FACILITY REQUIREMENTS

4.0 FACILITY REQUIREMENTS

This chapter identifies the airfield and landside facility requirements necessary to accommodate the forecasted level of demand at BNIA. The facility requirements for each airport component are based upon the aviation demand forecasts, interviews with airport personnel and tenants, and the guidelines provided in applicable FAA Advisory Circulars and regulations. The findings from this chapter serve as the basis for the formation of airport alternatives and development recommendations. Major components of this chapter are listed below:

- Airfield Capacity Analysis
- Airfield Facility Requirements
- Landside Facility Requirements

4.1 Airfield Capacity Analysis

In Chapter 3, *Aviation Demand Forecasts*, a historical view of the various aviation demands placed on the airport was presented along with a forecast of demands that are likely to occur over the planning period. The airport must be able to accommodate the projected demand by providing sufficient airside and landside components. If deficiencies exist in either of these two areas or their interfaces, they will impede the use of the facility. This, in turn, may hinder the economic potential of the airport and the communities it serves. The evaluation of the airside capacity and an airport's ability to meet the projected aviation demands is accomplished through a capacity and facility requirements analysis.

Capacity analysis can be accomplished through a variety of techniques. These techniques can range from the use of simple mathematical models to the use of expensive computer simulation models. The most widely used and accepted technique that will be employed in this study is described in the FAA Advisory Circular150/5060-5, Airport Capacity and Delay.

4.1.1 Airside Capacity

It is important to understand the various factors that affect the ability of an air transport system to process demand. Once these factors are identified and their effect on the processing of demand is understood, efficiencies can be evaluated. The airfield capacity analysis considered several factors that affect the ability of the airport to process its aviation demand. These factors include meteorological conditions, physical configurations of the runway, use of the runways, ratio of arrivals to departures, touch-and-go operations by general aviation, and runway/taxiway exits. Once an understanding of the various factors affecting capacity at BNIA is reached, a quantification of capacity can be determined based on different definitions of capacity. Capacity will be related through two terms: Annual Service Volume (ASV), and the VFR/IFR Hourly Capacities.

The Annual Service Volume is the annual theoretical capacity, or a maximum annual level, of operations at an airport (i.e., the level of annual aircraft operations

that will result in an average annual aircraft delay of approximately one to four minutes per aircraft operation). It should be noted that airports could, and often do, exceed their stated annual service volume. However, delays begin to increase rapidly once the annual service volume has been exceeded.

The VFR/IFR Hourly Capacities are the maximum number of aircraft operations that can take place on the runway system in one hour under VFR or IFR conditions. When hourly demand exceeds the hourly capacity, delays will force traffic into the succeeding hours.

4.1.1.1 Meteorological Conditions

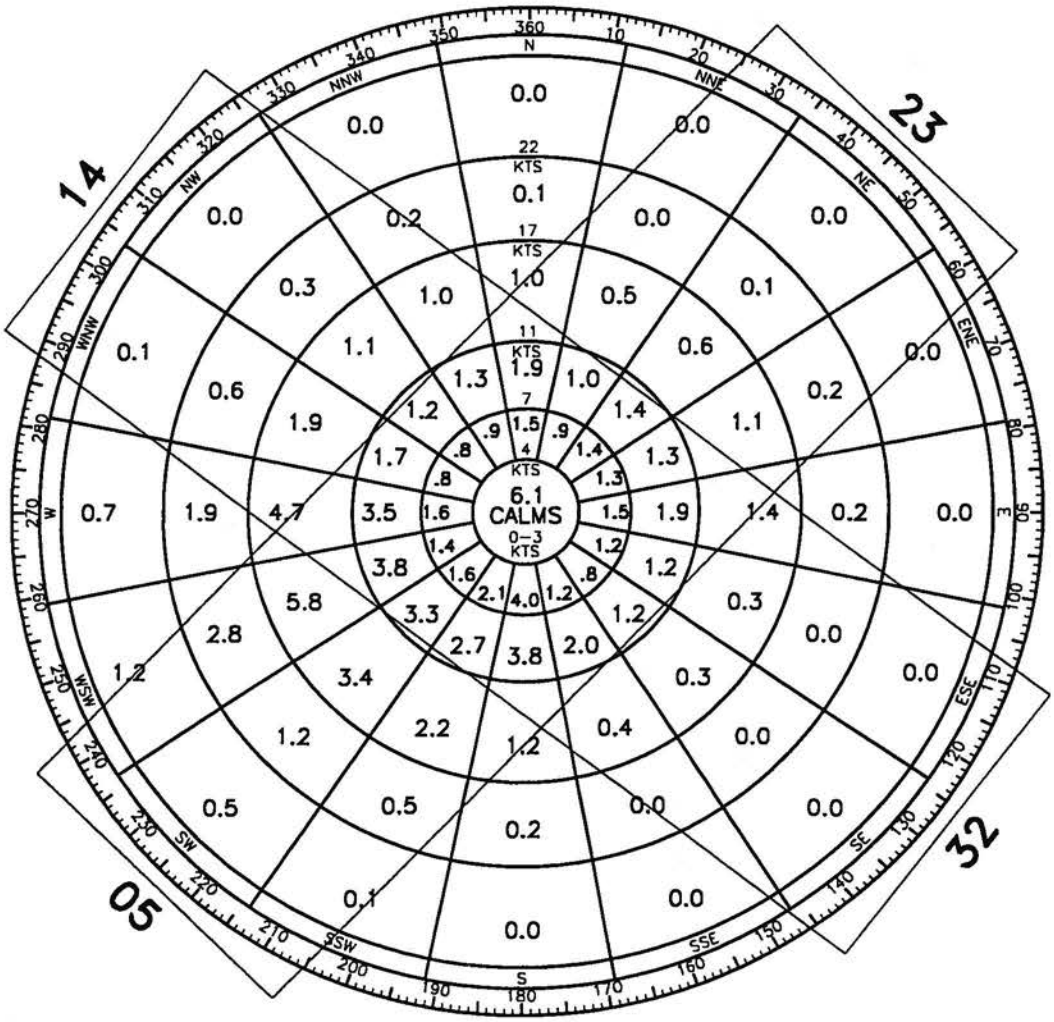
Meteorological conditions specific to the location of an airport not only influence the airfield layout, but affect the use of the runway system. As weather conditions change, airfield capacity can be reduced by low ceilings and visibility. Runway usage will change as the wind speed and direction change, also impacting the capacity of the airfield.

