Chapter I - Inventory

The first step in the airport master planning process involves gathering information about the airport and its environs. An inventory of current conditions is essential to the success of the master plan, since the information also provides a foundation, or starting point, for subsequent evaluations.

The inventory of existing conditions for the T.F. Green Airport Master Plan Update includes the following information:

- Information pertaining to airport ownership and management, the general airport setting, transportation access, the airport's relationship to the Federal airport system, and airport history
- Population and socioeconomic information for the geographic area where most of the passengers are coming from
- A review of historic and current airport activity, including commercial service, air cargo, general aviation, and military activity
- An overview of the area's airspace, air traffic control (ATC) management, and meteorological conditions
- Descriptions of facilities and services now provided at the airport including a general description of airside, terminal, landside, and support facilities, as well as utilities and other infrastructure
- A summary of environmental conditions at the airport

The data collected for this portion of the study was gathered from a variety of sources. A listing of inventory sources can be found from links in the *Table of Contents*, along with a list of acronyms used in the document. The information gathered for this portion of the master plan is current as of the end of calendar year 2000.

I.1 Background and History

I.1.1 Airport Ownership And Management

T.F. Green Airport was the first state-owned airport in the U.S. The property is owned by the Rhode Island Department of Transportation (RIDOT). In late 1992, the Rhode Island Airport Corporation (RIAC) was created as a quasi-public corporation of the state of Rhode Island specifically to assume management and operating responsibilities for all six state airports through a 30-year lease with the state of Rhode Island. In 2000, RIAC's Lease and Operating Agreement with the state was extended through the year 2028 to match the term of Airport Revenue Bonds issued in that year. **Exhibit I.1-1** illustrates the current airport property limits.

A seven-member Board of Directors, who are appointed by the Governor of Rhode Island and the Mayor of Warwick, implement RIAC's charter. An Executive Director is responsible for the overall management of all RIAC functions. A Deputy Executive Director and a number of department Directors (Administration and Finance, Property Management, Building Maintenance, Facilities and Operations, Public Affairs, Internal Audit, Human Resources, and Planning and Development) manage the various airport requirements on a day-to-day basis. In addition, RIAC maintains its own aeronautics inspectors, police force, and aircraft rescue and fire fighting (ARFF) personnel in order to maintain strict compliance with Federal Aviation Administration (FAA) Part 139 Airport Certification requirements. Currently, RIAC is an organization of approximately 150 people.

I.1.2 Airport Location

As shown on **Exhibit I.1-2**, T.F. Green Airport is situated on approximately 1,200 acres in the city of Warwick, Rhode Island at an average elevation of 50 feet above mean sea level (MSL). The airport is located approximately 10 miles south of downtown Providence and is bounded by Post Road (Route 1) on the west, Main Avenue (Route 113) on the south, Airport Road on the north, and Industrial Drive on the southeast. A significant amount of residential development surrounds the airport to its southwest, south, southeast, and east. Commercial development along Post Road (Route 1) and Airport Road, as well as industrial use along Industrial Drive comprise the other land uses adjacent to the airport. Directly east of the airport lies the Warwick Pond neighborhood, Warwick Pond, and the Buckeye Brook tributary and wetland system.

Major regional and national ground access is available in the airport area via Interstate Highways I-95 and I-295, Route 6, and Route 146. I-95 is the primary north-south ground transportation route accessing the entire east coast of the U.S. Route 6 is one of the most widely used routes connecting Rhode Island with Connecticut and other points west. Route 146, beginning in Providence, provides access to northern Rhode Island and Massachusetts.

I.1.3 T.F. Green's Relationship to the Federal Airport System

The Federal government has played a major role in the development of airports since the inception of aviation. Dating back to the Federal Airport Act of 1946, grants-in-aid programs have assisted communities in maintaining and improving their airports, and making each facility an integral part of the nation's air transportation system. These Federal assistance programs have continually been approved by the U.S. Congress and implemented by the FAA.

One such legislation was the Airport and Airway Improvement Act of 1982. Pursuant to the requirements of Section 504(a) of the Act, the FAA was delegated the responsibility of preparing a national plan for airports throughout the U.S. Periodically, the FAA compiles and updates its National Plan of Integrated Airport Systems (NPIAS), and the

Secretary of Transportation reports its findings to the U.S. Congress. The NPIAS Gross Domestic represents a plan for the development of the nearly 3,700 public-use airports in the country that are considered important to the national air transportation network. Because of the importance of T.F. Green Airport to the national aviation system, the FAA includes T.F. Green in the NPIAS.

T.F. Green Airport is classified in the NPIAS as a medium-haul commercial service airport. The classification of the airport as a medium-haul commercial service airport does not restrict or prevent its use by general aviation or military aircraft, nor does it preclude either “short haul” or “long haul” flights. Rather, the classification of airports according to the typical "haul" or "stage" length of its commercial airline fleet is intended to provide a general overview of the airport's role in the national airport system. Non-stop commercial airline service at medium-haul commercial airports primarily serves destinations between 500 and 1,500 miles.

Of the nearly 3,700 public-use airports in the country, T.F. Green is one of only 566 airports which currently have scheduled commercial airline service. Scheduled airline service provides the public with the means of accessing other cities across the country and around the world by air. For business and industry, economical access to all parts of the world is a critical factor in the decision to locate and remain in a community. In 1998, an economic impact study for T.F. Green identified an approximate 16,600 jobs (500 in the city of Warwick) and a $1.0 billion total economic benefit to the state of Rhode Island. RIAC plans to update this study this year in order to assess the economic impact of the increases in activity that has occurred since the previous study.

