Engine Piston	A-I
Globe Swift (1)	Single-Engine Piston	A-I
Grumman AA-1B (1)	Single-Engine Piston	A-I
Grumman Tiger (2)	Single-Engine Piston	A-I
Lancair 320 (1)	Single-Engine Piston	A-I
Mooney M-20 (4)	Single-Engine Piston	A-I
Moravan Zlin (1)	Single-Engine Piston	A-I
Piper Archer (5)	Single-Engine Piston	A-I
Piper Arrow (6)	Single-Engine Piston	A-I
Piper Aztec (2)	Multi-Engine Piston	A-I
Piper Cherokee 140 (6)	Single-Engine Piston	A-I
Piper Cherokee 180 (5)	Single-Engine Piston	A-I
Piper Cherokee 6 (2)	Single-Engine Piston	A-I
Piper Comanche (2)	Single-Engine Piston	A-I
Piper Cruiser (1)	Single-Engine Piston	A-I
Piper Cub (2)	Single-Engine Piston	A-I
Piper Dakota (1)	Single-Engine Piston	A-I
Piper Malibu (1)	Single-Engine Piston	A-I
Piper Saratoga (2)	Single-Engine Piston	A-I
Piper Warrior (3)	Single-Engine Piston	A-I
Rockwell Commander 112A (2)	Single-Engine Piston	A-I
Rockwell Commander 114 (1)	Single-Engine Piston	A-I
Ryan Navion A (2)	Single-Engine Piston	A-I
Stinson Voyager (1)	Single-Engine Piston	A-I
Van's RV6 (2)	Single-Engine Piston	A-I

Source: Mansfield Airport Commission

This data is used to develop the Based Aircraft Fleet Mix (Table 3-5). The based fleet mix represents the type of aircraft based at the Airport and the percentage of each aircraft type that comprise the fleet at the Airport. As presented in Table 3-5, the based fleet is dominated by single-engine piston aircraft (97.4%), with some representation of multi-engine piston aircraft (2.6%). There are no helicopters, jet or turboprop aircraft currently based at the Airport.

Table 3-5
Based Aircraft Fleet Mix

Aircraft Type	2008 (Actual)	Percent of Fleet
Single-engine piston aircraft	111	97.4%
Multi-engine piston aircraft	3	2.6%
Turboprop and Jet aircraft	0	0%
Helicopters	0	0%
TOTAL	**114**	**100%**

3.2.3 Overall Fleet Mix

The overall fleet mix at the Airport is a measure of the aircraft operating at the Airport, both based and transient. As the Airport is a non-towered facility and does not have precise records of aircraft-types and operation data, this report utilized two years of instrument operations data, obtained through FlightAware, in order to provide a basis for determining the overall fleet mix utilizing the Airport.

It should be noted that the operation data obtained through FlightAware includes only instrument operations, and is a sample of the total operations that occur annually at the Airport. The FlightAware data indicated that, during 2007 and 2008, a total of 2,488 instrument operations occurred at the Airport. This includes operations conducted by both based and itinerant aircraft. This forecast will assume that the FlightAware data provides a representative sample of the overall operational activity level and fleet mix at the Airport. Table 3-6 presents the overall fleet mix, as extrapolated from the 2007 and 2008 FlightAware operation data.

Table 3-6
Overall Fleet Mix

Aircraft Type	Percent of Fleet
Single-engine piston aircraft	82.80%
Multi-engine piston aircraft	11.57%
Turboprop & Jet aircraft	5.47%
Helicopters	0.16%
TOTAL	**100%**

This fleet mix, established on the assumption that the FlightAware data provides a representative sample of the overall activity at the Airport, does appear reasonable in comparison with trends in general aviation in the New England region and throughout the country. These numbers indicate that, as with the based fleet mix, single-engine piston aircraft are the predominant aircraft using the Airport. It is also apparent that there is a level of turboprop and jet activity reflected in the overall fleet mix that is not present in the based aircraft fleet mix.

3.2.4 Transient Fleet Mix

At smaller GA airports, it is often the case that the based aircraft fleet mix is reflective of the total variety of aircraft that use the airfield. However, this is not true in the case of the Airport, as can be seen in comparing the based fleet mix and the overall fleet mix. The Airport supports a much broader mix of aircraft than is reflected in its based aircraft fleet. The based aircraft fleet – primarily small single and multi-engine piston aircraft – does not reflect the high performance aircraft that constitute a part of the Airport's transient fleet. This is most likely due to the Airport's proximity to facilities such as the Comcast Center and Gillette Stadium.

Using the Airport Master Record and FlightAware data, the based and overall fleet mixes were established. Using this data and the ratio of based and transient operations at the Airport, the transient fleet mix was determined. Table 3-7 presents the Airport's transient aircraft fleet mix.

Table 3-7
Transient Aircraft Fleet Mix

Aircraft Type	Percent of Fleet
Single-engine piston aircraft	59.57%
Multi-engine piston aircraft	25.85%
Turboprop and Jet aircraft	14.16%
Helicopters	0.42%
TOTAL	**100%**

As expected, the transient fleet mix is comprised of a substantially higher percentage of multi-engine piston, turboprop and jet aircraft than the based fleet mix. This is likely a reflection of the Airport's proximity to facilities such as the Comcast Center and Gillette Stadium, whose patrons and related-businesses are likely to use these types of high-performance aircraft, in contrast to the small, single-engine piston aircraft that make up the Airport's based fleet.

3.3 Aviation Forecast

This section will use the current conditions at the Airport in order to forecast future growth of aircraft operations, based aircraft, and fuel flowage. In determining the proper growth rates to apply in developing this forecast, the FAA's Terminal Area Forecast (TAF) for the Airport was reviewed and found to project a 0.0 percent growth rate at the Airport. As this is unlikely to occur, national growth rates from the FAA Aerospace Forecast FY 2009-2025 (the FAA Forecast) were applied instead.

3.3.1 Airport Operations Forecast

The FAA Aerospace Forecast FY 2009-2025 projects an annual growth rate for general aviation operations as a whole of 1.0 percent for the time period from 2008-2025. The

FAA forecast also provides growth rates for each class of general aviation aircraft (i.e. single-engine piston, multi-engine piston, etc) separately. These individual growth rates offer a more moderate growth rate for each class of aircraft, and are likely to be more accurate than the overall general aviation fleet growth rate. This forecast utilizes the growth rates for each separate category of aircraft. Table 3-8 summarizes the growth rates used for each aircraft category.

Table 3-8
General Aviation Aircraft Growth Rate

Aircraft Type	Annual Growth Rate
Single-Engine Piston	0.1%
Multi-Engine Piston	-1.0%
Turboprop and Jet	3.5%
Helicopter	3.0%

These growth rates do indicate that although the growth in general aviation is projected to slow from previous years, in part due to a decline in the economy and other socioeconomic factors, there will be a general gradual growth trend in the industry. Multi-engine piston aircraft are the exception to this gradual growth trend, with a projected 1 percent annual decline in the multi-engine piston fleet. This may be attributed, in part, to growth in turboprop and small jet aircraft as alternatives.

Table 3-9 presents the Airport's Operations Mix Forecast. The operations mix forecast provides a breakdown of the operations forecast by local and itinerant operations and by aircraft type. In developing the forecast, the growth rates in Table 3-8 were used. This forecast assumes that the based, transient and overall fleet mixes previously established are reasonably accurate, and assumes that 61.5 percent of operations are based aircraft operations, and the remaining 38.5 percent of operations are transient. The transient and based operations percentages were taken from the Airport Master record, which indicated that, of the 57,000 operations occurring in the base year, 35,000 (61.5 percent) were local operations, and 22,000 (38.5 percent) were transient.

Table 3-9
Operations Forecast

Aircraft Type	2008 (Base Year)	2013	2018	2023	2028
Based Operations (61.5% of Total Operations)					
Single-Engine Piston	34,090	34,261	34,432	34,605	34,778
Multi-Engine Piston	910	905	901	896	892
Turboprop & Jet	0	0	0	0	0
Helicopter	0	0	0	0	0
Total	35,000	35,166	35,333	35,501	35,670
Transient Operations (38.5% of Total Operations)					

Aircraft Type	2008 (Base Year)	2013	2018	2023	2028
Single-Engine Piston	13,106	13,172	13,238	13,304	13,371
Multi-Engine Piston	5,688	5,660	5,631	5,603	5,575
Turboprop & Jet	3,115	3,700	4,394	5,219	6,198
Helicopter	91	105	122	142	164
Total	22,000	22,637	23,385	24,268	25,308
Total Operations (100% of Operations)					
Single-Engine Piston	47,196	47,432	47,670	47,909	48,149
Multi-Engine Piston	6,598	6,565	6,532	6,500	6,467
Turboprop & Jet	3,115	3,700	4,394	5,219	6,198
Helicopter	91	105	122	142	164
Total	**57,000**	**57,802**	**58,718**	**59,770**	**60,978**

As seen in Table 3-9, total operations at the Airport are expected to increase from 57,000 operations in 2008, to approximately 61,000 in 2028. This reflects a moderate growth rate and provides a fairly conservative estimate of future airport operations. A majority of the growth is projected to come from transient operations, due in large part to the much higher FAA growth rates for turboprop and jet aircraft, as compared to the piston aircraft that currently comprise the based fleet at the Airport.

This forecast assumes that the based aircraft fleet mix will remain relatively stable over the planning period. However, due to the projected overall forecast for growth in turboprop and jet aircraft, it is likely that small turboprop or jet aircraft may base at the Airport, which would change the based operations and based fleet mix in the future. Generally, the Airport is expected to continue the moderate growth it has experienced in the past.

3.3.2 Peak Operations Forecast

Peak operational activity forecasts are important when establishing future airport facility requirements. The peak operational activity has practical applications in determining the future need for airport facilities, such as quantity of aircraft parking spaces, automobile parking, and terminal building size. The peak month, design day, and design hour are used to determine airport capacity requirements. These are defined below:

> **Peak Month:** The peak month represents the calendar month with the highest number of aircraft operations during the year. For planning purposes 10% to 15% of total annual operations are assumed to occur in the peak month. The peak month will be calculated assuming it represents 10% of total annual operations. As the Airport experienced 57,000 annual operations in 2008, 5,700 operations (10 percent) would be expected to occur in the peak month.

Design Day: The design day is the average day in the peak month. It is normally derived by dividing the peak month operations by the number of days in the peak month. The peak month at the Airport is estimated to be August which has 31 days. For the base year of 2008, the design day would be calculated as follows: 5,700 peak month operations ÷ 31 days in peak month = 184 design day operations.

Design Hour: The design hour is the peak operations hour within the design day. It is assumed that 18% of the Airport's design day operations represent the design hour activity. For the base year of 2008, the design hour would be calculated as follows: 184 design day operations × 18 percent = 33.12 design hour operations.

Using this method, the peak operations forecast based on the total operations projected to occur during the planning period is presented in Table 3-10.

Table 3-10
Peak Operations Forecast

	Peak Operations				
Operations	**2008**	**2013**	**2018**	**2023**	**2028**
Total Operations	57,000	57,802	58,718	59,770	60,978
Peak Month (10%)	5,700	5,780	5,872	5,977	6,098
Design Day	184	186	189	193	197
Design Hour	33.12	33.48	34.02	34.74	35.46

Currently, during its peak hour (design hour) the airport experiences approximately 33 operations. By 2028, this is expected to increase slightly to 35 to 36 operations during the peak hour.

3.3.3 Based Aircraft Fleet Forecast

The based aircraft fleet forecast is presented in Table 3-11. This forecast again uses the FAA Forecast growth rates for single-engine piston and multi-engine piston aircraft, as presented earlier in Table 3-8.

Table 3-11
Based Aircraft Fleet Forecast

Aircraft Type	2008	2013	2018	2023	2028
Single-Engine Piston	111	112	112	113	113
Multi-Engine Piston	3	3	3	3	3
Turboprop & Jet	0	0	0	0	0
Helicopter	0	0	0	0	0
Total	114	115	115	116	116

Source: Gale Associates, Inc.

This conservative growth rate projects a minor increase in the number of based aircraft at the Airport over the planning period. Though this does not depict an increase in the number of turboprop and jet aircraft based at the Airport, the substantial national growth rates for such aircraft indicate that it may be likely for such aircraft to base at the Airport during the planning period.

3.3.4 Fuel Flowage Forecast

Fuel flowage forecasts are used as one method to determine future fuel storage needs at an airport. The Airport currently sells 100 Low Lead AvGas which is used exclusively by piston-powered aircraft. Turboprop, jet aircraft, and many helicopters use Jet-A fuel, which is not available at the Airport.

In 2008, the Airport sold 68,920 gallons of AvGas. A forecast for AvGas fuel flowage is provided in Table 3-12. This forecast was prepared using the FAA Forecast growth rate for general aviation fuel consumption which predicted a -0.1 percent annual growth rate for AvGas fuel flowage.