To better understand the impacts of weather conditions on capacity, the three types of aviation conditions must be understood. In the FAA Advisory Circular 150/5060-5, Airport Capacity and Delay, these weather conditions are described as Visual Flight Rule (VFR) conditions, Instrument Flight Rule (IFR) conditions and Poor Visibility & Ceiling (PVC) conditions. VFR conditions "occur whenever the cloud ceiling is at least 1,000 feet above ground level and the visibility is at least three statute miles." IFR conditions "occur when the reported cloud ceiling is at least 500 feet but less than 1,000 feet and/or visibility is at least one statute mile but less than three statute miles." PVC conditions "exist when the cloud ceiling is less than 500 feet and/or the visibility is less than one statute mile."

For BNIA, climate data from the National Oceanic and Atmospheric Administration (NOAA) was obtained and analyzed to reflect the ceiling and visibility characteristics at this site. Table 2.1 provided a weather summary for BNIA. As stated in Chapter 2, VFR conditions (clouds at 1,000 feet AGL and 3 miles of visibility) occur approximately 91 percent of the time. IFR conditions occur approximately eight percent of the time while, conditions below IFR only occur about one percent of the time.

Wind direction and speed determine the desired alignment and configuration of the runway system. Aircraft normally take-off and land into the wind, taking advantage of aircraft design. On departure into the wind, the air flowing over the wings allows the airplane to become airborne much sooner than under a no-wind or tail-wind condition. An aircraft landing into the wind will be able to slow down on approach much easier and land at a slower ground speed. Runways not orientated to take the most advantage of the prevailing winds at the site will restrict capacity of the airport to varying degrees.

To determine the overall wind velocities and direction at the Airport, the NOAA data was analyzed and used to develop an All-Weather Wind Rose. This wind rose is depicted in Figure 4.1. Wind data used to construct the All-Weather Wind Rose



ALL WEATHER WINDROSE

SOURCE:
GREATER BUFFALO INTERNATIONAL AIRPORT
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
1965–1974

BUFFALO NIAGARA INTERNATIONAL AIRPORT ERIE COUNTY, NEW YORK		
ALL WEATHER WIND ROSE		
SCALE: N/A	DATE: 6/98	FIGURE: 4.1
McFARLAND-JOHNSON, INC.		
NFIA		BUFFALO NIAGARA INTERNATIONAL AIRPORT

M:\users\j9750270\Drawings\windrose.dwg

was compiled by NOAA from weather observations taken from 1965 to 1974 at the Airport. The FAA has recommended that airports have adequate runways to provide for coverage of 95 percent of all wind directions under stipulated crosswind components. The runways at BNIA are 150 feet wide, which under planning standards indicates that a maximum crosswind component of 20 knots (23 mph) is acceptable. This means that the orientation and configuration of the runways should be developed so that the maximum crosswind component for the aircraft type to be accommodated is not exceeded more than 5 percent of the time.

Based on the wind analysis for BNIA, Runway 5-23 has 86 percent wind coverage and Runway 14-32 has 75 percent wind coverage, with a 20 knot crosswind component. Combined, the runways provide 97 percent wind coverage with a 20 knot crosswind component. From this analysis it can be seen that the existing runway configuration provides for greater than the recommended 95 percent coverage of all wind directions. Therefore, no additional runways are necessary at BNIA from a wind coverage standpoint, and the existing runway system is acceptable for both transport and utility aircraft.

4.1.1.2 Runway Utilization

The configuration of the runway system is defined by the number, location, and orientation of the active runway(s) and relates to the distribution and frequency of aircraft operations to those runways. The most desirable runway configurations from an air traffic control and capacity standpoint are non-intersecting runways. However, to obtain the greatest capacity with intersecting runways, the intersection of the runways should be close to their thresholds with aircraft operations flowing away from the intersection. At BNIA the runway intersection is located 1,325 feet from Runway 32, and 3,487 feet from Runway 23. This location reduces capacity somewhat. To maximize capacity at BNIA, both Runway 5-23 and 14-32 are used when conditions allow. During high winds, general aviation operations are conducted along the runway alignment providing the best wind coverage. At present, approximately 60 percent of total annual operations occur on Runway 23 and approximately 30 percent of operations occur on Runway 5. The remaining 10 percent of operations occur on Runway 14-32.

The majority of air carrier, air cargo, and military aircraft operations occur on Runway 5-23, while general aviation operations on a percentage basis are likely to be slightly more evenly distributed between the runways. Runway 14 is primarily used as a departure runway for general aviation aircraft from the FBO, while Runway 32 is primarily used as an arrival runway for general aviation aircraft.

4.1.1.3 Aircraft Fleet Mix

The capacity of a runway is dependent upon the type and size of aircraft that use it. Therefore, aircraft are placed into one of four categories when conducting capacity analysis. These categories are based on their wake turbulence class, number of engines, and the maximum takeoff weight. The four categories are Classes A through D. Class A consists of aircraft in the small wake turbulence class, single engine and a maximum takeoff weight of 12,500 pounds or less. Class B is made up of aircraft similar to Class A but with

multiple engines. Class C aircraft are in the large wake turbulence class with multiple engines and with takeoff weights between 12,500 and 300,000 pounds. Class D aircraft are in the heavy wake turbulence class and have multiple engines and a maximum takeoff weight greater than 300,000 pounds. Typically, Classes A and B aircraft are general aviation single engine and light twin engine aircraft. Classes C and D consist of large jet and propeller driven aircraft generally associated with the larger commuter, airline, air cargo, and military use.

The aircraft fleet mix is defined by the percentage of operations conducted by each of these four classes of aircraft at BNIA. Table 4.1 presents the current fleet mix for BNIA as well as the projected fleet mix through the planning period, based on the forecast of aviation demand previously presented.

Table 4.1 AIRCRAFT MIX FORECAST 1997 – 2020

Year	Types A and B	Type C	Type D
1997	37.0 %	62.0 %	1.0 %
2005	38.0 %	61.0 %	1.0 %
2010	37.4 %	61.6 %	1.0 %
2020	35.9 %	62.9 %	1.2 %

4.1.1.4 Percent Arriving Aircraft

The capacity of the runway is also influenced by the percentage of aircraft arriving at the airport during the peak hour. Arriving aircraft are typically given priority over departing aircraft. Therefore, the higher the percentage of aircraft arrivals during peak periods of operations, the lower the annual service volume. Discussions with air traffic control personnel revealed that operational activity at BNIA is well balanced between arrivals and departures. Therefore, it is assumed in the capacity calculations that arrivals equal departures during the peak period.