I.1.4 Airport History

In the early 1920s, aviation in the U.S. was just being discovered for its ability to provide mail delivery between communities across the nation. It was only later in the 1920s and 1930s that the idea of “convenient” air transportation for passengers conducting interstate commerce became a reality.

On July 2, 1929, the Rhode Island State Airport Commission selected the Hillsgrove Airport (a racetrack converted to a landing field) as the site for construction of the first state-owned airport. On September 27, 1932, the airport was officially dedicated and named the Rhode Island State Airport, and became the first state-operated airport in the U.S. Six years later on December 27, 1938, the airport's name was changed to Theodore Francis Green State Airport in honor of Mr. Green who was the Governor of Rhode Island from 1933 to 1937 and a U.S. Senator from 1937 to 1961.

To accommodate growth in activity and technological improvements over the years, facilities at the airport have been upgraded as needed. One of the first expansions occurred in 1936 when the original landing strip was replaced with three concrete

runways measuring 150 feet wide by 3,000 feet long. ATC and navigational aids consisted of a two-way radio and a radio range. Airport development in the 1930's included the construction of hangars, an airways communications station, and the establishment of the Army Air National Guard at the airport.

With the onset of World War II, the Army leased control of the airport from the state of Rhode Island. Under the Army's control, the runways were extended to 4,000 feet and a new hangar was constructed for the Army Air National Guard. In September of 1945, with the end of World War II, the state of Rhode Island again regained control of the ownership and management of the airport.

In 1950, Runway 5L-23R was extended to 4,965 feet and construction of parallel Runway 5R-23L was completed in 1951. The original length of Runway 5R-23L was 5,460 feet, and it was built with capabilities to accommodate aircraft activity in all weather conditions.

On August 13, 1961, a new airport terminal building was dedicated. Also in 1961, the airport property was expanded by the acquisition of approximately 144 acres for the anticipated extension of Runway 16-34. The extension of Runway 16-34 to 6,081 feet, along with an extension of Runway 5R-23L to 6,466 feet, was completed in 1967.

Additional major improvements over the past three-plus decades include (year of completion is in parentheses):

1970s:

- Pavement overlay and reconstruction of Runways 5R-23L, 16-34, and other miscellaneous pavements (1975)
- Acquisition of approximately 50 acres of land near the Runway 34 approach (Truk-Away Landfill) (1978)
- Renovation and expansion of the terminal building (1979-80)

1980s:

- Groove and mark Runways 5R-23L and 16-34 (1981)
- Expansion of taxiways and aircraft parking apron (1981)
- Environmental Assessment (EA) for Runway 5R extension (1981)
- Extension of Runway 5R by 700 feet (1983)
- Taxiway "S" extension to Runway 5R (1984)
- Construction of noise barrier (1985)
- Install Category (CAT) II lighting system on Runway 5R (1986)
- Expansion of the south public parking lot (1986)
- Airport Noise Control and Land Use Compatibility improvements (1988)

- Construction of an oil/water separator for the terminal apron (1988)
- Rehabilitation of Taxilane "A" (1988)
- Acquisition of 2.8 acres of land located northwest of the airport and the relocation of residences within the 75 DNL[1] noise contour (1988)

1990s:

- Environmental Impact Statement (EIS), Terminal Area Plan (TAP), and EA studies (1990)
- Reconstruction of Taxiway "A" and Taxiway "B", and construction of Taxiway "M" (1990)
- Construction of ARFF building (1990)
- Construction of a new Airport Traffic Control Tower (ATCT) (1991)
- Rehabilitation of Runway 5L-23R and Taxiway "V" (1992)
- Sound insulation treatment of Pilgrim High School (1993)
- Installation of airport access control system (1993)
- Reconstruction of Taxiway "N" and Taxiway "T", and other miscellaneous airfield improvements (1993)
- Installation of airport guidance signs and pavement markings (1994)
- Sound insulation treatment of three elementary schools (1995)
- Construction of new 15-gate terminal building, terminal apron, and installation of an additional oil/water separator (1996)
- Sound insulation treatment of 410 residences within the 65 DNL noise contour (1996)
- Sound insulation treatment of 40 residences within the 65 DNL noise contour (1997)
- Narrowing of Runway 5L-23R from 150 feet to 75 feet (1997)
- Master Plan Update (1997)
- Expansion of the long-term parking lot by 800 spaces (1998)
- Completion of construction of a four-gate expansion, and renaming of the terminal to the Bruce Sundlun Terminal (1998)
- Repairs to Taxiways "N" and "T" (1998)
- Additional expansion of the long-term parking lot by 1,200 spaces (1999)

[1] The Day-Night Average Sound Level (DNL) metric is currently the standard noise descriptor specified by the Federal Government for transportation noise sources.

2000s:

- Construction of a new 1,500-space parking garage adjacent to the Bruce Sundlun Terminal (2000)
- Part 150 Study Update (1998-2000)
- Rehabilitation of Runway 5R-23L, including narrowing of the pavement from 200 feet to 150 feet; removing in-pavement drainage system; installation of new runway pavement sensor system; installation of new lighting control system; overall electrical system upgrade (1999-2000)
- Sound insulation treatment of 450 additional homes within the 65 DNL contour (Phases 3, 4A, 4B, and 4C) (1997-2001)
- Sound insulation treatment of an additional 200 homes within the 65 DNL contour (Phase 4D) (2001)
- Reopening of Taxiway "S" and renaming to Taxiway "E" (2001)
- Repaving of Taxiway "T" Hold Apron (2001)
- Sound insulation treatment of an additional 400 homes within the 65 DNL contour (Phases 5 and 6) (2001-2002)
- Beginning of Voluntary Land Acquisition Program for 265 residences within the 70 DNL contour (2000)

I.1.5 Socioeconomic and Population Data

For an airport master plan, socioeconomic characteristics are collected and examined to derive an understanding of the dynamics of growth within the geographic area served by the airport. This information is then typically used in forecasting aviation demand. The types of socioeconomic data that are presented in this inventory include population and Gross Domestic Product (GDP).