Table 3-12
Fuel Flowage Forecasts

AvGas Fuel Flowage Forecast (gallons)					
	2008	2013	2018	2023	2028
Projected Fuel Flowage	68,920	68,576	68,234	67,893	67,555

3.3.5 Forecast Summary

Table 3-13 presents a summary of the forecasts.

Table 3-13
Forecast Summary

Aircraft Type	2008 (Base Year)	2013	2018	2023	2028
Based Aircraft					
Single-Engine Piston	111	112	112	113	113
Multi-Engine Piston	3	3	3	3	3
Total	114	115	115	116	116
Aircraft Operations					
Local	35,000	35,166	35,333	35,501	35,670
Itinerant	22,000	22,637	23,385	24,268	25,308
Total	57,000	57,802	58,718	55,770	60,978
Peak Operations					
Peak Month	5,700	5,780	5,872	5,977	6,098
Design Day	184	186	189	193	197
Design Hour	33.12	33.48	34.02	34.74	35.46
Fuel Flowage (Gallons)					
AvGas	68,920	68,576	68,234	67,893	67,555

3.4 Airport Reference Code

The Airport Reference Code (ARC) is a classification system used by the FAA to relate airport design criteria to the operational and physical characteristics of the aircraft intended to operate at an airport.[1] Many of the dimensional and other standards that apply to airports are based upon the designated ARC. Such things as the runway to taxiway separation, pavement widths, object free areas and other fundamental geometric design parameters are all based upon the ARC. Therefore, it is important that the Airport Master Plan Update consider not only the types of airplanes that currently use the airport but also those that are reasonably expected to use it within the 20-year planning period.

The ARC classification system uses a letter (A, B, C, D and E) to identify the aircraft approach speed and a Roman numeral (I, II, III, IV, V and VI) to identify aircraft wingspan. Table 3-14 presents the ARC classification criteria.

[1] FAA Advisory Circular 150/5300-13, *Airport Design*, includes changes 1-8, page 4.

Table 3-14
FAA Aircraft Categories

Wingspans	Approach Speeds				
	A: <91 kts	B: ≥91 kts <121 kts	C: ≥121 kts <141 kts	D: ≥141 kts <166 kts	E: ≥166 kts
I: <49 feet	A-I	B-I	C-I	D-I	E-I
II: ≥ 49 feet, <79 feet	A-II	B-II	C-II	D-II	E-II
III: ≥79 feet, <118 feet	A-III	B-III	C-III	D-III	E-III
IV: ≥118 feet, <171 feet	A-IV	B-IV	C-IV	D-IV	E-IV
V: ≥171 feet	A-IV	B-V	C-V	D-V	E-V

Source: FAA Advisory Circular 150/5300-13, *Airport Design*, including Changes 1 through 8.

The ARC at GA airports is based on the operational and physical characteristics of either a single aircraft or a family of aircraft having similar characteristics. Given the aircraft mix at the Airport, it is more effective to utilize the family of aircraft concept. To determine the appropriate ARC for the Airport, the most demanding family of aircraft (in terms of their physical and performance characteristics) that perform approximately 500 operations per year must be identified.

Reviewing the FlightAware data obtained for 2007 and 2008 indicated that in 2007, 75 instrument operations were performed by B-II aircraft. In 2008, this number decreased to 46 B-II operations. This decrease in B-II operations is likely a reflection of deteriorating economic conditions at the time of the data collection, and is not an indication that the number of B-II operations at the Airport will continue to decline. Though FlightAware data provides only a sample of the total operations on the Airport, it is reasonable to expect that most B-II aircraft operating on the Airport are likely to file an instrument approach plan, thus being reflected in the FlightAware data.

Table 3-15 provides a conservative B-II growth scenario, and also presents an assumed "maximum growth" scenario.

Table 3-15
B-II Forecast Scenarios

	2008	2013	2018	2023	2028
Conservative Growth (3.5%)	46	55	65	77	92
Exaggerated Growth (4.8%)	75	99	126	159	201

Assuming that a total of 46 B-II operations in 2008 is an accurate estimate, using the FAA growth rate for turboprop and jet aircraft of 3.5 percent per year, at the end of the planning period the Airport can conservatively expect to experience 92 B-II operations annually. In order to avoid understating the potential use of the Airport by B-II

aircraft, we can alternatively look at the total B-II operations reported for the prior year (75 operations), and can use the FAA annual growth rate of 4.8 percent for jet aircraft (rather than the combined turboprop and jet aircraft rate). This exaggerated estimate of B-II activity estimates approximately 200 annual operations of B-II aircraft annually by the end of the planning period, far below the 500 annual operations threshold that would trigger a change in the ARC at the Airport.

It appears unlikely that, during the planning period, the Airport will approach or exceed 500 annual operations of B-II aircraft. **Thus, it is recommended that the ARC for the Airport remain a B-I for the duration of the planning period, and the Critical Design Aircraft remain a Beech Baron 58.**

4 FACILITY REQUIREMENTS

This chapter takes the information collected in Chapter 2, *Existing Conditions*, considers the projected demand and ARC for the Airport identified in Chapter 3, *Aviation Forecast,* and provides an review of compliance with FAA airport design standards, other airport requirements, and user needs. FAA standards for airport design and Federal Aviation Regulation Part 77, *Objects Affecting Navigable Airspace* (FAR Part 77), are used to analyze facility conditions to identify needed improvements, replacement or expansion. Facility improvements may also be recommended to fill a demand for services, not just to meet design or safety standards.

A non-prioritized list of recommended facility requirements, divided into short, mid, and long-term completion periods, is provided at the end of this chapter. Implementation of these improvements will depend upon funding constraints, environmental permitting requirements, and FAA or MassDOT/AD funding schedules. Priorities of short-term project implementation occurred at a meeting between the Airport Commission, FAA and MassDOT/AD held on October 12, 2010. Environmental permitting requirements for recommended improvements are contained in Chapter 5, Schedule of Improvements.

4.1 AIRSIDE CAPACITY AND REQUIREMENTS

The airport facilities required for the movement of aircraft are generally considered to be airside facilities, and include runways, taxiways, aprons, navigational aids, and airfield lighting systems. This section will review the capacity and utility of the Airport's airside facilities, and their compliance with FAA design standards. As discussed in Chapter 3, the Mansfield Municipal Airport is a B-I, large aircraft[1], class airport with the Beech Baron 58 as its Critical Design Aircraft. These conditions are expected to remain for the duration of the 20-year planning period.

Beech Baron 58

4.1.1 Runway Capacity

Airport capacity is typically expressed in terms of the number of aircraft operations that can be conducted in a given period. Capacity is most often expressed as annual capacity (or annual service volume, ASV) and hourly capacity (or throughput capacity) for a particular runway and taxiway configuration. The FAA's Advisory Circular 150/6050-5, *Airport Capacity and Delay*, utilizes computer models developed by the FAA to evaluate airport capacity and reduce aircraft delay. These models use an airport's ASV to approximate the capacity of the runway, while accounting for differences in runway configuration, fluctuations in aircraft fleet mix, touch and go activity levels, and weather conditions, among other factors.

The FAA models estimate the Airport's ASV capacity to be up to 230,000 operations per year. The Airport's annual operations volume in 2008 was estimated to be 57,000, and

[1] According to FAA, a "large airplane" is an aircraft with a maximum certificated take-off weight in excess of 12,500 pounds.

the forecasted annual operations are not expected to reach 61,000 over the planning period. Therefore, runway capacity is not an existing problem nor does it appear that it will be a problem during the planning period. Further, according to FAA requirements, the Airport's runway capacity will be considered adequate until operations reach 60% of its ASV (138,000 annual operations).

Recommendation: The runway capacity at the Airport is sufficient to meet the needs of the Airport for the duration of the planning period.

4.1.2 Runway Requirements

Runway dimensional requirements are based upon the ARC for the runway during the planning period. The FAA has prescribed standards for the layout of airport facilities including taxiways, parking aprons, and approach surfaces, based on the ARC. Runway dimensional requirements for both runways and the Airport's current compliance status are presented in Tables 4-1 and 4-2. These standards are discussed individually in the following sections. The Runway to Taxiway separation standard is identified in Table 4-1, but is discussed under the *Taxiway Requirements,* subsection 4.1.3.

Table 4-1

Runway 14-32 Dimensional Requirements

Facility	FAA Design Criteria (B-I)	Existing Runway 14-32 (B-I)	Runway 14-32 Compliance
Runway centerline to holdline	200'	130'	**Does not comply**
Runway centerline to parallel taxiway centerline	225'	200'	**Does not comply**
Runway centerline to edge of aircraft parking	200'	300'	Complies
Runway protection zone at both runway ends: Length Inner width (200' beyond runway) Outer width	 1,000' 500' 700'	 1,000' 500' 700'	Complies
Runway pavement width	75'	75'	Complies
Runway safety area width	120'	120'	Complies
Runway safety area length beyond runway end	240'	240'	Complies
Runway object-free area width	400'	400'	Complies
Runway object-free area length beyond runway end	240'	240'	Complies
Runway obstacle-free zone width	400'	400'	Complies
Runway obstacle-free zone length	200'	200'	Complies

beyond runway end			

Table 4-2

Runway 04-22 Dimensional Requirements

Facility	FAA Design Criteria (A-I)*	Existing Runway 04-22 (A-I)*	Runway 4-22 Compliance
Runway centerline to holdline	125'	N/A†	N/A
Runway centerline to edge of aircraft parking	125'	180'	Complies
Runway protection zone at both runway ends: Length Inner width (200' beyond runway) Outer width	1,000' 250' 450'	1,000' 250' 450'	Complies
Runway turf width	60'	100'	Complies
Runway safety area width	120'	120'	Complies
Runway safety area length beyond runway end	240'	R/W 04 End 120' R/W 22 End 240'	**Runway 04 End does not comply**
Runway object-free area width	250'	250'	Complies
Runway object-free area length beyond runway end	240'	240'	Complies
Runway obstacle-free zone width	120'	130'	Complies
Runway obstacle-free zone length beyond runway end	200'	R/W 04 End120' R/W 22 End 200'	**Runway 04 End does not comply**

†Not Applicable
**Small Aircraft Exclusively*

Basic factors that determine a runway's length requirement includes the Airport elevation, its ambient temperature and the critical design aircraft's maximum certificated take-off weight. Each of these factors has an effect on the runway length requirement. For example, given that all other factors are equal, an aircraft taking off on a hot day will likely require a longer runway than the same aircraft taking off on a cold day.

4.1.2.1 Runway 14-32

Runway 14-32 is the Airport's primary runway; it is 3,500 feet in length. The threshold displacements of 236 feet on the Runway 32 End and 508 feet on the Runway 14 End result from existing obstructions to the runway's Part 77 Approach Surfaces. The displacements limit the available landing length to 3,264 feet when landing on Runway 32, and 2,992 feet on Runway 14. The Accelerate Stop Distance Available (ASDA),

which is the total distance required to accelerate an airplane to a specified take-off speed and, assuming failure of an engine at the instant that speed is attained, bring the airplane to a stop on the remaining runway without entering the RSA, is 3,500 feet when departing the runway.

To determine the Airport's minimum required runway length, the FAA Advisory Circular (AC) 150/5235-4B, *Runway Length Requirements for Airport Design*, was utilized. This AC uses an airport's elevation above mean sea level (MSL), mean daily maximum temperature of the hottest month at the Airport, and the critical design aircraft's useful load to determine a recommended runway length. The analysis determined that in order to accommodate 75 percent of the Airport's fleet at 90 percent useful load, based on the Airport's elevation of 123.2 above mean sea level, and mean daily maximum temperature of the hottest month for the Airport of 76.3ºF, a runway length of 5,850 feet is required. To accommodate 75 percent of the fleet at 60 percent useful load, based on the same mean temperature and elevation, a runway length of 4,600 feet is required. Due to environmental constraints present at both runway ends (wetlands), and because of the overall needs of the fleet mix utilizing the Airport are met with the current runway configuration, neither of these lengths are recommended for the Airport. The current runway length is adequate to serve the aircraft utilizing the Airport. It is recommended that steps be taken to remove the existing runway displacements in order to maximize the utility of the existing runway.

Runway 14-32 was last constructed in 1993 and is continually maintained through crack sealing and crack repair, a program implemented every other year. Runway 14-32 will have reached its design life in 2013, at which time it will be eligible for replacement with state and federal funding assistance.

Recommendation: Maintain Runway 14-32 at its current length of 3,500 feet, consider reconstruction once the design life has been exceeded, and take steps to remove the threshold displacements.

4.1.2.2 Runway 04-22

Runway 04-22 is the Airport's turf crosswind runway, which serves small[2] aircraft exclusively. This runway is 2,316 feet in length. The FAA typically recommends that crosswind runways at general aviation airports be no less than 80 percent of the length of the primary runway. This would require a runway length of at least 2,800 feet. However, this recommendation is not feasible to implement at the Airport due to constraints at both runway ends posed by I-495 at the Runway 04 end and Fruit Street at the Runway 22 end. Because of its turf surface and short available landing length, Runway 04-22 is limited to small aircraft use only. Larger, more sophisticated aircraft do not utilize this runway regardless of wind conditions. When crosswind conditions are unfavorable for larger aircraft attempting to use Runway 14-32, they will divert to other airports in the region. Runway 04-22 is of an adequate length to serve the aircraft that operate on that runway safely. However, design standards require this runway be shortened by 120 feet at the Runway 04 End to provide room for a standard RSA.