4.1.1.5 Percent Touch-And-Go Operations

A touch-and go operation refers to an aircraft maneuver in which the aircraft performs a normal landing touchdown followed by an immediate takeoff, without stopping or taxiing clear of the runway. These operations are normally associated with training and are included in the local operations figures reported by the air traffic control tower. Based on data received from the airport and the ATCT, touch-and-go operations comprise approximately nine percent of all operations at the airport. This percentage is expected to remain close to ten percent through the planning period.

4.1.1.6 Exit Taxiway Locations

The capacity of a runway system is greatly influenced by the ability of an aircraft to exit the runway as quickly and safely as possible. The location, design,

and number of exit taxiways affect the occupancy time of an aircraft on the runway system. The longer an aircraft remains on the runway, the lower the capacity of that runway.

The capacity analysis gives credit to only those exit taxiways located between 3,500 and 6,500 feet from the threshold of each runway. No credit is given for an exit within 750 feet of another exit.

4.1.1.7 ASV and VFR/IFR Hourly Capacities

The FAA specifies separation criteria and operational procedures for aircraft in the vicinity of an airport contingent upon aircraft size, availability of radar, sequencing of operations, and noise abatement procedures that may be in effect. The impact of air traffic control procedures on runway capacity is most affected by aircraft separation requirements, which are dictated by the mix of aircraft utilizing the airport. Presently, there are no special air traffic control rules in effect at BNIA that significantly impact operational capacity.

As previously described, determination of capacity and delay figures for BNIA utilized the throughput method of calculation, described in the FAA Advisory Circular 150/5060-5, Airport Capacity and Delay. The formulas contained in this advisory circular specify capacity in terms of the following results:

- Hourly Capacity of Runways
- Annual Service Volume

From these results it is possible to determine the adequacy of the airfield to accommodate potential demand scenarios.

Hourly Runway Capacity

Calculations of hourly runway capacity begin with an evaluation of each possible runway use configuration at the airport. Considering the airport's aircraft mix index, annual percentage of touch-and-go operations and taxiway exit rating, hourly capacity is calculated. BNIA's existing VFR hourly capacity was determined to be 77 operations, and the IFR hourly capacity was determined to be 57 operations. The current demand of approximately 50 and the future demand of 65 operations during the peak hour can be easily accommodated. A review of the forecasts associated with the establishment of a low-fare air carrier reveals that peak-hour operations are projected to be 75 by the year 2020. Thus, existing hourly capacity will still be sufficient to accommodate projected demand with this higher growth scenario.

Annual Service Volume

After determining the hourly capacity for each potential runway use configuration, a weighted hourly capacity of the airport can be calculated. The weighted hourly capacity takes into consideration not only the aircraft mix index but also the percent utilization of each possible runway use configuration. The weighted hourly capacity for BNIA

was determined to be 71 operations per hour. This weighted hourly capacity is then used in calculating the Annual Service Volume (ASV) for the airport. The ASV is calculated using the following formula:

$$ASV = C_w \times D \times H$$

C_w Weighted Hourly Capacity
D Ratio of Annual Demand to Average Daily Demand
H Ratio of Average Daily Demand to Average Peak Hour Demand

Under existing circumstances, the airport has been determined to have a daily ratio (D) of 300 and an hourly ratio (H) of 9.4 and, thus, an ASV of 200,000 operations.

The conditions that are involved with the determination of the weighted hourly capacity are not forecasted to change significantly in the future, and those numbers will remain fairly constant through the planning period.

It can be seen from Table 4.2 below that as the annual operations increase the ASV decreases, showing that the Airport is slowly reaching its capacity based on the current and projected changes in operation volumes and aircraft operation type over time. This trend is attributed to a decrease in the daily demand ratio (D) over the planning period from the current 300 operations to 282 operations in 2020. Thus, as presented in the following table, even without additional runway facilities, the ASV at BNIA will be approximately 194,000 operations by the year 2020, which is more than the forecasted demand.

Table 4.2 AIRFIELD DEMAND/CAPACITY SUMMARY
Status Quo Demand Forecast

Year	Forecasted Demand (Annual Operations)	Capacity	
		Annual Service Volume (ASV)	Percent of Capacity
1997	142,722	200,000	71
2005	158,334	196,000	80
2010	165,776	195,000	85
2020	179,964	194,000	93

In summary, the capacity analysis has shown that under the status quo set of aviation forecasts, the current runway system at BNIA is adequate for present and projected needs. The current runway system at BNIA exceeds the FAA recommended 95 percent wind coverage, adequately providing for aircraft operations in various wind conditions

experienced at the Airport. Therefore, no additional runways are needed on the basis of wind coverage.

Under those same forecast assumptions, the existing runway system provides sufficient capacity for both the current and projected aviation demands throughout the planning period. FAA guidelines, however, suggest that planning for capacity improvements should begin when an airport has reached 60 percent of its operational capacity. BNIA currently exceeds this level and is projected to reach 93 percent of its annual service volume by the year 2020. Considering the lack of peaking at BNIA and the associated lack of aircraft delay, BNIA is likely to continue operating well with the existing airfield throughout the planning period.

Since BNIA is planning for the entry of a low fare carrier to the airport, consideration must be given to the impact that such a carrier would have on the level of airport operations. A capacity analysis was therefore conducted using the aviation forecasts prepared under that scenario to see what effects the low-fare carrier airline demand forecast would have on projected airport capacity. This analysis shows that the ability of the airport to process the forecasted activity is still sufficient until the end of the planning period. At the end of the planning period it is projected that aircraft delays will increase as annual operations exceed the airport's ASV.

TABLE 4.3 AIRFIELD DEMAND/CAPACITY SUMMARY
Low-Fare Carrier Demand Forecast

	Forecasted Demand		Capacity	
Year	Annual Operations	Peak Hour Operations	Annual Service Volume (ASV)	Percent of Capacity
1997	142,722	50	200,000	71
2005	173,346	64	196,000	88
2010	183,662	68	195,000	94
2020	198,012	75	194,000	102

Given the fact that the existing airfield will be at 93 percent of ASV with the baseline forecast, and will exceed ASV with the low-cost carrier forecast, it seems prudent to plan actions to increase the airport's ASV. The last master plan proposed the construction of a parallel runway adjacent to the primary runway to address this shortfall.