The area served by an airport, within which most of its passengers come from, is generally referred to as the airport's "Air Trade Area." For the purposes of this report, the primary Air Trade Area for the airport is defined as the state of Rhode Island, southeastern Massachusetts, and eastern Connecticut.

The population in Rhode Island increased from approximately 857,700 in 1970 to 905,100 in 1998, and average annual growth rate of 0.19 percent. Southeastern Massachusetts' population increased from 5.2 million to 5.9 million over the same time period (0.41 percent annual growth). Eastern Connecticut's population increased by 0.23 percent from 1970 to 1998 (231,300 in 1970 versus 249,000 in 1988).[2]

[2] Woods & Poole Economics, 2001 MSA Profile, Metropolitan Area Projections to 2025.

The historical GDP for Rhode Island, Massachusetts, and New England for the period 1977 to 2000 is shown in **Table I.1-1**. Rhode Island's GDP has increased by 2.7 percent annually from 1977 to 2000. The GDP in Massachusetts increased by 3.8 percent annually over the same time period while New England's GDP increased by an average of 3.7 percent annually.

I.2 Historic and Current Aviation Activity

The recording of air traffic activities is an important function in the operation of an airport. Historical accounting of annual passenger enplanements and aircraft operations (takeoffs and landings) often provides a basis for forecasting future activity trends. Historical aircraft operations and enplaned passenger data is presented in **Table I.2-1**. Passenger enplanements (departing passengers) have increased from approximately 519,000 in 1980 to over 2.6 million in 2000.

Aircraft operations are reported in four general categories: air carrier, air taxi (which includes commuter airlines), general aviation, and military. Historical data for these categories are summarized in **Table I.2-2**. Total annual aircraft operations (takeoffs and landings) have essentially declined since 1980, attributable to a significant decrease in general aviation activity. In the same time period, air carrier and air taxi operations have increased from approximately 57,000 operations in 1980 to 92,500 in 2000.

I.2.1 Commercial Airline Service

Air carrier (major airlines) activity has fluctuated up and down in the 1980s and early 1990s. Air carrier activity then increased by over 56 percent from 1995 to 2000. Commuter/air taxi operations have also increased rapidly since 1995 (33 percent increase). This indicates an overall trend of air service enhancement at T.F. Green, with a significant strong base of operation by the major airlines.

Prior to October 1996, T.F. Green had 84 daily departures to hub airports served by the airlines. Approximately 60 percent of those departures were turboprop aircraft and 40 percent were jets.[3] The introduction of Southwest Airlines to T.F. Green Airport in October 1996 improved the quality of airline service to the region. With the initiation of low-fare, point-to-point service on Boeing 737 aircraft to many top markets, the number of airline passengers soared at T.F. Green between 1997 and 2000. The other major airlines serving the airport have also lowered fares, are using more jets for their service as opposed to turboprops, and have otherwise improved service to existing hub destinations.

As of May 2001, eight major and eight commuter airlines served T.F. Green Airport, providing non-stop service to 29 destinations with an average of 132 daily departures. Approximately 70 percent of the scheduled departures were regional jets (RJs) or air carrier jets.[4] Due to very high passenger load factors (nearly full flights on a regular

[3] Source: RIAC
[4] Source OAG, May 2001

Table I.1-1
GROSS DOMESTIC PRODUCT (GDP) (in millions)
T.F. Green Airport

Year	Rhode Island	Massachusetts	New England
1977	17,201	113,662	239,106
1978	17,681	119,335	251,413
1979	18,241	123,747	260,643
1980	18,214	125,848	265,038
1981	18,587	128,999	271,192
1982	18,401	129,210	272,510
1983	18,961	137,193	287,015
1984	20,348	150,429	313,387
1985	21,521	160,514	332,287
1986	22,561	169,338	350,747
1987	23,574	181,734	377,998
1988	25,174	192,239	401,733
1989	25,894	193,709	407,007
1990	25,548	187,196	398,217
1991	24,694	181,944	388,547
1992	24,881	182,784	391,184
1993	25,228	186,566	397,337
1994	25,388	195,180	410,084
1995	26,188	200,432	422,391
1996	26,668	210,097	439,533
1997	28,775	219,761	463,267
1998	29,201	233,628	489,200
1999	30,641	251,906	519,967
2000	31,728	267,863	545,282

Note: Year 2000 data is estimated.
Source: Bureau of Economic Analysis, base year 1996

Table I.2-1
AIR TRAFFIC ACTIVITY SUMMARY
T.F. Green Airport

Year	Total Operations	Enplanements
1980	244,783	519,342
1981	205,686	429,769
1982	179,731	361,314
1983	196,396	374,014
1984	190,906	468,360
1985	203,236	614,175
1986	207,766	803,412
1987	212,218	952,891
1988	202,946	1,102,828
1989	200,491	1,106,898
1990	180,279	1,216,312
1991	151,994	1,126,890
1992	146,937	1,136,769
1993	125,442	1,134,464
1994	123,195	1,199,822
1995	133,679	1,122,944
1996	119,355	1,082,925
1997	142,738	1,900,726
1998	153,799	2,219,471
1999	157,597	2,479,686
2000	161,303	2,638,600