[2] A small aircraft is defined by weight to have a maximum certificated take-off weight of less than 12,500 pounds.

Recommendation: Reduce length of Runway 04-22 by 120 feet on the Runway 04 end to provide compliant Runway Safety Area. (Completed as a 2010 project.)

4.1.2.3 Runway Approach Requirements

This section reviews the condition of the current runway approaches and provides an overview of the protected surfaces associated with the runways. Because the Airport is affected by various protected surfaces, recommendations are withheld until the end of the discussion regarding the Airport's "Runway end siting surfaces" that follows the Part 77 discussion below. According to the FAA where one protected surface conflicts with another, the stricter of the two apply.

Runway 32 has a "straight in", non-precision instrument approach whereas Runway 14 has a circling approach. Both runway approaches on Runway 04-22 are visual approaches.

Federal Aviation Regulation (FAR) Part 77

The airspace surrounding public use airports is governed by regulations found within 14 Code of Federal Regulations (CFR) Part 77. This regulation is known by its more common title as **14 CFR, Federal Aviation Regulation (FAR) Part 77 – Objects Affecting Navigable Airspace** (Part 77). Part 77, which was promulgated by the FAA, includes areas around airports (sometimes called Imaginary or Protected Surfaces) that must be kept clear of penetrating objects, called "obstructions". By accepting FAA funding, an airport agrees to make all reasonable efforts to keep its Part 77 protected surfaces clear of obstructions. Part 77 also includes guidance for analysis and marking of penetrating objects in specific cases. Objects are defined by Part 77 as:

> *"any object of natural growth, terrain, or permanent or temporary construction or alteration, including equipment and materials used therein, and apparatus of a permanent or temporary character; and alteration of any permanent or temporary existing structure by a change in its height (including appurtenances), or lateral dimensions, including equipment or materials used therein."*

Part 77 specifies the dimensions of imaginary surfaces for each individual airport based on the type and size of aircraft using the facility, the runway surface treatment, as well as the type of navigation and approach aids available to pilots. Five imaginary surfaces are identified and defined under Part 77, they are:

- Primary Surface
- Approach Surface
- Transitional Surface
- Horizontal Surface
- Conical Surface

Figure 4-1 depicts the relationship of these surfaces to a typical runway. Dimensions for each of these surfaces are stipulated in Part 77. Depending upon the application of criteria outlined in the regulation, surface dimensions may vary from runway to runway. The surfaces are defined as follows:

- Primary Surface – A rectangular shaped surface longitudinally centered on the runway centerline with the same elevation as the nearest corresponding point on the runway centerline. The primary surface dimensions will vary depending on the runway approach type and the type of runway surface.
- Approach Surface – A trapezoidal shaped surface centered on the runway centerline and extending outward and upward from each end of the primary surface at a prescribed slope angle. Approach surface dimensions and slope angle will vary according to the runway approach type.

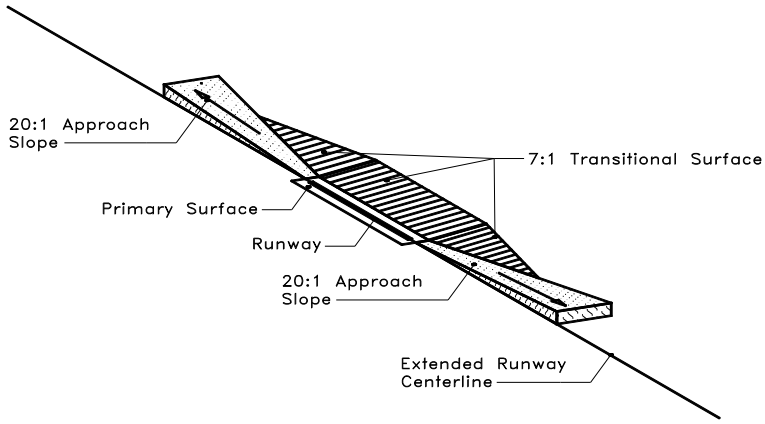


Figure 4-1

Typical Part 77 Protected Surfaces

- Transitional Surface – This surface is an inclined plane running parallel to the runway centerline beginning at the edges of the primary and approach surfaces. They then extend upward and outward at a slope of seven feet horizontally for every one-foot vertically (7:1) from the sides of the primary and approach surfaces to the horizontal surface (150' above the Airport elevation).
- Horizontal Surface – This surface is an oval shaped, horizontal plane established by Part 77 to be 150 feet above the Airport elevation**.** It is established by swinging arcs from the intersection of the extended runway centerline and primary surface at each end of the runway and then closing each area with tangent lines. In areas where the primary, approach and transitional surfaces may overlap, the surface with the lowest elevation is the controlling surface.
- Conical Surface – This surface extends upward and outward from the edge of the horizontal surface at a slope of twenty-foot horizontally for every one-foot vertically (20:1) for 4,000 horizontal feet from the edge of the horizontal surface.

The Part 77 surface dimensions and their compliance status for both Runways at the Airport are shown in Table 4-3 and 4-4. The Part 77 surfaces are shown on Sheet 7 of the ALP set, *FAR Part 77 Surfaces Plan*. Compliance, as defined in these tables, means

that the surface is unobstructed by penetrating objects, or that penetrating objects are properly mitigated through FAA approved lighting or other means.

Table 4-3

Runway 14-32 Part 77 Compliance

Protected Surfaces		Dimensions (Visual) Runway 14	Dimensions (Non-precision Instrument) Runway 32	Compliance
Primary surface	Width	500'	500'	**Obstructed**
	Length beyond R/W end	200'	200'	
Approach surface	Width at Inner end	500'	500'	**Runway 14 and Runway 32 Obstructed**
	Width at Outer end	1,500'	3,500'	
	Length	5,000'	10,000'	
	Slope	20:1	34:1	
Transitional surface slope		7:1	7:1	**Runway 14 and Runway 32 Obstructed**
Horizontal surface radius		5,000'	10,000'	Complies
Conical surface	Slope	20:1	20:1	Complies
	Radius	4,000'	4,000'	

**Primary & Approach Surface widths are dictated by the most stringent runway approach type, which at the Airport is the non-precision instrument approach to Runway 32*

Table 4-4

Runway 04-22 Part 77 Compliance

Protected Surfaces		Dimensions Runway 04 (Visual)	Dimensions Runway 22 (Visual)	Compliance
Primary surface	Width	250'	250'	**Runway 04 and Runway 22 Obstructed**
	Length beyond R/W end	0	0	
Approach surface	Width at Inner end	250'	250'	**Runway 22 Obstructed**
	Width at Outer end	1,250'	1,250	
	Length	5,000'	5,000'	
	Slope	20:1	20:1	
Transitional surface slope		7:1	7:1	**Obstructed**
Horizontal surface radius		5,000'	5,000'	Complies
	Slope	20:1	20:1	Complies

Protected Surfaces		Dimensions Runway 04 (Visual)	Dimensions Runway 22 (Visual)	Compliance
	Radius	4,000'	4,000'	

In order to determine the current condition of the Airport's protected surfaces, an aerial obstruction analysis survey and mapping project was performed to identify the top and ground elevation of the tallest object within a 100-foot-by-100-foot grid imposed by the mapper over the Airport's Part 77 surfaces. The mapping identifies the tallest object within the grid that penetrates the surface under analysis including buildings, vegetation, fences, poles and other objects. The primary purpose of the analysis is to determine the Airport's compliance with Part 77 and other protected surfaces, and to assist in determining which off-airport properties may require remedial action, such as the acquisition of property easements for object removal.

As indicated in Tables 4-3 and 4-4, the Runway 14-32 and Runway 04-22 Primary, Transitional, and Approach Surfaces are all obstructed. These obstructions must be removed, or, otherwise mitigated, to maintain safe airspace around the Airport. These obstructions are shown in Figures 4-2, 4-3, 4-4, 4-5, and 4-6 at the end of this Chapter. Additionally, large-scale worksheets have been attached to the ALP set to assist the Airport in its efforts to comply.

In order to clear all obstructions and maintain the Part 77 Approach and Transitional surfaces, easements must be acquired over 40 properties within the Town of Mansfield and 32 properties within the Town of Norton. Those properties with existing obstructions, or vegetation within 10 feet of becoming an obstruction, are indicated in Tables 4-5 and 4-6 and are shown in Figures 4-7, 4-8, 4-9, 4-10 and 4-11.

Table 4-5

Mansfield Properties with FAR Part 77 Obstructions

(Sorted by Runway End)

Parcel ID	Property Address	Runway End	Vegetative Obstruction	Vegetative Near Obstruction	Non Vegetative Obstruction
36-16	175 Fruit Street	04	✓	✓	
36-160	Reservoir Street	04	✓	✓	
36-18	72 Reservoir Street	04		✓	
36-36	Columbine Road	04		✓	
36-11	600 South Main Street	14	✓	✓	
36-134	157 Hall Street	14		✓	
36-138	83 Hall Street	14	✓	✓	
36-14	255 Fruit Street	14	✓	✓	

Parcel ID	Property Address	Runway End	Vegetative Obstruction	Vegetative Near Obstruction	Non Vegetative Obstruction
36-148	Fruit Street Rear	14	✓	✓	
36-150	Fruit Street	14	✓		
36-16	175 Fruit Street	14	✓	✓	
34-104	66 Tracy Circle	22	✓	✓	
34-106	70 Tracy Circle	22	✓		
34-110	571 Ware Street	22	✓	✓	
34-111	575 Ware Street	22	✓	✓	
34-112	579 Ware Street	22	✓	✓	
34-113	591 Ware Street	22	✓	✓	
34-114	595 Ware Street	22	✓	✓	
34-115	432 Fruit Street	22	✓	✓	
34-116	611 Ware Street	22	✓	✓	
34-130	362 Fruit Street	22	✓	✓	
34-165	294 Fruit Street	22		✓	
34-167	621 Ware Street	22	✓	✓	
34-169	Tracy Circle	22		✓	
34-245	631 Ware Street	22		✓	
34-361	11 Eugenia Drive	22	✓	✓	
34-364	6 Tracy Circle	22	✓	✓	
34-365	10 Tracy Circle	22	✓	✓	
34-366	14 Tracy Circle	22	✓	✓	
34-367	18 Tracy Circle	22	✓	✓	
34-368	22 Tracy Circle	22	✓	✓	
34-369	26 Tracy Circle	22		✓	
34-402	296 Fruit Street	22		✓	
34-403	Fruit Street	22	✓	✓	
34-415	Fruit Street	22	✓	✓	
34-51	300 Fruit Street	22	✓	✓	
34-52	358 Fruit Street	22	✓	✓	

Parcel ID	Property Address	Runway End	Vegetative Obstruction	Vegetative Near Obstruction	Non Vegetative Obstruction
36-29	15 Harding Lane	32		✓	

Table 4-6

Norton Properties with FAR Part 77 Obstructions

(Sorted by Runway End)

Parcel ID	Property Address	Runway End	Vegetative Obstruction	Vegetative Near Obstruction	Non Vegetative Obstruction
3-428	Woodland Road	32	✓	✓	
3-429	Fern Lane	32		✓	
3-776	19 Rock Lane	32		✓	
4-131-01	Cobb Street	32	✓	✓	
4-132	Cobb Street	32	✓	✓	
4-133	Cobb Street	32	✓	✓	
4-133-01	N Washington Street	32	✓	✓	
4-134-01	84 Cobb Street	32		✓	
4-136-02	N Washington Street	32	✓	✓	
4-136-03	N Washington Street	32	✓	✓	
4-137-01	212 N Washington Street	32	✓		✓
4-138	204 N Washington Street	32	✓	✓	
4-138-02	208 N Washington Street	32	✓	✓	
4-138-03	210 N Washington Street	32	✓	✓	
4-139	202 N Washington Street	32	✓	✓	
4-139-02	200 N Washington Street	32	✓		
4-140	198 N Washington Street	32	✓	✓	
4-141	N Washington Street	32	✓	✓	
4-142	190 N Washington Street	32	✓	✓	
4-143	166 N Washington Street	32	✓	✓	
4-143-01	86 Cobb Street	32	✓	✓	
4-152-03	193 N Washington Street	32	✓	✓	
4-153	189 N Washington Street	32	✓	✓	
4-153-01	N Washington Street	32	✓	✓	

Parcel ID	Property Address	Runway End	Vegetative Obstruction	Vegetative Near Obstruction	Non Vegetative Obstruction
4-154	N Washington Street	32		✓	
4-181	164 N Washington Street	32		✓	
4-183	160 N Washington Street	32	✓	✓	
4-184	156 N Washington Street	32	✓	✓	
4-185	154 N Washington Street	32		✓	
4-191	80 Cobb Street	32	✓	✓	
4-311	N Washington Street	32		✓	
4-784	N Washington Street	32	✓		

Runway End Siting Surface

Evaluation of the Airport's runway end (threshold) siting requirements is used to determine if a runway threshold meets approach and departure requirements as regards obstacle clearance. Each runway threshold must have a clear obstacle clearance surface (OCS), dictated by the approach type of that particular runway. Where a hazard to navigation exists, obstructing the OCS, the threshold must be displaced, reducing the length of runway available for landing. Depending on the reason for displacement, the portion of the runway behind the displacement may be available for take-off operations in either direction, or landing in the opposite direction, but aircraft are not allowed to land "before" the aircraft crosses the marked threshold. Table 4-7 presents the dimensional standards of the OCS for the Airport's runways.