The only location available for the construction of a parallel runway without demolishing existing facilities is the location shown on the last Airport Layout Plan. This location is 700 feet north of Runway 5-23. The last master plan proposed a Runway 5L-23R that would have a width of 75 feet and a length of 3,800 feet. Due to the short length of the runway, it would be limited to serving small general aviation aircraft. Review of the aviation forecasts for BNIA indicates that very little growth of small general aviation aircraft operations is anticipated during the planning period. In fact, total annual operations by single engine

aircraft are projected to increase to 8,100 in the year 2020 from 7,664 during 1997; an increase of only 436 operations in twenty-three years. The majority of the growth in the general aviation segment is projected to occur in the larger aircraft categories of multi-engine and turbojet.

Therefore, the segment of general aviation operations that would be able to use a small parallel runway are not the types of aircraft operations that are projected to grow at BNIA. In order for a parallel runway to provide the ability to accommodate the type of aircraft that are projected to increase at BNIA during future years, a longer runway length would be required. Since this is not possible without demolition and relocation of critical infrastructure, it is recommended that the airport's existing runway configuration be maintained, and that options other than the construction of a new parallel runway be explored for increasing airfield capacity. Such options may consist of greater use of Runway 14-32, and the construction of high speed taxiway exits on Runway 5-23.

4.1.2 Airspace Capacity Analysis

This section examines the ability of airspace surrounding BNIA to support the level of activity projected at BNIA and other surrounding airports through the planning period. Airspace capacity can be assessed using various measurements and criteria depending upon the issues being examined. For this analysis it was deemed appropriate to consider the following factors:

- Existing and potential conflicts between airport traffic patterns at BNIA and surrounding airports,
- Existing and potential conflicts between instrument approach procedures at BNIA and surrounding airports,
- Physical constraints, and
- Regulatory constraints.

In addition to these items, air traffic control was consulted regarding airspace issues.

4.1.2.1 Airport Traffic Patterns

The FAA has established dimensional criteria for traffic patterns at airports. These criteria are set forth in FAA Order 7400.2C "Procedures for Handling Airspace Matters" and were previously described in Section 2.3.4. The dimensions of the airspace required for airport traffic patterns varies depending upon the type of aircraft operating at the airport.

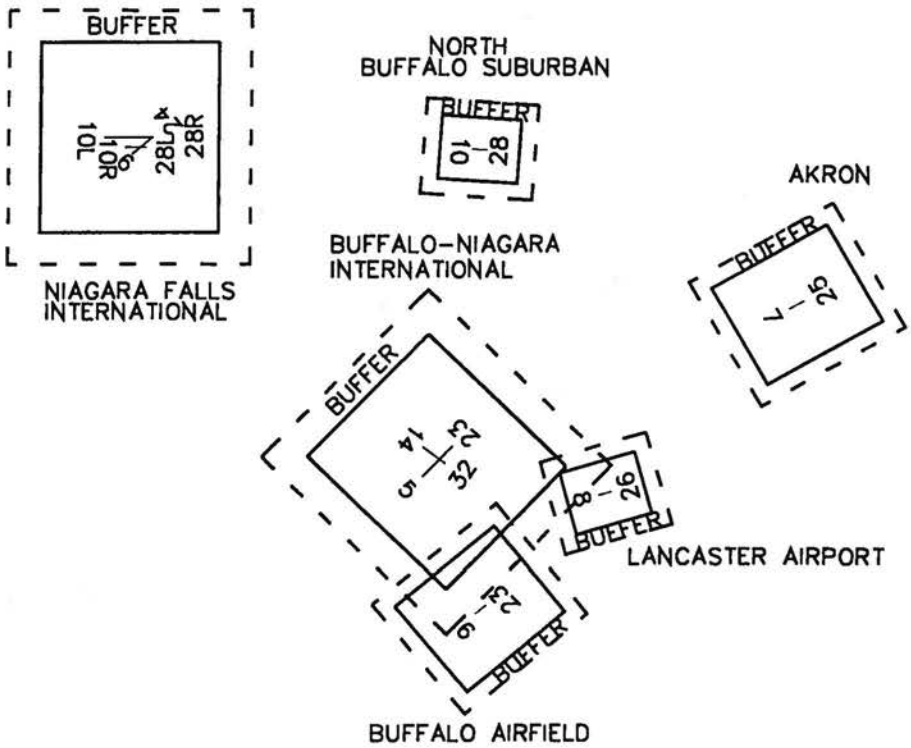
Application of these criteria to BNIA and surrounding airports is depicted in Figure 4.1. As the figure indicates, the airspace required for BNIA overlaps airspace requirements at Buffalo Airfield and Lancaster Airport, but does not overlap the airspace requirements associated with Niagara Falls International, North Buffao Suburban, or Akron Airports.

Consultation with air traffic control personnel at BNIA revealed that minor conflicts between air traffic at BNIA and surrounding airports do occur, but these conflicts are safely accommodated through application of vertical and horizontal separations of aircraft.

4.1.2.2 Instrument Approach Procedures

As was done for airport traffic patterns, dimensional criteria associated with instrument approach procedures were also obtained from FAA Order 7400.2C "Procedures for Handling Airspace Matters." These criteria specify an area having a width of 10 miles and a length of 15 miles on the approach end and 10 miles on the departure end. Runways that have bi-directional approaches require a length of 15 miles on both ends of the runway.

Figure 4.2 depicts the airspace requirements associated with instrument approach procedures at airports surrounding BNIA. While the figure depicts large amounts of overlapping airspace, these conflicts are adequately resolved through application of vertical separation by air traffic control personnel. Therefore, no significant airspace constraints exist on air traffic arriving or departing BNIA.