Source: FAA Terminal Area Forecast

Table I.2-2
HISTORIC OPERATIONS SUMMARY BY CATEGORY
T.F. Green Airport

Year	Air Carrier	Air Taxi	General Aviation	Military	Total
1980	25,793	31,328	179,954	7,708	244,783
1981	23,954	20,713	155,949	5,070	205,686
1982	21,897	12,577	137,689	7,568	179,731
1983	24,454	13,905	151,917	6,120	196,396
1984	29,546	13,883	141,423	6,054	190,906
1985	31,733	6,919	158,383	6,201	203,236
1986	35,335	10,888	157,045	4,498	207,766
1987	35,489	19,480	153,467	3,782	212,218
1988	30,751	23,564	145,797	2,834	202,946
1989	30,251	28,175	140,476	1,589	200,491
1990	34,058	26,874	118,048	1,299	180,279
1991	35,138	25,483	89,707	1,666	151,994
1992	33,744	34,554	77,065	1,574	146,937
1993	30,033	39,803	53,556	2,050	125,442
1994	30,100	38,589	51,629	2,877	123,195
1995	27,463	37,291	65,686	3,239	133,679
1996	27,700	31,805	56,491	3,359	119,355
1997	35,678	38,850	64,773	3,437	142,738
1998	43,260	41,005	65,964	3,570	153,799
1999	41,568	47,222	65,274	3,533	157,597
2000	42,948	49,548	65,274	3,533	161,303

Source: FAA Terminal Area Forecast

basis), there has been a trend toward use of larger aircraft (Boeing 757 vs. Boeing 727 or MD 80) by the major airlines, and a substitution of Canadair RJs for turboprop aircraft by the commuter airlines, making T.F. Green's air travel very comfortable for passengers. **Table I.2-3** contains a list of the major airlines currently serving T.F. Green and the primary destinations to which they fly.

Table I.2-3
AIRLINES AND DESTINATIONS
T.F. Green Airport

Airline[1]	Major Destinations
American	JFK, LaGuardia, and Chicago O'Hare
Continental	Albany, Cleveland, Newark, Houston
Delta	Atlanta, Cincinnati, Ft. Lauderdale, Orlando
Midway	Raleigh/Durham
Northwest	Detroit, Minneapolis[2]
Southwest	Nashville, Baltimore, Ft. Lauderdale, Long Island, Kansas City, Orlando, Chicago-Midway, Phoenix, Tampa
United	Washington D.C., Chicago-O'Hare
US Airways	Baltimore, Charlotte, Newark, LaGuardia, Orlando, Philadelphia, Pittsburgh, Washington D.C.

[1] Includes commuter partners
[2] Service to Minneapolis will begin in August of 2001

Source: Official Airline Guide, May 2001

I.2.2 Air Cargo Activities

In addition to scheduled airline passenger service, T.F. Green Airport is served by three all-cargo airlines. Federal Express, United Parcel Service (UPS), and Airborne Express each provide delivery of small packages and bulk freight. Each of the three carriers operates large hub operations at other airports. The cargo facilities at T.F. Green Airport serve a large geographic area, indicative of the solid demand for all-cargo service in the airport area.

Each of the three cargo carriers serves the airport with one daily departure during non-holiday periods. During holidays, the carriers increase their service to meet increased demand for the shipment of packages. Federal Express operates a Boeing 727, UPS operates a Boeing 757-200, and Airborne operates a DC-9. The United States Postal Service (USPS) also transports U.S. Mail to and from T.F. Green Airport in the cargo compartments of passenger aircraft.

As shown in **Table I.2-4**, the amount of cargo shipped in and out of T.F. Green Airport has decreased from approximately 22,500 tons in 1997 to 21,600 tons in 2000. The amount of mail has decreased in this period while the level of freight has increased.

Table I.2-4
HISTORICAL CARGO TONNAGE
T.F. Green Airport

Year	Mail	Freight	Total
1997	9,808	12,687	22,495
1998	9,336	13,455	22,791
1999	6,784	13,740	20,523
2000	7,266	14,303	21,569

Source: RIAC

I.2.3 General Aviation Activity

Although general aviation activity has declined at T.F. Green over the past 15 years, general aviation aircraft still perform around 65,000 annual takeoffs and landings at T.F. Green Airport. Therefore, general aviation remains a significant contributor to the overall activity at the airport. Business travel, emergency transport of patients, delivery of supplies and small parts for industry, and pilot training are just some of the daily activities involved in the use of general aviation aircraft. At T.F. Green, the most significant use of general aviation aircraft is for corporate travel and other itinerant business use.

General aviation activity remains strong for corporate operations, with some major local corporations basing their aircraft at T.F. Green (CVS, Textron, Fleet, Bell Helicopter). The number of general aviation training operations has declined at T.F. Green, accounting for the majority of the overall drop in general aviation activity.

I.2.4 Military Operations

The Army National Guard and Air National Guard base of operations moved to Quonset Airport in the 1980s. Since that time, military traffic has represented only a small portion of total aviation activity at T.F. Green.

Military operations at T.F. Green are primarily transient in nature, since there is no base of operation at the airport. Approximately 3,200 to 3,600 annual takeoffs and landings by military aircraft have been recorded at T.F. Green over the past several years.

I.3 Airspace and Air Traffic Control

On an average day in the U.S., approximately 80,000 general aviation and commercial aircraft depart an airport enroute to another destination. As the volume of air traffic has grown so significantly over the history of aviation, there has been an increasing need to regulate the efficient use of airspace. The Federal Aviation Act of 1958 established the FAA as the responsible agency for the control and use of navigable airspace within the U.S. Administratively, control of air traffic at T.F. Green Airport is assigned to the FAA's New England Region located in Burlington, Massachusetts.