Table 4-7

Runway End Siting Surfaces

Runway Type	Dimensional Standards (Feet)				Slope	Compliance
	Distance from Threshold (feet)	Inner Width (feet)	Outer Width (feet)	Length (feet)		
Runway 22: Approach end of runways expected to serve small airplanes with approach speeds of less than 50 knots (visual runways only, day/night)	0	120	300	3,000	15:1	**Runway 22: Obstructed**
Runway 14: Approach end of runways expected to serve large airplanes (Visual day/night); or instrument minimums ≥ 1 statute mile (day only)	0	400	1000	10,000	20:1	**Runway 14: Obstructed**
Runway 32: Approach end of runways expected to support instrument, straight-in, night	200	400	3,800	10,000	20:1	**Runway 32: Obstructed**

Runway Type	Dimensional Standards (Feet)				Slope	Compliance
operations, serving approach category A and B aircraft only						

The extent of OCS obstructions is depicted graphically in Figures 4-12, 4-13, 4-14, and 4-15, located at the end of this chapter.

Failure to maintain an obstruction free OCS will result in further displacement to the Runway thresholds on Runway 22, 14 and 32 to the following distances calculated from each runway end:

- Runway 22: 462 feet
- Runway 14: 460 feet
- Runway 32: 500 feet

Displacing the runway thresholds by the distances noted above would provide an unobstructed OCS for each runway end.

Recommendations: Because the Part 77 surfaces are the most restrictive and must be cleared of obstructions, it is recommended that the Airport continue its efforts to obtain property rights (fee simple or easement acquisition) on off-airport properties, and continue efforts to work with owners to clear identified obstructions to the Airport's Part 77 surfaces. However, in the event the rights to clear obstructions is not obtained, the Airport should either request that FAA perform an aeronautical study of each approach to determine whether obstruction lighting would mitigate the situation or displace the thresholds as required by FAA.

File FAA Form 7460, *Notice of Proposed Construction or Alteration*, for the existing obstructions and proposed obstruction mitigation. See the sample form located at the end of this chapter.

4.1.2.4 Runway Width and Crosswind Requirements

FAA, AC 150/5300-13, *Airport Design*, requires that airport runways provide at least 95 percent wind coverage. According to the Airport's 2001 Master Plan Update, Runway 14-32 provides 86.1 percent wind coverage and Runway 04-22 provides 90.5 percent wind coverage. The combined wind coverage for the Airport is 98 percent as stated in the Airport's 1981 Master Plan Update. It is important to note that because Runway 14-32 provides for only 86.1 percent wind coverage, the runway was constructed 15 feet wider than the FAA minimum required width of 60 feet to provide a greater margin of safety for larger aircraft during crosswind conditions that cannot utilize the crosswind runway. This additional width provides pilots with extra space that may be needed during an operation where winds are unfavorable.

Recommendation: Runway 14-32 should be maintained at a paved width of 75 feet.

4.1.2.5 Other Runway Requirements

Runway Lighting:

Runway 14-32 is lighted with MIRLs (Medium Intensity Runway Lighting System) which were rehabilitated in 1983. The system is currently in fair to poor condition; and its design life expired in 2003. Runway 04-22 is not lighted.

Recommendation: Replace MIRLS at the time Runway 14-32 is reconstructed. At the same time, the electrical vault should be moved to a new site closer to where the EAA trailer currently is located.

Runway Safety Areas:

A Runway Safety Area (RSA) is a defined surface surrounding a runway that is suitable for reducing the risk of damage to an aircraft in the event that an aircraft undershoot, overshoot, or veers from the runway. An RSA also provides access to fire fighting and rescue equipment during such incidents. FAA design standards require that the RSA be cleared and graded and have no potentially hazardous, surface variations; be capable of supporting snow removal equipment, emergency equipment, and aircraft; and be free of objects, except for those that need to be located in the RSA because of their function.

Runway 14-32

The RSA width for Runway 14-32 is required to be 120 feet wide centered on the runway centerline, and extend 240 feet beyond each runway end (Table 4-1). The Runway 14-32 RSA complies with FAA design standards.

Recommendation: Maintain standard RSA on Runway 14-32.

Runway 04-22

The RSA length must extend 240 feet beyond each runway end (Table 4-2). The existing RSA width is 120 feet, measured along the runway centerline, making it compliant with the required standard, but its length does not extend 240 feet beyond the Runway 04 end. Therefore, the Runway 04 end RSA length does not comply with FAA requirements (120 feet shorter than required).

Some options exist to bring the Runway 04 end RSA into compliance with the required standards.

Option 1: The first option shifts the runway 120 feet to the northeast to provide the required 240 feet of RSA at the Runway 04 end. There exists adequate land area at the Runway 22 end to accomplish the shift. This option moves the runway closer to Fruit Street while still providing adequate space for compliant RSAs at both runway ends. However, this option results in a reduction of the existing runway length to 2,286 feet - a 30 foot reduction from the existing length, and it also brings the Runway 22 end closer to existing obstructions in the Runway 22 Part 77 Approach Surface; increasing the Runway 22 non-compliant condition with Part 77.

Option 2: A second option is to remove 120 feet of runway at the Runway 04 end. This option results in a runway length of 2,196 feet - a 120-foot reduction in runway length. However, it does provide needed area for a compliant RSA length beyond the Runway 04 End without moving the runway

closer to Fruit Street and exacerbating the Part 77 non-compliance status of Runway 22.

Option 1 is not acceptable because it trades one condition (Runway 22, Part 77 obstructions) that is non-conforming with FAA requirements to satisfy another non-conforming condition (Runway 04 RSA length beyond runway end) – a situation that is not acceptable to the FAA.

Option 2 is preferable though not ideal. This option allows the Runway 04 end RSA to extend to the required 240 feet beyond the runway end without increasing the non-conforming condition at Runway 22. However, the Airport does lose 120 feet of runway length on Runway 04-22.

Recommendation: Remove 120 feet of runway length from the Runway 04 end to create a standard 240-foot RSA length beyond the Runway 04 end.

Runway-to-Taxiway Separation

Adequate separation between runways and other airport facilities (i.e., taxiways, aircraft parking aprons, hold lines) is necessary for airport operations to be conducted safely and not be hampered by other operations occurring in the vicinity. The FAA required separation distances (as presented in Table 4-1) are based on the Airport's ARC and approach capabilities of the runway, which are always measured from the runway centerline.

Runway 14-32

The required separation distance between Runway 14-32 and the parallel taxiway (Taxiway "A") is 225 feet. Currently, the existing runway-to-taxiway separation distance is 200 feet, which is 25 feet less than required. It is important to note that both Runway 14-32 and Taxiway "A" are constrained by wetlands on both sides and this must be considered when determining an appropriate compliance distance adjustment. A number of possible solutions exist to bring the facility into compliance with the required runway-to-taxiway separation distance. Three possible solutions are presented below.

Option 1: Relocate the Runway 14-32 centerline 25 feet to the southwest. This option will provide the required separation distance from Taxiway "A." However, the new runway and RSA location requires the filling and re-grading of approximately 4,150 square feet of wetlands and its buffer areas. This work will require environmental permits associated with wetland and buffer zone impacts. Utilizing this option would also alter a number of important areas such as runway approach design, Part 77 surfaces and published management plans. This option also requires that the runway be fully reconstructed as well as the stub taxiways providing access to Taxiway "A".

Option 2: Relocate Taxiway "A" 25 feet to the northeast. This option provides the required runway-to-taxiway separation distance. However to provide the required 49 foot Taxiway Safety Area (TSA) with the new taxiway location, an existing 1,000 foot long stream and associated buffer areas along Taxiway "A" must be altered requiring extensive environmental review and permitting efforts. Drainage system changes and improvements, and potential grading activities in these areas would be required to provide the required TSA. The drainage improvements, environmental permitting and

mitigation costs that will be necessary because of associated stream impacts makes this option costly.

Option 3: Relocate Taxiway "A" 12.5 feet to the northeast and Runway 14-32, 12.5 feet to the southwest. This option provides the required separation distance for compliance with separation standards. It also allows for the creation of standard RSAs and TSAs. This option will alter approximately 2,800 square feet of wetlands and associated buffer areas near the Runway 32 End RSA, and will require extensive grading. This option avoids impacts to the wetland and stream areas adjacent to Taxiway "A" as the taxiway can be graded and constructed outside of wetlands. Because construction of the TSA for Taxiway "A" will affect the 100-foot wetland buffer zone, it will require environmental permits. This option would alter a number of important areas such as runway approach design, Part 77 surfaces and published management plans as well.

Option 4: Apply to the FAA and request a modification to the runway-to-taxiway separation standards based upon the design aircraft. A Beech Baron, with a 52' wingspan and over 500 operations per year, was used as the design aircraft to determine if the existing separation is adequate to maintain wingtip clearance. FAA Order 5300.1F, *Modifications to Agency Airport Design, Construction, and Equipment Standards,* establishes approval level for modifications to standards applicable to airport design and construction projects. If approved, the Modification will need to be revisited during each subsequent planning project to determine whether conditions have changed that would render the Modification no longer appropriate.

- **Recommendation: Option 4 is recommended because it requires the least amount of environmental damage and is less costly than the other options.**

However, if the Modification to Standard were not approved, Option 2 would become the preferred choice because:

- **The runway is currently in good condition and should remain sound through the mid-term provided adequate maintenance;**
- **This option does not require the full reconstruction of the runway and RSA;**
- **This option does not require the design and publication of revised instrument approach procedures or additional tree clearing to maintain un-obstructed airspace;**
- **This option requires the least environmental damage of other available options, and,**
- **This option is less costly, the runway and RSA can be reconstructed in place, causing less environmental damage and mitigation.**

Runway 04-22

The existing separation distance between Runway 04-22 centerline and the Taxiway "B" centerline is 88 feet - 62 feet less than required. The required separation distance is 150 feet. Due to the proximity of the runway and taxiway to the Airport terminal area, a

limited number of options exist to bring the separation distance into compliance. Two possible solutions are described below

Option 1 Relocate the Runway 04-22 centerline to the southeast by 62 feet to provide the required 150-foot separation from Taxiway "B". This option does not disturb other terminal area facilities (i.e., aprons) but does require the relocation of some of the runway light fixtures serving Runway 14-32. The light fixtures were moved to accommodate a relocated Runway 04-22 centerline in 2010.

Option 2 Relocate the Taxiway "B" centerline 62 feet to the northwest to provide the required 150-foot separation from Runway 04-22. Relocation of this taxiway to the northwest would violate the separation standards for taxiways and parked aircraft.

Recommendation: Relocate Runway 04-22 centerline to the southeast by 62 feet to meet required separation distance from Taxiway "B". (This recommendation was approved in the Airport's most recent master plan update published in 2001).

Runway Obstacle Free Zone

The Runway Obstacle Free Zone is a defined volume of airspace centered above the runway centerline. This airspace is above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The ROFZ precludes taxiing, parked aircraft and object penetrations, except for objects that are required to be located in the ROFZ due to their function. The ROFZ extends 200 feet beyond each runway end.

The Runway 14-32 ROFZ is 400 feet wide and runs 200 feet beyond each runway end. It is in compliance with FAA design standards.

Runway 04-22 has an ROFZ width that is currently 120 wide and runs 80 feet beyond the Runway 04 end and 200 feet beyond the Runway 22 end. The ROFZ length beyond the Runway 04 end is not in compliance with FAA standards.

Recommendation: Remove the existing runway end marker on Runway 22 End, which is an obstruction to the ROFZ, non-frangible, and designed for daytime use only. Replace the runway end marker with a concrete pad or similar marker placed at grade level.

The Runway 04 end ROFZ length will be brought into compliance with standards during the proposed shifting and reconstruction of the runway and RSAs.

Runway Object Free Area

The Runway Object Free Area (ROFA) is a surface that is centered on the runway centerline at the elevation of the runway's edge elevation. The ROFA precludes penetrations by fixed or movable objects except for those objects whose location is fixed by its function. However, it is acceptable to place objects within the ROFA for air navigation or aircraft ground maneuvering purposes that extend above the runway edge elevation.