SCALE

0 6 12

NAUTICAL MILES

N

BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

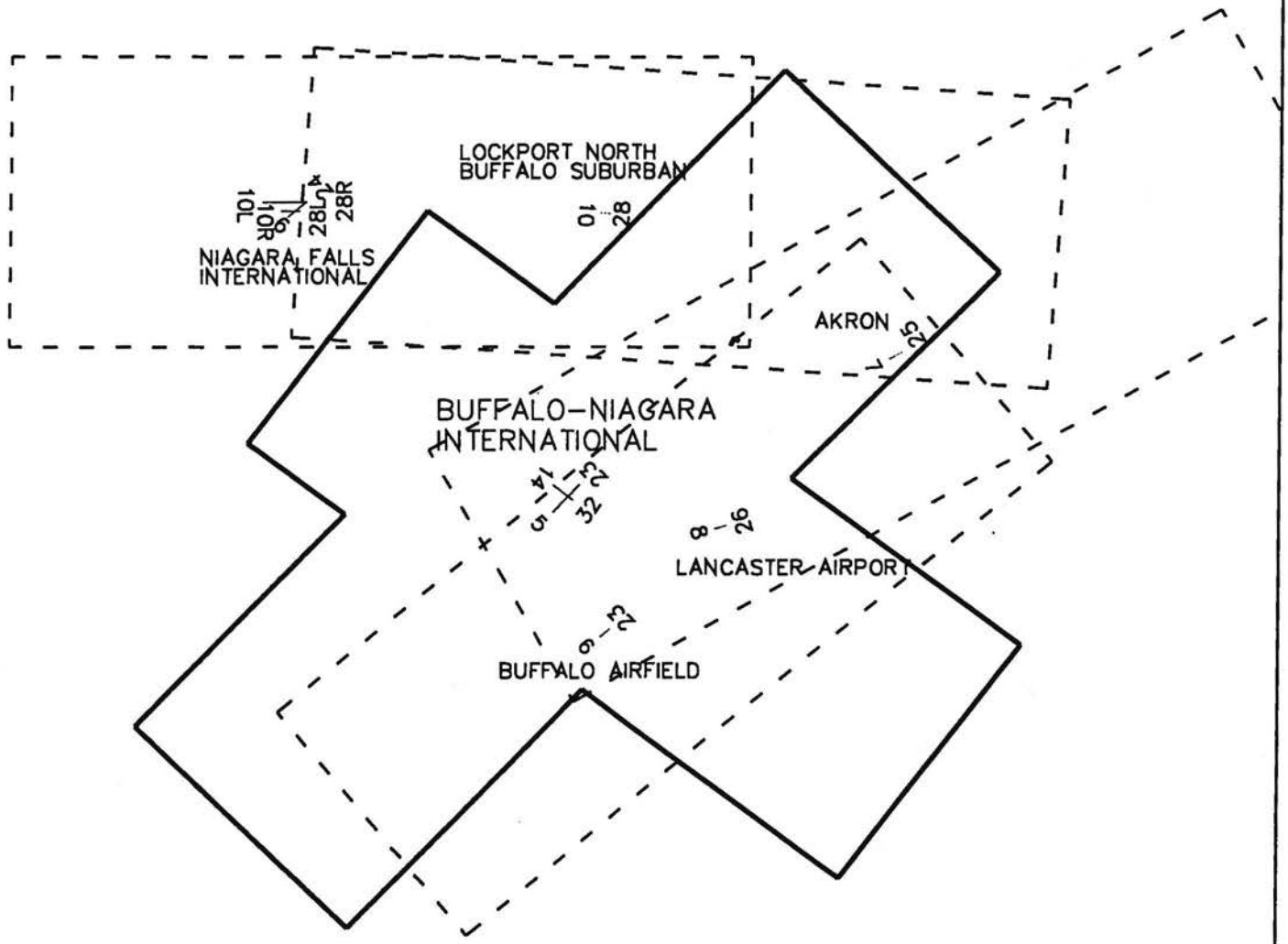
VFR TRAFFIC PATTERN AIRSPACE

SCALE: AS SHOWN	DATE: 12/98	FIGURE: 4.2

McFARLAND-JOHNSON, INC.

BUFFALO NIAGARA INTERNATIONAL AIRPORT

M:\users\j9750270\MASTER PLAN REPORT\VFR AIRSPACE.dwg



SCALE

0 6 12

NAUTICAL MILES

N

BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

IFR RADAR
AIRSPACE AREAS

SCALE: AS SHOWN	DATE: 12/98	FIGURE: 4.3

McFARLAND-JOHNSON, INC.

BUFFALO NIAGARA
INTERNATIONAL AIRPORT

M:\users\j9750270\MASTER PLAN REPORT\AIRSPACE.dwg

4.1.2.3 Physical and Regulatory Constraints

Physical constraints include tall towers or terrain that could limit the routing of aircraft into the airport. A review of aeronautical charts revealed that there are no physical constraints that have the potential to limit airspace use or capacity in the vicinity of BNIA.

Regulatory constraints include military operations areas, restricted airspace, or special use airspace that places restrictions on the flight of civilian aircraft. As described in the Inventory chapter, the only special use airspace in the vicinity of BNIA is located over Niagara Falls. This airspace does not affect arrivals or departures from BNIA. Likewise, the only military operations area is located above Lake Ontario and is too distant to affect airspace capacity at BNIA.

In conclusion, airspace in the vicinity of BNIA does not contain operational, physical, or regulatory constraints that would limit demand or cause significant delay with the volume of aircraft operations projected by the master plan forecasts.

4.2 Airfield Facility Requirements

Airfield facility requirements address items that are directly related to the arrival and departure of aircraft, including runways and taxiways and their associated safety areas. To ensure that all runway and taxiway systems are correctly designed, the FAA has established criteria for use in planning and design of airfield facilities. The selection of appropriate FAA design standards for the development of airfield facilities is based upon the characteristics of the most demanding aircraft expected to use the airport.

Planning for future aircraft use is particularly important because design standards are used to establish the physical dimensions of facilities and the separation distances between facilities. Use of appropriate standards will ensure that facilities can safely accommodate aircraft using the airport today, as well as aircraft that are projected to use the airport in the future.

4.2.1 Critical Aircraft

Airport planning and design are based upon a designated critical aircraft for the airport. The critical aircraft for an airport is defined as the most demanding aircraft (on the basis of its approach speed and wingspan) that conducts a minimum of 250 or more takeoffs (500 operations) per year. In addition to approach speed and wingspan, the critical aircraft weight should also be considered when assessing the adequacy of pavement strength.

Air carrier aircraft operated by passenger and cargo airlines are currently the largest and most demanding aircraft operating at Buffalo-Niagara International Airport. Of these aircraft, the Boeing 737-400/500 has the highest approach speed at 139/140 knots, while the Boeing 757 aircraft operated by UPS has the widest wingspan at 125 feet and the heaviest maximum taxiing weight at 256,000 pounds. The 757 is projected to be the critical aircraft throughout the planning period. While larger aircraft may occasionally use BNIA for charter

operations, these aircraft are not projected to generate the minimum number of operations necessary to become the critical aircraft.

4.2.2 Airport Reference Code (ARC)

The FAA has developed and published minimum standards for the planning and design of airport facilities. These standards are described in FAA Advisory Circular 150/5300-13, Airport Design. This advisory circular provides criteria for grouping of aircraft into Airport Reference Codes (ARC). The ARC is comprised of an Aircraft Approach Category (which is based upon the approach speed of the aircraft) and an Airplane Design Group (which is based upon the aircraft's wingspan). The ARC for an airport is selected on the basis of the current and future critical aircraft according to the following criteria.