The FAA has established the National Airspace System (NAS) to protect persons and property on the ground and to establish a safe and efficient airspace environment for civil, commercial, and military aviation. The NAS covers the common network of U.S. airspace, including air navigation facilities; airports and landing areas; aeronautical charts; associated rules, regulations, and procedures; technical information; and personnel and material. The system also includes components shared jointly with the military.

I.3.1 Regional Airspace

Airspace in the U.S. is classified generally as controlled, uncontrolled, or special use. Controlled airspace encompasses those areas where there are specific certification, communication, and navigation equipment requirements that pilots and aircraft must meet to operate in that airspace.

As shown in **Exhibit I.3-1**, the U.S. airspace is further divided into seven classes, each of which has different rules and regulations. These classes are:

- **Class A:** This is designated for positive control of the aircraft. This area of airspace ranges from 18,000 feet above MSL to 60,000 feet above MSL. Within Class A airspace, only Instrument Flight Rules (IFR)[5] operations are authorized. The aircraft must have specific equipment and an ATC clearance before entering the airspace.
- **Class B:** This is multi-layered airspace from the surface of the earth up to 10,000 feet above MSL. It is designed to regulate the flow of uncontrolled traffic above, around, and below the arrival and departure airspace required for high performance aircraft at major airports. The aircraft must have specific equipment and an ATC clearance before entering the airspace.

[5] IFR refers to procedures used by pilots when operating in accordance with Federal Aviation Regulations (FAR) that require an instrument flight plan.

- **Class C:** This airspace is defined around airports with ATCTs and radar approach control facilities. The top of Class C airspace is normally 4,000 feet above ground level (AGL). The aircraft must have specific equipment and must have established communications with the ATC facility having jurisdiction over the airspace before entering the airspace.
- **Class D:** This airspace is normally a circular area with a radius of four to five nautical miles around the primary airport and any extensions necessary to include instrument approach and departure paths. Class D airspace does not have radar approach control facilities.
- **Class E:** This is a general category that contains controlled airspace previously designated as control zones for non-towered airports, airspace transition areas, and Federal airways.
- **Special Use Airspace (SUA):** An area wherein activities must be confined because of their nature, or wherein limitations are imposed on aircraft operations not part of those activities. SUA is generally classified as a Restricted, Prohibited, or Military Operations Area (MOA).
- **Class G:** Airspace not designated as either Class A, B, C, D, E, or SUA is considered uncontrolled and is classified as Class G.

The Class C airspace reserved for T.F. Green Airport is divided into two concentric circles about the center of the airport. The inner circle has a radius of five nautical miles and extends from the surface up to 4,100 feet MSL. The outer circle's radius is 10 nautical miles from the airport. It begins at 1,700 feet MSL on the west side of the airport and 1,300 feet MSL on the east side, with the top of the Class C airspace at 4,100 feet MSL. Unless otherwise directed by ATC, no person may operate an aircraft in this area unless two-way communication is established with Providence Approach Control. There is also a ring with a radius 20 miles from the airport in which two-way communication with Providence Approach Control is voluntary on the part of the pilots.

I.3.2 Air Traffic Control

FAA Order 7110.65M, *Air Traffic Control*, establishes that the primary purpose of the ATC system is safety and further states that the "primary purpose of the ATC system is to prevent a collision between aircraft operating in the system and to organize and expedite the flow of traffic." ATC is the means by which aircraft are directed and separated within controlled airspace.

ATC is managed by three different FAA facilities depending on where the aircraft is located within the airspace. Air Route Traffic Control Centers (ARTCC) separate participating aircraft traveling between airports. At airports with high volumes of traffic, the responsibility for separating traffic is delegated to an ATCT and/or a Terminal Radar Approach Control Facility (TRACON).

Both a TRACON and an ATCT control aircraft arriving and departing to and from T.F. Green Airport. The T.F. Green Airport ATCT is located south of Runway 16-34 and east of Runway 5R-23L. The Providence TRACON is located in the lower level of the ATCT.

The TRACON controls all aircraft operating within approximately 4,500 square miles, including Rhode Island, the eastern portion of Connecticut, the southeast portion of Massachusetts, the tip of Long Island, and part of the Atlantic Ocean. The TRACON provides service for aircraft within its boundaries from the surface to 10,000 feet MSL. Above 10,000 feet MSL, aircraft are controlled by the Boston ARTCC. In 2000, approximately 350,000 aircraft operations were controlled by the Providence TRACON, with approximately one-half (175,000) being aircraft that departed or arrived at T.F. Green Airport.[6]

The airspace within the inner circle of the Class C airspace is controlled by the ATCT. The ATCT operates from 6:00 a.m. to midnight. After midnight, the Boston ARTCC (located in Nashua, New Hampshire) assumes responsibility of the airspace. When operating, the airspace controlled by an ATCT becomes Class D, which provides stricter aircraft operating rules.

The T.F. Green ATCT operates to control the movements of all aircraft within a five-mile radius of the airport up to an altitude of 2,500 feet AGL. Due to the high level of activity being focused at the airport, the control of air traffic is most critical on the airport and in the immediate traffic patterns.

I.4 Meteorological Conditions

Weather conditions play an important role in the operational capabilities of an airport. Temperature is an important factor in determining the length of runway required for aircraft takeoffs and landings. High temperatures in the summer months result in longer runway length requirements. In addition, wind speed and direction determine runway orientation and therefore dictate the period of time a particular runway may be in use. Periods of low visibility due to weather conditions are a major factor in determining the need for instrument aids.

In order to determine these conditions at T.F. Green Airport, eighteen years of hourly weather data collected by the National Weather Service (NWS) between the years 1980 and 1999 were analyzed.[7] The analysis of NWS data was focused on temperature, wind, ceiling, and visibility. The average annual temperature for the region is around 50 degrees Fahrenheit. During the months of June, July, August, and September, temperatures average 69 degrees Fahrenheit, with average highs of 77 to 82 degrees Fahrenheit.