The purpose of the ROFA is to provide an area adjacent to the runway that is clear of unnecessary objects that could cause damage to the engine pods or other parts of an aircraft that might overhang the ROFA if an aircraft inadvertently overran or veered off a runway. FAA standards require clearing of the ROFA of any above ground objects protruding above the ROFA elevation. Any trees, shrubs or other penetrations to the ROFA must be removed.

The required width of the Runway 14-32 ROFA is 400 feet and extends 240 feet beyond runway end. The required ROFA width for Runway 04-22 is 250 feet and extends 240 feet beyond the runway end.

Recommendation: The ROFA for both runways is compliant with FAA standards upon the removal of the existing runway end marker at Runway 22 End.

4.1.3 Taxiway Requirements

Taxiways provide access between landside facilities and the runway.

4.1.3.1 Taxiway Pavement Requirements

The Airport has six taxiways, a parallel taxiway (Taxiway "A") two entrance/exit taxiways (Taxiways "E", and "G") and three access/exit taxiways (Taxiway "B", "C" and "D"). FAA design standards for the Airport require a paved taxiway width of 25 feet. The six taxiways at the Airport are all in compliance with this standard. Table 4-8 presents the applicable FAA taxiway design standards.

Table 4-8

Taxiway Compliance

Facility	Design Criteria (B-I)	Current Compliance
Taxiway width	25'	Complies
Taxiway edge safety margin	5'	Complies
Taxiway shoulder width	10'	Complies
Taxiway safety area width	49'	Complies
Taxiway object-free area width	89'	Complies
Taxilane object-free area width	79'	Complies

Source: FAA AC 150/5300-13, Airport Design

The Pavement History Plan (Sheet 4) contained as part of the ALP plan set depicts the pavement age and condition of all pavements throughout the Airport. Routine maintenance activities have been performed on all of the Airport's paved surfaces to help extend their useful design lives. Despite the age of many of these surfaces, most were documented to be in fair to good condition.

Portions of Taxiway "A" have been resurfaced during different years and so the condition of the entire taxiway is not consistent. The eastern half of the taxiway was reconstructed in 1994 and the pavement is currently in fair condition. This portion of the taxiway will exceed its 20-year design life in 2014; however, routine maintenance

may extend this design life. The western half of Taxiway "A" was last reconstructed in 1981 exceeding its useful design life in 2001. This portion of the taxiway is in poor condition.

Taxiway "B" was reconstructed in 1994, and is currently in fair condition. The design life will be exceeded in 2014. The end portion of this taxiway is in good condition as it was last constructed in 2004. Pavement on this portion of the taxiway will exceed its design life in 2024.

Taxiway "C" was constructed in 2005 and is currently in good condition. The design life for this taxiway pavement will be exceeded in 2025.

Taxiway "D" was constructed in 2005 and is currently in good condition. The design life for this taxiway will be exceeded in 2025.

Taxiway "E" was last reconstructed in 1994, is in fair condition, and has been maintained with routine crack sealing. The design life for this taxiway pavement will be exceeded in 2014.

Taxiway "G" was reconstructed in 1994. This taxiway is in fair condition, and the design life will be exceeded in 2014.

Recommendation: Reconstruct the western portion of Taxiway "A" and other paved areas that have exceeded their useful design life in the short term. Provided the recommendation to relocate the centerline of Taxiway "A" 25 feet to the northeast is accepted, this taxiway relocation project will remedy the condition of the taxiway's western portion. Otherwise, the western portion of the taxiway should be reconstructed in the short term.

Prepare to schedule the reconstruction of other paved areas within 5 years of the end of their design life.

4.1.4 Apron Capacity

Aircraft parking aprons are used to accommodate aircraft parked outdoors, on either a short or a long-term basis. Both based aircraft and transient aircraft are expected to use aircraft parking aprons. In New England, it is typical that the owners of more than 50 percent of the based aircraft will want to have their aircraft housed indoors in a hangar shelter, rather than parked on an apron. This helps to protect aircraft from wind, snow and ice, as well as from snow-removal or mowing efforts. Storing aircraft in hangars has also been one of the methods recommended by the Transportation Security Administration (TSA) to help prevent aircraft theft and misuse[3].

There are three aircraft parking aprons at the Airport, which cumulatively accommodate up to 100 aircraft. The paved main terminal apron was rehabilitated in 2000; it is in good condition with its design life ending in 2020. The paved East Ramp accommodates 10 aircraft. It was reconstructed in 2000 at the same time as the Main Apron; it is also in good condition. The Quadrant Four Apron was constructed in 2005; it is in good condition with its design life ending in 2025. In 2008, the Airport had 114, based aircraft. In 2028, at the end of the planning period, the based aircraft fleet is

[3] *Security Guidelines for General Aviation Airports*, Transportation Security Administration, May 2004.

forecasted to grow by 2 additional aircraft to 116. Assuming that 50 percent of the based aircraft will require tie-downs at the end of the planning period, 58 aircraft tie-downs will be needed to accommodate them.

Additionally, transient aircraft make use of the parking aprons. The Airport experienced 57,000 operations in 2008, with 22,000 (38.5 percent) being performed by transient aircraft. In order to identify the number of required parking spaces for transient aircraft, the formula listed below was used. This number was identified by multiplying the number of operations per peak month (5,700) by the percent of transient aircraft at the Airport (38.5 percent), divided by the number of days in the month (31) multiplied by 110 percent and then divided by 2, assuming that half of the transient operations will require apron space.

$$\{[(\text{operations/month} \times \%\ \text{transient})\ /\text{days/month}] \times 110\%\} \div 2$$

$$\{[(5{,}700 \times 38.5\%)\ /31] \times 110\%\} \div 2$$

$$= 39 \text{ transient aircraft parking spaces}$$

The calculation concluded that 39 transient parking spaces would be needed to accommodate the transient fleet during the planning period. Based upon the calculations it is reasonable to conclude that the Airport will require 97 tie-down spaces to accommodate aircraft through the planning period. Since the Airport currently has 100 tie-down spaces, additional spaces are not recommended at this time.

Recommendation: No additional tie-down spaces are recommended. Pavements for existing tie-down spaces should be reconstructed as they near their design life.

4.1.5 Navigation and Approach Aids

Aids to navigation provide pilots with information to assist in locating the Airport, and to provide horizontal and/or vertical guidance during landing operations. Additionally, navigational aids (NAVAIDs) are critical to providing access to the Airport during poor weather conditions. Navigation guidance at the Airport is provided in the form of a rotating beacon, non-directional beacon, lighted windsock, and a PAPI.

4.1.5.1 Rotating Beacon

A tower-mounted rotating beacon is located to the north of the administration building parking lot. The beacon was last serviced in 2006. At that time, the beacon assembly was replaced and in 2007, the beacon tower was painted. Currently it meets the needs of the Airport.

Recommendation: Maintain the existing rotating beacon and replace when its condition requires.

4.1.5.2 Non-Directional Beacon

A Non-Directional Beacon (NDB) is located in Quadrant Four, 75' east of Hangar "N". The NDB is owned and maintained by the Massachusetts Department of Transportation/Aeronautics Division (MassDOT/AD). The NDB currently meets the needs of the Airport. However, because the FAA is considering phasing out the NDB in favor of other technologies in the near future, it is possible that the entire beacon mechanism will be removed sometime during the planning period.

Recommendation: Maintain the existing NDB until decommissioned.

4.1.5.3 Lighted Windsock

The Airport has one lighted windsock, located near the intersection of the two runways, east of the parallel taxiway, which was replaced in 2009. The windsock is currently in good condition. A non-lighted, supplemental windsock is located adjacent to the PAPI at the Runway 32 End. This windsock is currently in need of replacement or repair.

Recommendation: Maintain the existing lighted windsock. Replace or repair existing supplemental windsock.

4.1.5.4 Precision Approach Path Indicator

The Airport has one Precision Approach Path Indicator (PAPI) on Runway 32, which is owned and operated by the FAA. The PAPI was installed in 2007 and is currently in good condition. In 2008, 3,400 feet of cable and conduit supplying electricity to the PAPI were replaced.

Recommendation: None.

4.1.5.5 Runway End Identifier Lights

The Airport currently does not have Runway End Identifier Lights (REILS) on either runway. REILS are white flashing strobe lights located at the runway end to provide rapid and positive identification of the approach end of a particular runway during conditions of low visibility. The Airport has expressed a desire to incorporate this type of lighting for Runway 32. Runway 04-22 only has visual approaches and it is not likely to be used by landing aircraft during conditions of low visibility, therefore REILS are not required.

Recommendation: REILS should be installed at the Runway 32 End. Project scheduled for completion in 2010.

4.1.5.6 Automated Weather Observing System (AWOS)

The Airport currently does not have an Automated Weather Observing System. An AWOS is an automated sensor suite, designed to serve aviation and meteorological observing needs for safe and efficient aviation operations and weather forecasting. AWOS units may be installed and operated by the FAA, or the Airport.

An AWOS generally reports at 20-minute intervals and does not report special observations for rapidly changing weather conditions. There are several varieties of AWOS depending upon the sensor systems that are installed; the most common type is the AWOS-III, which observes temperature and dew point in degrees Celsius, wind speed and direction in knots, visibility, altimeter setting, cloud coverage and ceiling up to twelve thousand feet. Additional sensors have become available for AWOS systems, which include the present weather conditions and account for freezing rain and thunderstorms (lightning).

Recommendation: Install an AWOS III system in the short-term.

4.2 LANDSIDE CAPACITY AND REQUIREMENTS

Airport facilities that are not required for the movement of aircraft are considered landside facilities. These facilities usually consist of terminal and maintenance buildings, hangars, and automobile parking areas. This section will provide a review of the capacity and functionality of the Airport's landside facilities.

4.2.1 Airport Terminal Building

The Airport's existing terminal building is a converted two-story house currently leased by the Airport's FBO and houses office space, a flight instruction classroom, operations desk, pilot's lounge and restroom facilities. The existing available floor space is approximately 2,000 square feet. Currently the building is deficient in the areas listed below.

- The facility does not meet standard handicap accessibility codes.
- The facility does not meet most current building codes (electrical, plumbing, etc.).
- The overall size of the building is inadequate for the needs of the Airport.
- Many facilities, particularly the offices, are too small for their intended use.
- The facility lacks needed storage and office space.
- The facility lacks a restaurant, which could attract additional patrons and subsequent revenue.
- The existing facility has a leak in the roof, a stone foundation and dirt crawl space. These deficits consequentially generate a water problem in the basement, which has resulted in mold and mildew growth throughout the building.
- The existing parking lot has problematic drainage.

In order to correct the above-referenced deficiencies, a new Terminal Building should be constructed in the general location of the existing facility. The building must contain sufficient area (3,500 square feet is recommended) to house larger offices for the FBO and Airport Manager, as well as additional classroom space for flight instructions, bathrooms, pilot lounges and larger storage areas. Other considerations include space to accommodate a small restaurant (approximately 1,000 sq. ft. in area), maintaining convenient access to vehicular parking, suitably located delivery area, secured airside access, and a good view of the airfield for both airport personnel and restaurant patrons.

The administrative offices should be located so that airport personnel have expedient access to the aircraft fueling area as well as a broad view of the airfield to enable supervision of people entering the airside of the field.

Under the Americans with Disabilities Act (ADA) of 1990, state and local governments are required to follow specific standards in the new construction and alteration of buildings. Additionally, the Architectural Barriers Act (ABA) requires that buildings

and facilities that are leased by a federal agency, or are designed, constructed or altered using federal funds, comply with federal standards for physical accessibility.

Given the conditions and the age of the building, the Airport is in need of a new, code-compliant, terminal building. In order to support and improve the current uses and provide adequate space for future expansion, a new 3,500 square foot terminal building is needed.

Recommendation: Construct a new 3,500 square-foot airport terminal building in the existing location considering the needs of the public, existing tenants, and airport security. Replace parking lot pavement and improve parking lot drainage at time of construction.

4.2.2 Hangars

Demand for aircraft hangars depends on a number of variables, including airport location, aircraft type, cost, seasonal and climatic conditions. Presently, there are 47 hangar spaces at the Airport. Assuming 50 percent of aircraft are utilizing tie-downs, with a fleet of 116 at the end of the planning period, a theoretical need for 11 additional hangar spaces, totaling 58, are needed.

The proposed development of the new Quadrant Four hangars is privately funded and constructed. After a review of the property, and correspondence with the Airport Commission, a suitable site plan was selected. The location is a portion of land to the south of the Quadrant Four hangars, in the general location of the Airport's existing NDB. As stated, the NDB will be removed as the FAA moves to discontinue the program. The removal of this structure will provide an adequate amount of land area to accommodate the need for future hangars. The Part 77 transitional restricts the maximum height of these new hangars to not more than 28 feet, or 149.5 feet above sea level, at a point 430 feet from the Runway 14-32 centerline.