4.2.2.1 Aircraft Approach Category

The Aircraft Approach Category is based on the landing speed of the aircraft, which is defined as 1.3 times the stall speed of the aircraft as follows:

- **Category A** - Speed less than 91 knots
- **Category B** - Speed 91 knots or more but less than 121 knots
- **Category C** - Speed 121 knots or more but less than 141 knots
- **Category D** - Speed 141 knots or more but less than 166 knots
- **Category E** - Speed 166 knots or more

4.2.2.2 Airplane Design Group

The Airplane Design Group is based on airplane wingspan as follows:

- **Group I** - Up to but not including 49 feet (15m)
- **Group II** - 49 feet (15m) up to but not including 79 feet (24m)
- **Group III** - 79 feet (24m) up to but not including 118 feet (36m)
- **Group IV** - 118 feet (36m) up to but not including 171 feet (52m)
- **Group V** - 171 feet (52m) up to but not including 214 feet (65m)
- **Group VI** - 214 feet (65m) up to but not including 262 feet (80m)

4.2.2.3 ARC for Buffalo-Niagara International Airport

The current and future ARC for BNIA can be determined on the basis of aircraft fleet mix projections presented in the Aviation Demand Forecasts. During 1997, the 757 was the critical aircraft operating at BNIA. This aircraft has an ARC of C-IV. According to the forecasts, the future critical aircraft will most likely be a 757. It is possible that the McDonnell Douglas DC-10 or the MD-11 could provide occasional charter services with the potential to increase the ARC at BUF to a D-IV. However, because the requirements for an ARC of D-IV are equal to the requirements for an ARC of C-IV, it is recommended that an ARC of C-IV be used for planning facilities associated with Runway 5-23.

Facilities associated with Runway 14-32 should be designed to ARC C-III. Runway 14-32 is intended to serve as a crosswind runway and a back-up runway for Runway 5-23 during periods when it is out of service for maintenance or other reasons. This runway does not need to accommodate aircraft in the design group IV category on a regular basis. Therefore, planning and designing this runway to ARC C-III standards will ensure the most cost-effective use of these facilities.

It should be noted that not all airport facilities need to be designed to accommodate the most demanding aircraft. Certain airside and landside facilities, such as general aviation areas or runway/taxiway systems that are not intended to serve large aircraft, may be designed to accommodate less demanding aircraft, where necessary, to ensure cost-effective development. Conversely, a new taxiway that is intended to serve large aircraft may require the application of Design Group IV standards. Designation of the appropriate standards to each development area on the airport will be shown in the airport plans.

4.2.3 Airfield Dimensional Standards

The FAA provides planning and design guidance for airfield pavements and for the separation between elements of airfield pavements. A summary of critical dimension and separation distances is shown in Table 4.4. Criteria are shown for general aviation aircraft including piston, turboprop, or turbojet powered aircraft under ARC B-II. Critical dimensions for commuter and air carrier aircraft are shown under ARCs B-III through C-IV. These dimensions will be used in the development of airport plans for BNIA.

Table 4.4 - FAA DIMENSIONAL STANDARDS

Airport Feature	Airport Reference Code			
	B-II	B-III	C-III	C-IV
Typical Aircraft	Piston/ Turboprop	Commuter	Air Carrier	Air Carrier
Aircraft Operational Characteristics:				
Maximum Approach Speed	121 knots	121 knots	141 knots	141 knots
Aircraft Approach Category	B	B	C	C
Maximum Wingspan	79 feet	118 feet	118 feet	171 feet
Airplane Design Group (ADG)	II	III	III	IV
Airport Reference Code (ARC)	B-II	B-III	C-III	C-IV
Runway:				
Width	75 feet	100 feet	100 feet	150 feet
Shoulder Width	10 feet	20 feet	20 feet	25 feet
Blast Pad Width	95 feet	140 feet	140 feet	200 feet
Blast Pad Length	150 feet	200 feet	200 feet	200 feet
Safety Area Width	150 feet	400 feet	500 feet	500 feet
Safety Area Length Beyond R/W End	300 feet	800 feet	1,000 feet	1,000 feet
Object Free Area Width	500 feet	800 feet	800 feet	800 feet
Object Free Area Length Beyond R/W End	300 feet	800 feet	1,000 feet	1,000 feet
Runway Separation Standards: (Runway Centerline to				
Taxiway or Taxilane Centerline	240 feet	300 feet	400 feet	400 feet
Aircraft Parking Area	250 feet	400 feet	500 feet	500 feet
Taxiway:				
Width	35 feet	50 feet	50 feet	75 feet
Shoulder Width	10 feet	20 feet	20 feet	25 feet
Taxiway Safety Area Width	79 feet	118 feet	118 feet	171 feet
Taxiway Object Free Area Width	131 feet	186 feet	186 feet	259 feet
Taxilane Object Free Area Width	115 feet	162 feet	162 feet	225 feet
Taxiway Separation Standards: (Taxiway Centerline to)				
Parallel Taxiway/Taxilane Centerline	105 feet	152 feet	152 feet	215 feet
Fixed or Movable Object	65.5 feet	93 feet	93 feet	129.5 feet
Taxilane Separation Standards:				
Parallel Taxilane Centerline	97 feet	140 feet	140 feet	198 feet
Fixed or Movable Object	57.5 feet	81 feet	81 feet	112.5 feet

Source: FAA Advisory Circular 150/5300-13, Airport Design

4.2.4 Runway Length

Runway length requirements are a function of the types of aircraft currently using or projected to use the airport, their takeoff weights and stage lengths (i.e., distance to the destination) as well as other factors such as air temperature and airport elevation. Runway length requirements were calculated for BNIA and are shown in Table 4.5. These runway lengths are based upon four primary factors as follows:

- **Takeoff Weights** - Takeoff weights are the total of the aircraft operating empty weight (OEW), the payload, and fuel required for non-stop destinations. For purposes of these calculations, a full complement of passengers was considered the payload.

- **Airport Reference Temperature** - The mean maximum daily temperature of the hottest month (July) for BNIA is 79.5°F (26.4°C).

- **Airport Elevation** - The reference elevation of BNIA is 724 feet (221 meters).

- **Runway Gradient** - The effective runway gradients for runways at BNIA are 0.58 percent towards the northeast for Runway 5-23 and 0.17 towards the southeast for Runway 14-32.