[6] Source: Providence Air Traffic Control Tower handout, May 30, 2000.

[7] Source: EarthInfo, Inc. from the National Climatic Data Center (NCDC) database, National Weather Service (NWS) hourly surface aviation observations, 1980 – 1999 (excluding 1989 and 1994 due to bad data).

The direction and speed of the wind affects the direction in which an airport operates. The FAA recommends that an airport's runway configuration provide coverage during approximately 95 percent of all wind conditions. The 95 percent wind coverage is computed on the basis of the crosswind not exceeding the thresholds defined in Advisory Circular 150/5300-13, Change 6, page 10. Associated wind coverage for each runway and aircraft group are presented in **Table I.4-1**. The parallel 5-23 runways do not provide the required coverage for all aircraft types. Therefore, a crosswind runway is needed to accommodate all aircraft types at T.F. Green Airport. When the parallel runways are combined with Runway 16-34, wind coverage exceeds 95 percent.

Table I.4-1
RUNWAY WIND COVERAGE
T.F. Green Airport

Runway	Category	Crosswind Component (knots)	Percent Wind Coverage
Parallel 5-23	A-I and B-I	10.5	82.5
	A-II and B-II	13	93.2
	A-III, B-III, and C-I through D-III	16	96.4
	A-IV through D-VI	20	99.5
16-34	A-I and B-I	10.5	76.4
	A-II and B-II	13	88.6
	A-III, B-III, and C-I through D-III	16	95.8
	A-IV through D-VI	20	99.6

Notes:
Category A - Speed less than 91 knots
Category B - Speed >=91 knots, < 121 knots
Category C - Speed >= 121 knots, < 141 knots
Category D - Speed >=141 knots, <166 knots
Category E - Speed >=166 knots

Group I - Wingspan < 49 feet
Group II - Wingspan >=49 feet, <79 feet
Group III - Wingspan >=79 feet, <118 feet
Group IV - Wingspan >=118 feet, <171 feet
Group V - Wingspan >=71 feet, <214 feet
Group VI - Wingspan >=214 feet

Source: 1999 T.F. Green Airport Master Plan

Independent of the wind direction, the ceiling and visibility conditions at an airport determine the ATC procedures in effect. Ceiling is the height above the earth's surface of the lowest layer of clouds not classified as "thin" or "partial." Visibility is the ability to see and identify prominent unlighted objects by day and prominent lighted objects by night. Ceiling and visibility vary with cloud conditions, fog, precipitation, and haze. According to air traffic controllers, the ceiling and visibility minimums at T.F. Green are grouped into two categories: Visual Flight Rules (VFR) and IFR. VFR is in effect when the cloud ceiling is greater than or equal to 1,000 feet and visibility is greater than or equal to three miles. IFR conditions prevail when the visibility or cloud ceiling falls below those minimums prescribed under VFR. There are three IFR approach categories (I, II, and III) with different ceiling and visibility minimums. CAT III is further

subdivided into three categories (a, b, and c) based on different ceiling and visibility minimums. The category of IFR is important because runways may or may not be able to accommodate aircraft landings under the various categories, depending on the type of instrumentation available.

Table I.4-2 presents the annual occurrence of each weather category at T.F. Green Airport. VFR occurs over 85 percent of the time, while IFR occurs 14 percent of the time. CAT I occurs the majority of the time (12.9 percent) during IFR. CAT II and III occur less than two percent of the time.

Table I.4-2
ANNUAL OCCURRENCE OF WEATHER CATEGORIES
T.F. Green Airport

Category	Ceiling (in feet)	Visibility (in miles)	Annual Occurrence
VFR	>=1,000	>=3	85.76%
IFR			
CAT I	> = 200 & <1,000	> = 1/2 & <3	12.85%
CAT II	> = 100 & <200	> =1/4 & <1/2	1.03%
CAT IIIa	<100	> = 700 feet & <1/4	0.18%
CAT IIIb	<100	> = 150 feet & <700 feet	0.12%
CAT IIIc	<100	<150 feet	0.6%
Total IFR			14.24%
Total			**100.00%**

Source: EarthInfo, Inc. from the National Climatic Data Center (NCDC) database, National Weather Service (NWS) hourly surface aviation observations, 1980 – 1999 (excluding 1989 and 1994 due to bad data).

I.5 Existing Airport Facilities

An airport can be divided into several distinct areas. The airfield area consists of the parts of the airport that accommodate the movement of aircraft. This includes the navigational and communication equipment designed to facilitate aircraft operations and airport utility. Terminal facilities include the airline passenger terminal building, hangars and other structural development, and areas for the movement and parking of aircraft. Landside facilities include auto parking, access, and other facilities. In addition, there are support-related facilities at an airport. Airport support facilities include those for utility delivery, aircraft fire fighting, and airport operations, such as snow removal, maintenance, and airport management facilities.

1.5.1 Airfield Facilities

The largest land use type located at T.F. Green Airport is the airfield. The airfield consists of the parts of the airport which accommodate the movement of aircraft. The airfield encompasses runways, associated taxiways, and airfield lighting. Within the discussion of airfield facilities is a presentation of the navigational and communication aids serving the airport, as well as the status of identified airspace obstructions. The existing airfield is depicted on **Exhibit I.5-1**.

Runways

Runways are defined rectangular surfaces on an airport prepared or suitable for the landing or takeoff of airplanes. Each runway end is identified by a number. The number designation of a runway corresponds to its general position on the compass. Therefore, a runway number of 5 corresponds to a compass position of 50 degrees, and a runway number of 23 indicates a 230-degree compass position. Each runway at an airport provides two compass positions (Runway 5-23 accommodates both the 50-degree and 230 degree compass positions).