Visual inspection indicates a need to replace the Quadrant One Hangars, which are some of the oldest aircraft storage hangars at the Airport. These hangars are old, in deteriorating condition, and replacement appears more cost-effective than rehabilitation.

Recommendation: Replace Quadrant One hangars. Allow proper construction of additional Quadrant Four hangar facilities to accommodate future indoor parking demand.

4.3 SUPPORT FACILITY REQUIREMENTS

Support facilities are those facilities on the Airport, which help to ensure efficient operation of the Airport. The Airport has fueling facilities, snow-removal and grass-mowing equipment, access roads, security fencing, and other facilities which all must be maintained and upgraded as needed so that day-to-day operations may continue.

4.3.1 Automobile Parking Facilities

The Airport can accommodate approximately 60 automobiles in the terminal building parking area and up to 20 vehicles in the Quadrant Four automobile parking area. Combined, there are 80 automobile parking spaces available at the Airport. Based on the forecasted growth rate for the Airport over the planning period, and the lack of on-

site businesses requiring additional parking, the automobile parking area requirements are limited to meeting the automobile parking demands of pilots and their passengers.

Recommendation: Maintain current automobile parking facilities except as influenced by the potential addition of a restaurant.

4.3.2 Aviation Fueling Facilities

The Airport has one fuel storage facility that was installed in 1994 and is operated by King Aviation. The facility consists of one 8,000 gallon, aboveground storage tank (AST) and two freestanding gas pumps that dispense 100LL AvGas. Currently, the fuel facility is in good condition.

At this time, and throughout the duration of the planning period, the number of forecasted jet operations at the Airport is not expected to reach a level that would appear to warrant the sale of Jet-A fuel.

Recommendation: Maintain existing AvGas facility and replace or upgrade when condition requires.

4.3.3 Snow Removal Equipment

The FAA AC 150/5220-20, *Airport Snow and Ice Control Equipment*, provides guidance in determining the type and size of needed Snow Removal Equipment (SRE). These determinations are based upon the ARC, the number of annual operations, and the average amount of annual snowfall.

The AC states that non-commercial service airports having more than 30 inches of snow, or those with over 10,000 operations and at least 15 inches of snow, should have a minimum of one high-speed rotary plow supported by two displacement plows of equal capacity[4]. In 2008, the Airport had approximately 57,000 operations and had an average annual snow fall of approximately 42 inches. Based on this data, and the guidelines set forth in AC 150/5220-20, the Airport is eligible for one high-speed rotary plow and two displacement plows of equal capacity.

The Airport currently owns the following SRE:

- 1 – 2007 Ford F-650 Diesel plow/dump truck with 11' Viking plow blade
- 1 – 2009 John Deere 544K Tractor with 3 yard bucket, 12' articulating Viking blade and Viking wind plow, and a 14' box plow
- 1 – 2003 John Deere 5420 Tractor with 85" bucket and 10' box plow

While the Airport does not choose to own a high-speed rotary plow, it does own three carrier vehicles, one of which may be utilized as the carrier vehicle for a future rotary plow attachment.

Recommendation: Maintain existing snow removal equipment.

4.3.4 Snow Removal Equipment Storage

The existing SRE building, adjacent to the Airport entrance on Fruit Street, is approximately 3,250 square feet in total area. Of this area, approximately 1,200 square

[4] FAA AC 150/5220-20, Chapter 6, Section 38a, June 30, 1992.

feet is comprised of administrative and meeting space, as well as kitchen and restroom facilities. The remaining area (approximately 2,050 square feet) is utilized for SRE storage and maintenance.

The building's storage and maintenance areas consist of three bays capable of storing the Airport's 3 large maintenance vehicles with a moderate amount of space allocated for smaller maintenance equipment and materials. The building is congested with maintenance equipment, and during the early stages of this project, the Airport Commission indicated that the building does not provide adequate storage space. Space allocation for equipment storage is based upon the FAA's AC 150/5220-18A, *Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment,* which gives recommendations for equipment storage based on the number and type of equipment comprising the fleet. This AC, which provides detailed recommendations for the design of SRE storage facilities, indicates that the Airport is eligible for a larger SRE building, as the existing facility does not provide adequate space for Equipment Safety Zones (ESZs) and a number of support items.

In Table 3-1 of the *Minimum Equipment Space Allocations Using the Equipment Safety Zone Concept*[5], ESZ clearance standards are provided. The Airport is eligible for up to 5,000 square feet of fleet storage area by applying the ESZ dimensional standards to the dimensions of the existing SRE fleet.

Space allocations for support items are provided in Table 3-3, *Typical Storage Space Allocations for Support Items*[6]. Support areas falls into two basic categories: (1) an area dedicated to administrative duties, employee areas such as a kitchen, training/conference room, restrooms, etc. and (2) an area dedicated to the maintenance and repair of equipment. As the existing SRE building has adequate space for administrative and employee areas, only the space allocation for dedicated maintenance and equipment repair area will be addressed.

The following support area allocations were identified for the Airport:

- Parts Area associated directly to snow vehicles: 200 SF,
- Lubrication, Oil, Grease storage: 150 SF,
- Recycled Oil and Used Anti-Freeze: 150 SF,
- Mechanic Bench Area: 100 SF, and,
- Repair Bay: 600 SF.

Table 3-3 indicates that the Airport qualifies, at a minimum, for approximately 1,200 square feet of storage space for the above-referenced support items. Other additional support item areas were identified as unlikely to be required, including a parts area associated with snow removal operation, a welding area, and a cleaning bay. According to the AC, the Airport is reasonably qualified for a 6,200 square foot SRE building for the storage of the SRE fleet and associated equipment and non-administrative support areas. The existing building has approximately 2,050 square feet of storage area for SRE, parts and equipment. This represents a deficiency of approximately 4,150 square feet.

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[5] FAA Advisory Circular 150/5220-18A, September 14, 2007, page 13
[6] FAA Advisory Circular 150/5220-18A, September 14, 2007, page 15

The only corrective action for this deficiency is complete reconstruction of the SRE facility. As this is impracticable, it will be assumed that the existing 2,050 square foot area is sufficient for the storage of the Airport's SRE fleet. However, the building remains deficient in regards to space allocations for support items including equipment maintenance and parts storage. An addition of 1,000 square feet to the existing facility will provide a reasonable storage area to accommodate the Airport's existing and future SRE facility needs. Construction of the addition should be planned with garage doors located on both sides of the new structure to allow for the ability to drive equipment through the building.

Recommendation: Construct a 1,000 square-foot addition to the SRE building for storage.

4.3.5 Airport Access Gates

The Airport has five vehicle access gates and two personnel gates. All access and personnel gates are currently in good condition and meet the needs of the Airport, with the exception of Gate "D" which has problems with reflectors and is located too close to Fruit St. to allow for safe egress and access, particularly for delivery trucks.

Recommendation: The access gates are in good condition. Relocate Gate "D" to provide adequate distance from Fruit St. Scheduled for completion in 2010.

4.3.6 Airport Fencing

As described in Chapter 2, the Airport property is almost entirely surrounded by chain-link fencing topped with barbed wire standing 8-foot tall, principally to mitigate wildlife hazards and prevent intrusion by members of the public. A shorter 5-foot tall section, 4,700 feet in length, owned by the Massachusetts Highway Department, is in place along the Airport property boundary parallel to I-495. This section of fence is not tall enough to serve its function adequately. In order to effectively protect the Airport and the public, and not affect the state's fence, an additional 4,700 feet of 8-foot tall, barbed wire fencing should be installed on airport property parallel to I-495. Ideally, the Airport should approach the Highway Department to investigate whether cost sharing could eliminate the need for two fences.

Recommendation: Install 4,700 linear feet chain-link fence topped with barbed wire, 8-foot tall, parallel to I-495.

4.3.7 Airport Security Needs

Security requirements have become very important in planning airport facilities. In the FAA document, *Security Guidelines for General Aviation Airports*[7], recommendations for minimum security measures are provided. The recommendations take into consideration a number of factors, including airport location, based aircraft, runway length, as well as number and type of airport operations performed. Point values are assigned to each factor, and based on the total number of points, minimum security recommendations are provided.

Table 4-9

Airport Security Characteristics Measurement

Security Characteristic	Assessment Scale
Within 30 nm of a mass population area	5
Greater than 101 based aircraft	3
Runway length less than 5,000', greater than 2,001'	4
Over 50,000 annual operations	4
Asphalt or Concrete Runway	1
Flight Training	3
Total	**20**

Based on the TSA *Guidelines*, the following minimum security measures are recommended:

- Update and distribute an emergency contact list;
- Formalize an airport community watch program;
- Formalize a policy whereby the identity of all persons entering airport operations areas are verified and that all baggage and cargo is known;
- Formalize airport security procedures and distribute to airport employees and tenants;
- Install additional warning signs around the perimeter of the area to deter unauthorized access to the Airport;
- Install additional cameras to deter unauthorized access to the Airport and improve security;
- Establish procedures to identify non-based pilots and aircrafts using the facility;
- Establish airport security committee composed of airport tenants and users with the main goal being involvement of airport stakeholders in developing

[7] *Security Guidelines for General Aviation Airports*, Transportation Security Administration, May 2004.

effective and reasonable security measures and disseminating timely security information; and

- Maintain liaison with appropriate law enforcement agencies including local, state and federal branches.

Recommendation: Continue to update and distribute emergency contact list, participate in the community watch program, maintain identification policy and airport security procedures, including procedures to identify non-based pilots and aircrafts, have regular airport security committee meetings, maintain liaison with law enforcement agencies, and, install warning signs at the gates (not on the fence).

4.4 SUMMARY OF FACILITY REQUREMENTS

The Airport is a quality facility offering a wide variety of general aviation services to the region. Improvements to the facility are needed to meet basic safety requirements per the applicable FAA standards and to provide adequate space for the Airport's current and future aircraft fleet, as well as, airport tenants and visitors.

Short Term (2011-2015) Improvement Requirements (no order of priority is given to improvements)

- Taxiway "A" Crack Repair.
- Take steps to remove the threshold displacements.
- File FAA Form 7460, *Notice of Proposed Construction or Alteration.*
- Remove existing runway end marker on Runway 22 end.
- Install Runway End Identifier Lights (REILS) at the Runway 32 End.
- Relocate the centerline of Runway 04-22, 62 feet to the southeast to provide for standard Runway-to-taxiway separation.
- Shorten Runway 04-22 on the 04 end by 120 feet, which reduce its length to 2,196 feet and provides a standard Runway Safety Area at the Runway 04 end.
- Continue to work with abutters to acquire easements and clear vegetative obstructions to the Airport's FAR Part 77 and Runway End Siting Surfaces.
- Apply to the FAA to request a Modification of Airport Design Standards and FAA Order 5300.1F. If the Modification is not approved, relocate and reconstruct Taxiway "A" to provide standard runway-to-taxiway separation.
- Reconstruct Quadrant One hangar facilities.
- Replace Medium Intensity Runway Lighting System (MIRLs) and relocate the electrical vault.
- Install an AWOS system.
- Consider construction of the Quadrant Four hangar facilities.

- Obstruction Mitigation Plan.

Mid-Term (2016-2021) Improvement Requirements

- Install 4,700 linear feet of chain-link and barbed wire fencing along the Airport property boundary parallel to I-495.
- Reconstruct terminal building and address issues with parking lot drainage.
- Construct 1,000 foot addition to the existing SRE building.
- Reconstruct Taxiway "B" as its design life is exceeded.
- Reconstruct Taxiway "E" as its design life is exceeded.
- Reconstruct Taxiway "G" as its design life is exceeded.

Long-Term (2022-2031) Improvement Requirements

- Reconstruct Runway 14-32 and install MIRLS.
- Reconstruct Taxiway "D" pavement as its design life is exceeded.
- Reconstruct Taxiway "C" pavement as its design life is exceeded.
- Reconstruct Airport's Main Apron and East Ramp as their design lives are exceeded.
- Reconstruct the Quadrant Four Apron as its design life is exceeded.

5 SCHEDULE OF IMPROVEMENTS

This chapter presents a recommended Schedule of Improvements (the Schedule) for implementing the improvements described in Chapter 4, *Facility Requirements,* and shown on the Airport Layout Plan (ALP). The schedule is a first step in the Airport's efforts to develop a coordinated Capital Improvement Plan (CIP) in cooperation with the FAA and MassDOT/AD. The schedule presented in this chapter represents the Airport's desired implementation schedule.

Proposed projects have been grouped according to short term (2011-2015), mid-term (2016-2021) and long-term goals (2022-2031). No order of priority has been assigned to the proposed projects. It should be noted that the costs submitted for the proposed projects are estimates derived from assumed scopes of work, experience with similar types of projects, or costs of projects recently completed by Gale Associates, Inc.

For construction projects, costs include, among other things, project development (scope of work, budgets, etc.); design (plans and specifications); bidding in accordance with federal, state and local regulations; construction; construction supervision and administration; and project administration.

The cost estimates provided assume that the airport regulatory environment remains the same as in existence today. Changes in the regulatory environment will likely affect project costs where these regulations apply.