The conditions stated above were used to calculate runway length requirements for the current and forecast commercial aircraft fleet. Runway length requirements were calculated for three categories of stage lengths as follows:

- **Current Commercial Service** - Runway length requirements for the current commercial jet fleet were calculated for the longest current destination for each model of aircraft shown in Table 4.5. The destinations and distances shown represent the current non-stop destinations served from BNIA.

- **Western Hub Services** - Runway length requirements for the commercial jet fleet were calculated for the non-stop distance to a "western" hub. Denver, Colorado was used for this analysis.

- **Charter Services** - Runway length requirements for the commercial jet fleet were calculated for the non-stop distance to the west coast. This would include most popular destinations including Las Vegas.

Table 4.5 - CALCULATED RUNWAY LENGTH REQUIREMENTS

Aircraft	Non-Stop Destination	Average Runway Length Required* (ft)	Stage Length (nm) **		
			Current Services	Western Hubs	Charter
B727-200	Atlanta, GA	6,950	710		
B737-100/200	Atlanta, GA	5,870	710		
B737-300	Chicago, IL	6,500	461		
B737-400	New York, NY	5,380	287		
B737-500	Orlando, FL	5,960	1,003		
B757-200	Dayton, OH (UPS Cargo)	6,280	353		
DC-9	Minneapolis/St. Paul, MN	6,590	734		
MD-80	Orlando, FL	6,140	1,003		
B727-200	Denver, CO	8,590		1,400	
B737-100/200	Denver, CO	7,560		1,400	
B737-300	Denver, CO	7,080		1,400	
B737-400	Denver, CO	7,260		1,400	
B737-500	Denver, CO	6,460		1,400	
B757-200	Denver, CO	5,930		1,400	
DC-9	Denver, CO	8,530		1,400	
MD-80	Denver, CO	7,290		1,400	
B757-200	San Francisco, CA	6,090			2,300
B767 (All Series)	San Francisco, CA	6,870			2,300
DC-10	San Francisco, CA	7,530			2,300
MD-11	San Francisco, CA	8,780			2,300

Notes: **Average of aircraft models and engines evaluated*
***Maximum stage length for aircraft model shown in current service*

Basis of runway length calculations: *Wind velocity = 0; Elevation = 724 feet MSL; Mean Maximum Temperature = 79.5F*
Effective Gradient R/W 5-23 = 0.58%, R/W 14-32 = 0.17%; Full passenger Load
Source: Aircraft manufacturers "Airport Characteristics Handbook"

4.2.4.1 Runway Length for Current Air Service

The current length of Runway 5-23 (8,102 feet) is adequate for service to all destinations currently served. The current length of Runway 14-32 (5,373 feet) is inadequate for air service to many current destinations. Review of Table 4.5 indicates that a runway length of 7,000 feet would be required for this runway to serve destinations such as Atlanta with currently used air carrier aircraft. Runway 14-32 is adequate to serve most general aviation aircraft and certain commuter aircraft.

4.2.4.2 Runway Length for Western Hub Air Service

The 8,102-foot length of Runway 5-23 is adequate for most combinations of non-stop distances to the hubs and current and future commercial jet fleet such as the Boeing 757 and long-range models of the 737, as identified in the aviation activity forecasts. Certain aircraft, such as the Boeing 727 and the DC-9, require longer runway for service to these destinations. However, these aircraft are currently in the process of being phased out of many airline fleets. Therefore, the airport's current length on Runway 5-23 appears adequate to accommodate likely potential future air service to a western hub airport.

4.2.4.3 Runway Length for Charter Air Service

The 8,102-foot length of Runway 5-23 is also capable of accommodating operations by Boeing 757, 767, and DC-10 aircraft to charter destinations such as Las Vegas or the West Coast of the United States with full passenger loads. Air service to these destinations by other aircraft such as MD-11 would likely require payload penalties or one-stop service.

4.2.4.4 Recommended Runway Lengths

The existing length of Runway 5-23 appears adequate for air service to all existing and likely future destinations for most common types of air carrier aircraft. However, in the event of full or partial closure of Runway 5-23 for repair or maintenance, Runway 14-32 does not have adequate length to accommodate air carrier aircraft without payload restrictions. A runway length of 7,000 feet would be required on Runway 14-32 in order to avoid any impact to current operations under hot day conditions. Runway lengths shorter than 7,000 feet but greater than the current length of 5,373 feet would improve the ability of this runway to accommodate air service to many current destinations. Options for extending Runway 14-32 will be examined in the alternatives analysis.

4.2.5 Runway Width

Runway 5-23 and Runway 14-32 have widths of 150 feet. This width is the FAA's standard for runways that serve aircraft in Design Group IV. Therefore, the current width of both runways is adequate to accommodate all aircraft anticipated to serve BNIA throughout the planning period.

4.2.6 Runway/Taxiway/Apron Strength

An update of the airport's 1993 pavement management study is currently underway. Visual surveys and nondestructive testing performed in May 1998 revealed that most runways, taxiways, and apron pavements are in good condition.

Pavement strength for Runway 5-23 is reported to be 195,000 pounds for dual gear and 450,000 pounds dual-tandem gear. These strengths are adequate for anticipated traffic on Runway 5-23 and the taxiway/apron systems served by that runway.

Pavement strength for Runway 14-32, upon completion of the 1998 overlay, is reported as 75,000 pounds single gear, 150,000 pounds dual gear, and 240,000 pounds dual-tandem gear. These strengths are adequate for commuter aircraft operations and limited operations by air carrier aircraft.

4.2.7 Taxiways

Most taxiways at BNIA currently have widths of 75 feet. This width meets the requirements specified by the FAA for aircraft in Design Group IV. Therefore, these taxiways will be adequate to serve aircraft anticipated to serve BNIA throughout the planning period. Taxiway "Q" and Taxiway "P" have widths of 50 feet. These taxiways primarily serve aircraft using the general aviation facilities, and therefore are adequate to serve aircraft in Design Group III. Consultation with airfield operations personnel revealed that improvements to the geometry of these taxiways is needed in front of the general aviation ramp in order to prevent the wheels of larger aircraft from running off the pavement. Specifically, improvements are needed at Taxiway P2 and the intersection of Taxiway "Q" and Taxiway "P". Such improvements were recommended in the last master plan and are recommended by this plan as well.