There are currently three runways available at T.F. Green Airport. Two of the runways are parallel, oriented in the 5-23 direction. When an airport has parallel runways, one runway is designated as the Left runway and the other is the Right runway (for EACH compass position - i.e. Runway 5 Left (5L) is also Runway 23 Right (23R), and Runway 5R is also Runway 23L). Runway 5R-23L is 7,166 feet long by 150 feet wide and is the primary runway for air carrier operations. Runway 5L-23R is 4,432 feet long by 75 feet wide and is used only by small general aviation aircraft during the daytime in good weather conditions. Due to the limited space at the terminal gate area, Runway 5L-23R is also used for overnight air carrier aircraft parking. The runway is also used as a taxiway during low visibility conditions. Runway 5L-23R operates with a displaced threshold[8] of 1,039 feet for Runway 5L and 903 feet for Runway 23R. A crosswind runway oriented in the 16-34 direction measures 6,081 long by 150 feet. Runway 16 has a 565-foot displaced threshold.

Taxiways

Taxiways are paved areas over which airplanes move from one part of the airfield to another. One of their more important uses is to provide access between the terminal and the runways. There are three types of taxiways: parallel, entrance/exit, and access. Taxiways that are parallel to runways generally provide a route for aircraft to reach the runway end. Entrance/exit taxiways, which usually connect runways to parallel taxiways, provide paths for aircraft to enter the runway for departure or leave the runway after they have landed. Access taxiways provide a means for aircraft to

[8] A threshold that is located at a point on the runway other than the designated beginning of the runway. This threshold is designated for arriving aircraft. The physical beginning of the runway can be used for departing aircraft.

move among the various airside components of the airport: terminal areas, cargo or general aviation aprons, fueling areas, etc.

The airfield's taxiway system consists of taxiways designated by alphabetical letters, arranged in various directions. Taxiway "K" serves as the partial parallel taxiway for Runway 16-34. Taxiways "T", "M", and "S" serve as the partial parallel taxiways for the 5-23 runways. None of the runways are served by a full-length parallel taxiway, which can cause an aircraft to be delayed from exiting the runway system. The location of the VORTAC (a navigational aid) in the center of the airfield precludes a full-length parallel taxiway for the main air carrier runway, Runway 5R-23L. The remaining taxiways serve as entrance, exit, and access taxiways for the airport's runways and various airside areas.

Design standards related to airport geometry are derived from the most demanding aircraft anticipated to use a particular runway. The largest aircraft regularly using Runways 5R-23L and 16-34 is a Boeing 757. The B-757 is classified as Airport Reference Code (ARC) C-IV[9] by the FAA. FAA separation standards for Group C-IV aircraft require 400 feet of lateral separation between the centerlines of a runway and taxiway. The parallel taxiways for Runway 5R-23L meet this standard. The parallel taxiway to Runway 16-34, Taxiway "K", does not meet this standard as it has only 300 feet of lateral separation to Runway 16-34. Runway 5L-23R serves small aircraft exclusively and requires 240 feet of separation to Taxiway "T." Taxiway "T" exceeds this standard with over 300 feet of separation to Runway 5L-23R.

Aprons

There are two primary areas for aircraft parking along the north and west perimeters of the airport. On the west end of the airport, adjacent to and west of Runway 5L-23R is the passenger terminal apron. The majority of this apron is used for air carrier and commuter activity. The south portion of the terminal apron is used for air carrier "belly"[10] cargo activities supported by a single cargo building.

The ramp area on the north side of the airport, along Airport Road, is separated into the Northwest Ramp and Northeast Ramp. This area is currently used for general aviation, air cargo, Fixed Base Operators (FBO), and RIAC field operations.

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[9] The ARC is a coding system used by the FAA to relate airport design criteria to the operational and physical characteristics of the airplanes intended to operate at the airport. The ARC has two components: aircraft approach speed and wingspan. ARC C-IV includes aircraft with approach speeds of 121 knots or more but less than 141 knots, and wingspans of 118 feet or more but less than 171 feet.

[10] Cargo transported in passenger aircraft.

Aircraft Overnight Parking Areas

There are five aircraft overnight parking areas on the airport. These areas are depicted on **Exhibit I.5-2** and described below:

- **Area 1** (Runway 5L-23R between Taxiway "C" and Taxiway "D"): Area 1 utilizes the existing Runway 5L-23R. This runway was originally 180 feet wide (including shoulders), but was restriped to a width of 75 feet, with the remaining width being maintained for use as a taxiway during nighttime remote parking operations. Remain Overnight (RON) aircraft are parked at an angle on the south side (the "runway half") of the 180-foot wide section of pavement. The aircraft are positioned so that the nose of the aircraft is on the centerline of the runway, facing the terminal.

  The north side of the pavement is used for taxiing aircraft. Removable reflective markers are used to delineate the taxiway. Aircraft are tugged in and out of position, and can come and go in any order. Frangible sticks are placed in the grass area to the sides of the runway to assist the tug operators in aligning the fuselage of the aircraft with the proper parking position.

  This portion of Runway 5L-23R south of Taxiway "C" can accommodate six Boeing 727s and one Boeing 757. The one B757 position is at the south end of the runway, and when a B757 is parked in that location, it does not allow adequate clearance for other aircraft to taxi or to be towed past it.