5.1 INFLATIONARY EFFECTS ON COST ESTIMATES

Project costs will likely rise in the future with inflation and other factors. All project costs occurring after 2011 have been adjusted for inflation. The inflation rate used in the adjustment represents a compounded increase of 2.83% per year in cost. The inflation rate used was based upon the average annual inflation rates from 1999 through 2009, as calculated from the Consumer Price Index (CPI).

Future inflation rates may vary; therefore, the costs shown in Table 7-1 may need further adjustment. For this purpose, reference is made to the Construction Cost Index (CCI) presented in Engineering News Record, a weekly nationwide civil engineering and construction magazine published by the McGraw-Hill Company. Each month the CCI is revised, reflecting changes in typical labor rates and material costs. By applying future CCI numbers as they become available, the cost estimates can be updated to reflect a more accurate and probable cost prior to implementation.

5.2 ENVIRONMENTAL PLANNING PROJECT COSTS

Actual costs of planning or environmental review and permitting projects are not known with any degree of accuracy until the project scope of work is developed. Developing the scope of work is a process that takes place approximately one year before the actual start of a project in preparation for funding applications. Therefore, the cost of these

types of projects may vary from the estimated costs due to changes in the actual scope of the project at the time of implementation.

In addition, costs for environmental mitigation are not known until mitigation plans are presented to regulators and approved. Therefore, projects that contain environmental mitigation components must be assumed so that the costs of these projects can be represented in the Schedule.

5.3 PROJECT PHASING

In an effort to manage funding capabilities or project costs better, the Schedule separates some projects into two or more phases, or schedules them apart from other compatible projects that could be grouped together. Conversely, to take advantage of economies of scale, some small projects may be grouped together to make the implementation of those projects more cost effective for the Sponsor and funding agencies.

5.4 FUNDING SOURCES

Federal airport funding under the FAA Airport Improvement Program (AIP) currently allows the FAA to reimburse sponsors up to 95% of eligible project costs with the State and Airport equally sharing the remaining costs.

AIP eligible items generally include environmental planning and permitting, airfield components, land acquisition, aircraft aprons, obstruction removal or lighting, fencing, airport access, etc. Items of highest priority are related to the runway and taxiway system and are safety related. Some items, such as hangars, may be eligible for AIP funding assistance provided the FAA finds that all safety related projects are complete or an in the process of being addressed to FAA satisfaction. Items that are typically not eligible for AIP funding include, automobile parking lots, terminal buildings, and facilities that are for sole use of private parties. Further, certain electronic and visual navigational aids may be provided entirely by the Airways Facilities and Equipment (F&E) Division of the FAA at no cost to the Airport. Certain recommended improvements are either not currently eligible for federal funding assistance or are unlikely to obtain federal funding. These projects are noted in the schedule.

Where a project is eligible for state funding but not federal funding assistance, assistance may be applied for under the MassDOT/AD's Airport Safety and Maintenance Program (ASMP) at a reimbursement rate of 80% of eligible costs, with the remaining 20% of project costs the responsibility of the sponsor (the Airport). The Schedule identifies projects that include only state and local funds.

5.5 FORECASTED VS ACTUAL DEMAND

Although it is the intent of the Schedule to program improvements required to meet the projected demand through the short and mid-term planning periods, it is not recommended that facilities be built unless <u>actual</u> demand for the improvement

develops. In all probability, demand will likely not occur exactly as scheduling indicates which in turn may affect development timetables. In addition, any noticeable delays in environmental and other review processes may require alterations to the Schedule. In such a case, some of the work items for a given period may have to be postponed, or moved into a later planning period.

Because some of the long-term improvements are based on forecasts alone, there is no guarantee that these improvements will need to be constructed. Thus, the Airport should closely monitor demand and be prepared to initiate steps to implement long-term recommendations as demand dictates. However, the Airport should begin the process of implementing short-term recommendations as soon as practicable, given funding constraints, as the demand for these projects is in evidence.

The following Schedule provides an indication of each project's eligibility for federal or state funding assistance.

Table 5-1
Schedule of Improvements

Fiscal Year	Project Title	Project Cost	Funding		
			Federal(95%)	State	Local
2011	415 Fruit Street Acquisition	$106,500	$101,176	$2,662	$2,662
2011	Obstruction Mitigation Plan	$45,000	$42,750	$1,125	$1,125
2012	Update VMP/YOP*	$200,000	$190,000	$5,000	$5,000
2012	Easement Acquisition	$1,400,000	$1,330,000	$35,000	$35,000
2013	On-Airport Land Restoration	$350,000	$332,500	$8,750	$8,750
2014	Off-Airport Obstruction Removal	$500,000	$475,000	$12,500	$12,500
2015	Reconstruct Taxiways "A", "B", "E" and "G" and Relocate Electrical Vault	$2,800,000	$2,660,000	$70,000	$70,000
2015	Reconstruct Quadrant One T-hangars	$1,600,000	$450,000	$920,000	$230,000
2016	Install AWOS	$400,000	$380,000	$10,000	$10,000
2016	SRE Building Expansion	$450,000	$427,500	$11,250	$11,250
2017	Install Perimeter Fence (Along Rte. 495)	$200,000	$190,000	$5,000	$5,000
2018	Construct Terminal Building	$2,500,000	$2,375,000	$62,500	$62,500
2020	Reconstruct Main Apron and East Ramp	$1,400,000	$1,330,000	$35,000	$35,000
2023	Reconstruct Runway 14-32	$4,000,000	$3,800,000	$100,000	$100,000
2025	Reconstruct Quadrant Four Apron	$500,000	$475,000	$12,500	$12,500
2025	Reconstruct Taxiways "C" and "D"	$750,000	$712,500	$18,750	$18,750

**ASMP project*

5.6 SHORT-TERM IMPROVEMENTS

This section provides summary descriptions of the individual projects included in the Airport's short-term Capital Improvement Program (from FY 2011-2015). The following descriptions are for planning purposes only and will likely require refinement and review prior to starting work on a particular project.

5.6.1 FY2011 – Acquisition of 415 Fruit Street

This project is to acquire a vacant lot located at 415 Fruit Street in Mansfield, Massachusetts. The lot is approximately 2.83± acres in area and is located in the Part 77 Approach Surface and Runway Protection Zone for Runway 04. The lot is heavily forested with numerous trees penetrating the approach surface.

An appraisal established a fair market value of $80,000 for the property. A review appraisal supported this value, and the Commission purchased 415 Fruit Street for $80,000 on January 29, 2010. The remaining funds were for planning, engineering, legal, appraisal, and similar project costs.

The work under this Project was accomplished as specified in Advisory Circular No. 150/5100-17, *Land Acquisition and Relocation Assistance for Airport Improvement Program Assisted Projects*, dated November 2, 2005, and in conformance with the *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970*.

This project is eligible for state and federal funding assistance.

Project Cost: $106,500

5.6.2 FY2011 – Obstruction Mitigation Plan

This project is to develop a written plan to assist the Airport in examining strategies and establishing priorities for tree removal or mitigation of on-Airport and off-Airport obstructions. Identification and analysis of penetrations and collection of parcel and owner data have been provided through AIP 3-25-0028-22-2009. This project will use this information to examine a limited number of tree clearing scenarios and their effect on runway threshold. A major emphasis on the plan will be Runway 14-32, the primary runway. This project will file with FAA for the conduct of aeronautical studies with the objective of determining where other obstruction mitigation efforts, such as hazard beacons may be appropriate. The project will include a brief report describing the plan.

This project is eligible for state and federal funding assistance.

Estimated Project Cost: $45,000

5.6.3 FY2012 – VMP/YOP Update

In 1999 the Airport undertook a project to develop a Vegetation Management Plan (VMP) to identify vegetative penetrations and develop a comprehensive plan for their

removal. The scope of the VMP was limited to examining on-airport conditions. Recent obstruction evaluations indicate that extensive tree clearing is required off-airport property and a VMP will need to include these obstructions, particularly if tree clearing in wetlands is anticipated. In addition, the VMP included a Yearly Operating Plan (YOP), which covered 2005 – 2009 and needs to be updated to current conditions. This project will update the VMP for on and off-airport conditions and develop a current five year plan as required.

This project is eligible for federal & state funding assistance.

Estimated Project Cost: $200,000

5.6.4 FY2012 – Easement Acquisition

The purpose of this project is to obtain sufficient property interest, in the form of avigation easements, to protect the Runway 14-32 and 04-22 approaches and allow for removal of existing and imminent obstructions. For the purposes of this project, imminent obstructions are defined as trees and other living obstructions within 10 feet of the Airport's protected surfaces that have the potential to become obstructions within the short term.

This project will be further defined upon completion of the Obstruction Mitigation Plan, but preliminary analysis has identified thirty-seven properties for avigation easement acquisition in Mansfield. An additional thirty-two properties have been identified for avigation easement acquisition in Norton.

The work under this project will be accomplished as specified in Advisory Circular No. 150/5100-17, *Land Acquisition and Relocation Assistance for Airport Improvement Program Assisted Projects*, dated November 2, 2005, and in conformance with the *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970*

The cost of this project is wholly dependent upon the number and nature of easements the Airport is able to procure from off-Airport properties. Priorities for easement acquisition will likely be identified in the Obstruction Clearing Plan planned for development in 2011. It is possible, that the placement of obstruction lights or hazard beacons may negate the need to obtain some of the easements which may in turn lessen the costs of easements. Further, depending upon the number of easements to be procured, this project may be split into several sections to accommodate funding constraints and other considerations.

This project is eligible for state and federal funding assistance.

Estimated Project Cost: $1,400,000

5.6.5 FY2013 – On-Airport Land Restoration

This project is a follow up project to AIP 3-25-0028-10-2000 (AIP 10) which funded the removal of vegetative obstructions on Airport property. At the time AIP 10 was

implemented, it was decided to remove vegetation, but to leave stumps and shrubs, due to funding constraints. This project will remove those tree stumps and shrubs, and rough grade the areas sufficient to allow the Airport to mow the areas in accordance with their VMP maintenance requirements. These areas underlie the Part 77 surfaces in close proximity to both runways.

This project is eligible for state and federal funding assistance.

Estimated Project Cost: $350,000

5.6.6 FY2014 – Off-Airport Obstruction Removal

This project is limited to removing vegetative obstructions to the Part 77 Approach Surfaces to Runways 14-32 and 04-22 that are located off the Airport property.

All obstruction removal will be conducted as "selective tree clearing". Trees over 12" diameter will be cleared in upland and wetland areas. Felled trees in the upland area will be removed from the site. Within the wetlands felled trees that are able to be removed without mechanized equipment will be removed. The remaining felled trees will be lopped into 4'± sections and left in the wetlands. All trees that are to be removed shall be hauled off site.

The cost of this project is directly tied to the success in obtaining off-Airport easements (see Section 5.6.5) and to the nature of the clearing (i.e. whether forested or single tree, upland or wetland, on active residence property). Once tree clearing limits are known, more accurate cost estimates can be calculated.

This project is eligible for state and federal funding assistance.

Estimated Project Cost: $500,000

5.6.7 FY-2015 Reconstruct Taxiways "A", "B", "E" and "G"

This project is to reconstruct Taxiways "A" "B", "E", "G" after their design life has ended, and the pavement deteriorates (at least 20 years of age). This project assumes full-depth construction including: the removal of the existing pavement and base materials, subgrade preparation, placement of a gravel sub-base and aggregate base layers, the placement of bituminous concrete pavement, and restoration of the taxiway safety areas. Additional work includes installation of new MITLS systems, drainage improvements, electrical ducts, erosion control, re-grading of the safety areas, re-spreading topsoil and seeding. This project also includes relocation of the electrical vault and consolidation of electrical circuits. All taxiways are 30 feet in width.

Cost Breakdown:

Taxiway	*Length (in feet)*	*Estimated Cost*
A	*3,811*	*$1,800,000*
B	*675*	*$350,000*
E	*257*	*$250,000*
G	*230*	*$250,000*
TOTAL	*4,973*	*$2,650,000*

This project is eligible for state and federal funding assistance.

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Estimated Project Cost: $2,800,000

5.6.8 FY-2015 Reconstruct Quadrant One Hangar Facilities

This project replaces the Quadrant One hangars which consist of two T-hangar buildings with a capacity of ten small aircraft each. The project assumes:

- Replacement hangars will be prefabricated metal type
- Existing foundations and electrical utilities are re-usable
- Fire sprinkler system will be required
- No taxilane improvements

The estimated project cost for this project is limited to the airport's aggregation of three years of FAA, AIP Non-primary Entitlement funds at the current rate of $150,000 per federal fiscal year.

This project is eligible for state and federal funding assistance. (Federal assistance for this type of project is generally only allowed when all safety oriented are in compliance with FAA standards.) Funding for this project would likely develop as follows: the FAA will contribute $450,000 in non-primary airport entitlement funds with MassDOT/AD providing 80% or $920,000 of the remaining non-federal share of $1,150,000, and the Sponsor will contribute the remaining $230,000 (or 20% of the non-federal share).