- **Area 2** (Runway 5L-23R between Taxiway "C" and Runway 16-34 Part 77 Surfaces): Area 2 utilizes a portion of Runway 5L-23R north of Taxiway "C" and up to the overlying Part 77 surface protecting Runway 16-34. For planning purposes, the Runway 16-34 Part 77 transition surface elevation which is equivalent to the B757 tail height has been selected as the northerly limit for RON parking on Runway 5L-23R. This area is currently used to park up to two B757s (tail to tail) parallel with the runway centerline. This allows each aircraft to come and go in any order. If both aircraft are parked in Area 2, and the northern aircraft needs to exit first, the only exit route available is via Runway 16-34.

- **Area 3** (Behind Gate 17): Area 3 is located across the taxilane from Gate 17. This area has been fitted with Portland Cement Concrete pads to accommodate up to a B737-500 and is used exclusively by Southwest Airlines, due to the proximity to their gates (15 and 17). It should be noted that Southwest operates at this RON position with the understanding that less than 20 feet remains between the aircraft and the blast wall when parked. Southwest provides added wing walkers during the RON pushback parking maneuver to ensure adequate clearance.

  Overnight Parking Positions

- **Area 4** (Taxiway "T" Runup Pad): Area 4 is the bituminous asphalt runup pad located off Taxiway "T", south of the belly cargo building. This location can accommodate two B757s. Due to failing asphalt, two sets of Portland Cement Concrete pads have been installed so that the main gear and nose wheel of the all jets are positioned on the pads. Taxiway "T" will be repaved during the summer of 2001 to reinforce the pavement strength. One operational benefit that Area 4 offers to the airlines is the ability to perform minor maintenance on the aircraft while at this RON position. Because Area 4 is adjacent to the perimeter road, the airlines' ground service equipment does not need to enter an Airport Operations Area (AOA) to access the site.

- **Military Area** (Abandoned Taxiway "S"): This area is not exclusive to military aircraft, however it is typically where RIAC Operations will choose to place military aircraft for two reasons: (1) this position is not directly adjacent to air carrier aircraft and (2) this position is not preferred by airlines due to the distance from the terminal. This area is restricted to one jet aircraft due to potential interference with the Runway 5R navigational aids, which could occur when more than one aircraft is parked along this taxiway. Abandoned Taxiway "S" is slated to be repaved and reopened (as Taxiway "E") in the fall of 2001.

Pavement Condition

The pavement conditions for the runways, taxiways, and aprons were reviewed as part of the Master Plan and are discussed below.

Runway Pavement Conditions

Runway 5R-23L was rehabilitated in 1999; thus its entire pavement is in excellent condition. The rehabilitation narrowed the pavement to 150 feet (from 200 feet) with 25-foot paved shoulders and added a minimum of two inches of bituminous concrete. The pavement is rated at 102,000 pounds single wheel type landing gear, 170,000 pounds dual wheel type landing gear, 295,000 pounds dual tandem type landing gear, and 590,000 pounds double dual tandem type landing gears.

The pavement of Runway 16-34 is constructed of Portland Cement Concrete and was last resurfaced with an asphalt concrete overlay in 1978. The crosswind Runway 16-34 has a number of existing distresses including longitudinal and transverse cracking, joint reflection cracking, and raveling/weathering. The Pavement Condition Index (PCI) values for Runway 16-34 ranged from fair to good according to the 1994 *Field Investigation, Pavement Evaluation and Classification Report.* The pavement is rated at 102,000 pounds single wheel type landing gear, 170,000 pounds dual wheel type landing gear, 295,000 pounds dual tandem type landing gear, and 590,000 pounds double dual tandem type landing gears.

The pavement of Runway 5L-23R is Portland Cement Concrete and received an asphalt overlay in 1991. The runway was in very good to excellent shape according to the 1994 *Field Investigation, Pavement Evaluation and Classification Report*. A few areas of Runway 5L-23R located on both sides of the intersection to Runway 16-34 did have some lower PCI values due to the older surface conditions relative to the remainder of the areas. The pavement strength is rated at 33,000 pounds for single wheel type landing gear.

Taxiway Pavement Conditions

There are several pavement rehabilitation projects that have been completed or are scheduled for completion that improve the condition of the taxiway system:

- Taxiway "S1" was rehabilitated from Taxiway "D" to Holding Apron 3 in 1999.
- Taxiway "B" and "C" were reconstructed west of Runway 5R-23L in 2000, providing standard 90-degree intersections.
- Taxiway "M" was extended from Taxiway "N" to Taxiway "C" in 2000.
- Taxiway "B" was extended east from Runway 5R-23L to Taxiway "C1" in 2000.
- Re-designated Taxiway "K" (Runway 16-34 partial parallel taxiway) as Taxiway "C" in 2000.
- Abandoned Taxiway "S" was reopened as Taxiway "E" in spring 2001. It is scheduled for repaving in the fall 2001.
- Taxiway "T" Hold apron is being repaved in summer 2001.

According to the 1994 *Field Investigation, Pavement Evaluation and Classification Report,* the taxiway pavement ratings ranged widely from excellent on Taxiways "A", "B", "H", "M", and "V", to fair on Taxiway "J" and to poor on sections of the newly re-designated Taxiway "C." All the taxiways except for Taxiways "J" and "C" rated good or higher.

Apron Pavement Conditions

In 1996, the main terminal facility and adjacent apron re-opened after undergoing an extensive reconfiguration. The new apron is comprised of Portland Cement Concrete and is in excellent condition.

The Northwest Ramp/Taxilane "A" is divided into two sections NR1 and NR2. NR1 is constructed of an Asphalt Concrete Overlay over Portland Cement Concrete and NR2 of Portland Cement Concrete. According to the 1994 *Field Investigation, Pavement Evaluation and Classification Report*, Section NR1 had a PCI value of good while section NR2 had a PCI value of fair.