Estimated Project Cost: $1,600,000

5.7 MID-TERM IMPROVEMENTS

This section provides summary descriptions of the individual projects included in the Airport's mid-term Capital Improvement Program (from FY 2016-2021). The following descriptions are for planning purposes only and may require refinement and review prior to starting work on a particular project.

5.7.1 FY 2016 – Install AWOS

This project is to purchase and install an AWOS unit at the Airport to provide pilots with local weather information. This project assumes that the AWOS unit provides data on wind speed, wind gust, wind direction, variable wind direction, temperature,

dew point, altimeter setting, density altitude, visibility, variable visibility, precipitation, day/night, present weather, and precipitation discrimination. The cost of the AWOS may increase or decrease as capabilities are introduced into the equipment.
This project is eligible for state and federal funding assistance.

Estimated Project Cost: $400,000

5.7.2 FY-2016 Construct SRE Building Addition

This project will construct an addition to the SRE building of approximately 1,000 square feet for the storage of the Airport's airfield maintenance equipment and supplies.

The major components of this project will include:

- Design, bidding, construction supervision and administration
- Construction of a concrete slab foundation;
- Erecting a steel frame and sheathed 1000 square-foot SRE building;
- Two garage doors to access the front and rear of the building.

This project is eligible for state and federal funding assistance.

Estimated Project Cost: $450,000

5.7.3 FY-2017 Install Perimeter Fence

This project is to install 8-foot high galvanized chain-link fencing, topped with barbed wire, along the Airport boundary adjacent to Interstate 495, principally to mitigate wildlife hazards and prevent intrusion by members of the public.

This project is eligible for state and federal funding assistance.

Estimated Project Cost: $200,000

5.7.4 FY-2018 Reconstruct Terminal Building

This project is to construct a new Terminal Building in the general location of the existing facility. The one story building will be approximately 3,500 square feet. The project will include demolition, excavation, foundation, framing, roofing, siding, windows and doors, plumbing, electrical, heating work, insulation, drywall, interior and exterior trim, paint, and flooring to commercial specifications.

This project also includes:

- Removing unsuitable earth materials from building foundation and parking lot and replacing with suitable base materials.
- Installing stormwater drainage structures.
- Installing new sewage line for administration building.
- Grading and paving parking lot and access drive.
- Removing and re-installing chain link fence.

- Marking new parking lot spaces including handicap spaces and loading area for new building.
- Installing parking lot lighting/entrance sign.

This project is eligible for state funding assistance.

Estimated Project Cost: $2,500,000

5.7.5 FY-2020 Reconstruct Main Apron and East Ramp

This project includes the reconstruction of the Main Apron and the East Ramp. The project will include:

- Removing bituminous concrete on existing aprons, removing unsuitable base material and replacing with suitable sub-base material;
- Installing stormwater drainage structures;
- Paving;
- Installing tie-down hardware; and
- Marking tie-downs and taxilane centerlines.

This project is eligible for state and federal funding assistance.

Estimated Project Cost: $1,400,000

5.8 LONG-TERM IMPROVEMENTS

This section provides summary descriptions of the individual projects included in the Airport's long-term Capital Improvement Program (from FY 2022-2031). The following descriptions are for planning purposes only and may require refinement and review prior to starting work on a particular project.

5.8.1 FY2023 – Reconstruct Runway 14-32

This project includes reconstruction of the existing Runway 14-32 at 3,500 feet in length by 100 feet in width, to include:

- Full depth reconstruction of the entire runway, including the removal of existing pavement and base materials, subgrade preparation, placement of gravel sub-base and aggregate base layers, and placement of bituminous concrete pavement.
- Reconstructing portions of all exit taxiway stubs to conform to new runway elevations.
- Reconstructing both Runway Safety Areas (120' x 240').
- Installing MIRLS.
- Applying runway & taxiway markings
- Installing drainage improvements
- Restoring disturbed areas

This project is eligible for state and federal funding assistance.

Estimated Project Cost: $4,000,000

5.8.2 *FY-2025 Reconstruct Quadrant Four Apron*

This project includes the reconstruction of the Main Apron and the East Ramp. The project will include:

- Removing bituminous concrete on existing aprons, removing unsuitable base material and replacing with suitable sub-base material;
- Installing stormwater drainage structures;
- Paving;
- Installing tie-down hardware; and
- Marking tie-downs and taxilane centerlines.

This project is eligible for state and federal funding assistance.

Estimated Project Cost: $500,000

5.8.1 FY- 2025 Reconstruct Taxiway "C" and "D"

This project is to reconstruct Taxiways "C" and "D" after they have exceeded their design lives, and the pavement has deteriorated. These taxiways are 30 feet wide and a combined 1,100 feet in length. The reconstruction will consist of full-depth construction including: the removal of the existing pavement and base materials, subgrade preparation, placement of a gravel sub-base and P-aggregate base layers, and the placement of bituminous concrete pavement. Additional work includes drainage improvements, electrical ducts, erosion control, re-spreading topsoil and seeding.

Estimated Project Cost: $750,000

6 PUBLIC INFORMATION MEETING

This chapter represents the culmination of the work efforts that result in a final presentation of the AMPU to the Airport, the FAA, MassDOT AD and the public.

The Public Informational Meeting was held on February 28th, 2011. A public notice was published in the local newspaper and on the Town website. Additionally, abutters to the Mansfield Municipal Airport received notification of the meeting via United States Postal Service.

A PowerPoint presentation was developed and used as collateral to support the presentation. Special attention was targeted toward the public for the purpose of education regarding the need for projects that are generally safety oriented and which keep the airport in compliance with FAA standards. The CIP projects included in the Chapter 5, Schedule of Improvements, with FAA and State funding are not for the purpose of airport expansion. It was explained that the highest priority items are related to the runway and taxiway system and are safety related. However, other projects, such as hangars may be eligible for AIP funding assistance, but only if the FAA finds that all safety related projects are complete or in the process of being addressed to FAA satisfaction. FAA standards for airport design (AC 150/5300) and Federal Aviation Regulation Part 77, *Objects Affecting Navigable Airspace* (FAR Part 77), are used to analyze facility conditions and to identify needed improvements, replacement or expansion.

Significant emphasis was placed on the need for tree clearing to maintain un-obstructed airspace. The Airport is examining strategies and establishing priorities for tree removal or mitigation of on-Airport and off-Airport obstructions. In the AMPU, penetrations were identified, parcel and owner data was provided and an analysis was prepared. The information will be used to examine a limited number of tree clearing scenarios and their effect on runway threshold. The major emphasis will be on improving the safety of Runway 14-32, the primary runway.

Following the presentation, the public was asked for comments, questions or concerns. The questions directed to the Airport Commission and responses are contained in the *Visitors Comments* section of the minutes.

The meeting minutes follow.

6.1 PUBLIC INFORMATION MEETING

Commissioners:
Louis Andrews
Robert Andrews
Philip Finer
Carl Lambrecht
Howard Fiske

King Aviation:
David Dinneen

Visitors:
Gail Lattrell
David Fetherston
George Bezreh
Mr. & Mrs. Dhuphar
Bill Dillon
Olivier Kozlowski
Dana St. James
Ron Purat
Kevin Moran

Airport Engineer:
Armand Dufresne

Louis Andrews welcomes the attendees and introduces the members of the Commission, FAA, Board of Selectman, Airport Manager, and Airport Engineer.

Armand Dufresne highlights the following items in regard to the Airport Master Plan Update:

- Examines the airport facilities and discusses what projects will be addressed.
- States the Airport Commission is responsible for the care, the custody, and the management of all aspects of the airport.
- The Mansfield Municipal Airport is approximately 235 acres and the fifth largest general aviation airport in MA.
- The users of the airport include private pilots, recreational pilots, corporations/businesses, emergency flights, community events, fundraisers, and school visits.
- The airport offers many services to the flying and non-flying public.
- The idea behind a Master Plan Update is to essentially remain in compliance with FAA standards. Every ten to fifteen years the airport completes an update to insure the standard of safety, a response to change, and observe the financial climate. To continue to receive FAA funding, the airport is required to comply with the standards set forth by the FAA.
- The mandatory Advisory Circulars include compliance of standards, adherence to regulations, planning guidance, FAA interpretation, and design standards.
- The Master Plan Update will span between the years 2008-2028. The Update will include existing conditions including details of the infrastructure, forecast, facility requirements/compliance standards, alternatives, schedule of improvements, and the ALP.
- There total number of operations in 2008 was 57,000. The number of operations predicted for 2028 is 60, 978. This represents less than 1% growth.

- Anticipated projects for the airport include relocation of the runway, runway to taxiway separation, SRE Building expansion, new administration building, reconstruction of hangars, and obstruction mitigation.
- A review of the schedule of improvements over the next five years.
- Armand concludes with a review of the Airport Layout Plan.
- Louis Andrews states the intent of the Airport Commission is to manage a safe and operational airport, minimize any impact to airport neighbors, new hangar construction in Quadrant 4, airport upkeep and maintenance, and off airport tree issues. Yearly revenue at the airport ten years ago was $1,200.00. Today the airport is fully self supporting and generates $75,000.00 per year. The airport earns the Town of Mansfield $29,000.00 in tax revenues each year.

Visitors Comments:

A member of the audience questions the Commission's intent on offsite tree removal. Louis Andrews states a mutual agreement will be made between the land owner and the Airport Commission.

A member of the audience asks why the Airport purchased 415 Fruit Street. Louis Andrews states the land was purchased to protect the airport down the road.

David Dinneen states the airport has and continues to maintain a respectful relationship with the neighbors. Neighbors and members of the community are always invited to come to the airport with questions or concerns. The Commission and King Aviation has always made an effort to fit into the neighborhood causing as little disruption as possible.

6.2 FINAL DOCUMENTATION

Final documentation signals the conclusion of the General Consulting Services with Gale Associates, Inc. for the preparation of an Airport Master Plan Update (AIP No. 3-25-0028-22-2009). Documentation includes the preparation of the final Airport Master Plan Update Report, which consists of compiling all previously prepared draft report chapters into a coordinated final report, reproducing and transmitting the final report, and converting the final report and ALP to an indexed, portable document format (pdf) report for the Client Group.

PART 77 SURFACE DIMENSIONS

	14	32	4	22
APPROACH SURFACE				
INNER WIDTH	500'	500'	250'	250'
OUTER WIDTH	1500'	3500'	1250'	1250'
LENGTH	5000'	10000'	5000'	5000'
SLOPE	20:1	34:1	20:1	20:1
TYPE	VISUAL	NON-PRECISION	VISUAL	VISUAL
HORIZONTAL SURFACE				
DISTANCE FROM RW END	10000'	10000'	5000'	5000'
ELEVATION	272'			
PRIMARY SURFACE				
WIDTH	500'	500'	250'	250'
LENGTH BEYOND RW END	200'	200'	0'	0'
TRANSITIONAL SURFACE	7:1 SLOPE FROM PRIMARY & APPROACH SURFACES TO HORIZONTAL SURFACE			
CONICAL SURFACE				
INNER EDGE ELEVATION	272'			
OUTER EDGE ELEVATION	472'			
WIDTH	4,000'			
SLOPE	20:1			

LEGEND

AIRPORT PROPERTY LINE

BOUNDARY OF PART 77 SURFACES

ULTIMATE RUNWAY DATA

RUNWAY	TYPE	RUNWAY LENGTH	END COORDINATES		END ELEV.	DISPLACEMENT	APPROACH		
–	–	–	LATITUDE	LONGITUDE	–	(DIST./ELEV.)	TYPE	SLOPE	LENGTH
14	NON-UTILITY	3500'	42°00'9.41" N	71°12'07.11" W	121.50'	508'/120.75' MSL	VISUAL	20:1	5.000'
32	NON-UTILITY	3500'	41°59'50.79" N	71°11'28.06" W	119.50'	NONE	NPI	34:1	10,000'
04	UTILITY	2030'	41°59'59.39" N	71°12'08.45" W	117.94'	NONE	VISUAL	20:1	5,000'
22	UTILITY	2030'	42°00'17.35" N	71°11'55.67" W	123.42'	NONE	VISUAL	20:1	5,000'

GALE

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PROJECT

AIRPORT MASTER PLAN UPDATE
MANSFIELD AIRPORT COMMISSION
AIP NO. 3-25-0028-22-2009

OWNER

MANSFIELD MUNICIPAL AIRPORT
MANSFIELD, MASSACHUSETTS

NO.	DATE	DESCRIPTION	BY

PROJECT NO.	776350
CADD FILE	SHEET 8
DESIGNED BY	AJD
DRAWN BY	SEH
CHECKED BY	AJD
DATE	AUGUST 2011
DRAWING SCALE	1"=1600'

GRAPHIC SCALE
0 800 1600 3200
SCALE: 1" = 1600'

SHEET TITLE

14 CFR PART 77
IMAGINARY
SURFACES
PLAN

SHEET

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