Consultation with air traffic control personnel revealed that one taxiway improvement that would be helpful to the operational efficiency of the airfield is the construction of a taxiway from Runway 5-23 to Taxiway "Q" along the northeast side of Runway 14-32. The purpose of this taxiway would be to accommodate the movement of aircraft to and from the general aviation ramp. Presently, aircraft must taxi from Runway 5-23 to the general aviation ramp via Taxiway "D" and must cross Runway 14-32. This is undesirable from both a safety perspective and air traffic controller workload. Construction of a taxiway on the northeast side of Runway 14-32 would resolve these problems. However, the need for such a new taxiway will depend heavily upon future levels of general aviation activity. The current level of general aviation activity would not appear to warrant the construction of this taxiway. However, as general aviation operations increase toward the end of the planning period, the need for this taxiway may justify construction.

Currently there is only one path from the air cargo ramp to Runway 5-23. This taxiway contains an "s" shaped path. A realignment of this taxiway and/or the construction of a new taxiway from Runway 5-23 to the air cargo ramp should be considered and examined in the alternatives analysis.

Finally, high-speed taxiway exits should be considered for Runway 5-23. According to the demand/capacity analysis, the airfield will approach and perhaps surpass its annual service volume during the planning period. Consequently, the construction of high-speed exits would provide an increase of capacity, if properly spaced. Proposed spacing of these taxiways exits will be shown in the alternatives analysis in conjunction with other proposed taxiway improvements.

4.2.8 Runway Safety Areas (RSA) And Runway Object Free Areas (ROFA)

Runway safety areas for Runways 5-23 and 14-32 should be 500 feet wide for the full length of the runway and extend 1,000 feet beyond each end of the runway. FAA standards state that the runway safety areas must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations. They must be drained by grading or storm sewers to prevent water accumulation. They also should be able to support the occasional passage of an aircraft without causing structural damage to the aircraft or injury to passengers.

The RSA at the end of Runway 23 currently meets standards within airport property limits. There will be sufficient space to develop an RSA for Runway 32 when the adjoining Westinghouse property (i.e., Buffalo Air Center) is acquired. However, the RSAs at the ends of Runways 5 and 14 cannot meet FAA criteria within the limits of airport property, if measured from the end of runway pavement. The RSA shown for Runway 5 has a length of 350 feet. The RSA for Runway 14 has a length of approximately 730 feet. A 1,000 foot long RSA at the end of Runway 5 would extend beyond airport property and cross the Kensington Expressway as well as the intersection of Genesee Street and Cayuga Road, if measured from the end of runway pavement. A 1,000 foot long RSA at the end of Runway 14 would extend beyond airport property and cross Cayuga Road. Options for addressing these safety area deficiencies are discussed in the following sections.

Runway object free areas (ROFA) for Runways 5-23 and 14-32 should be 800 feet wide for the full length of the runway and extend 1,000 feet beyond each end of the runway. FAA standards state that the ROFA must be free of objects, except for those that are required for air navigation or aircraft ground maneuvering purposes. There is sufficient space to establish the ROFAs for the end of Runway 32, once the adjoining property is acquired. However, the ROFAs at the ends of Runway 5 and Runway 14 cannot meet FAA criteria within the limits of airport property, if measured from the end of runway pavement. A 1,000 foot long ROFA at the end of Runway 5 would extend beyond airport property and cross the Kensington Expressway, as well as the intersection of Genesee Street and Cayuga Road. A 1,000 foot long ROFA at the end of Runway 14 would extend beyond airport property and cross Cayuga Road. Alternative means of enhancing the RSA and ROFA for Runways 5 and 14 include the application of declared distances or the construction of an engineered materials arresting system. These options are discussed in the following paragraphs.

4.2.8.1 Declared Distances

In instances where the development of a standard RSA is not possible, the FAA planning guidelines allow the RSA to be provided within existing airport

property boundaries through the application of declared distances. Declared distances indicate the amount of runway length that is declared useable for takeoff and landing.

The application of declared distances at BNIA would require further displacement of the runway thresholds for Runway 5 and Runway 14. The necessary displacement for Runway 5 would total approximately 650 feet from the end of runway pavement. The necessary displacement of the threshold of Runway 14 would be approximately 270 feet. These displacements would reduce the useable length of these runways which, in turn, would place operating restrictions on aircraft currently operating at BNIA. Since this is not a desirable course of action, the application of declared distances with respect to Runway 5-23 is not recommended. The application of declared distances to Runway 14-32 needs to be further examined in conjunction with potential extension or realignment of this runway in the alternatives analysis.

4.2.8.2 Engineered Materials Arresting Systems (EMAS)

The FAA Advisory Circular 150/5220-22, Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns, describes a method of enhancing the safety of non-standard RSAs and ROFAs . This can be done where they cannot physically meet current FAA standards, and where the use of declared distances "may result in the inability to accommodate aircraft that are currently in use at that airport." An EMAS consists of "high energy absorbing materials of selected strength, that will reliably and predictably crush under the weight of an aircraft." The purpose of an EMAS is to safely bring an aircraft that overruns the end of a runway to a stop. It is recommended that the installation of an EMAS be considered for the approach end of Runway 5.

4.3 Landside Facility Requirements

While the airside facilities provide for the movement of aircraft into and out of the sky, the landside facilities address needs of the many ancillary activities which support the operation of aircraft. These include not only those activities essential to aircraft operation, such as airfield maintenance, hangars, aprons, fueling and maintenance of the aircraft, but also those activities that depend on, and are the reason for, the aircraft operations. Facilities to serve the passengers and cargo which are transported by the aircraft are equally important to the efficient operation of a modern airport. The airside and landside facilities must work smoothly together, and both must be based on a common set of assumptions regarding the various activities that take place at the airport. The landside facilities discussed below are based on the major functional areas of the airport, and include the following:

- Airline Terminal Requirements
- Air Cargo Requirements
- General Aviation Requirements
- Other Facility Requirements

4.3.1 Airline Terminal Requirements

The facility requirements of the BNIA terminal area have been briefly evaluated. The evaluation consisted primarily of a review of the new terminal's design parameters in light of the most recent aviation demand forecasts. A primary source was the March 1990 GBIA Master Plan/Terminal Area Plan Update, by Howard, Needles, Tammen & Bergendoff, in which the design parameters of the new facility were identified. The review of terminal area requirements for BNIA included an evaluation of the following:

- Airline Terminal Building
- Airline Gates
- Auto Parking Requirements

4.3.1.1 Airline Terminal Building

The new airline terminal building opened in 1997, just as this current master plan update was beginning. The new terminal's design was based upon the analysis and recommendations contained in the 1990 Terminal Area Plan, as amended by subsequent engineering studies. The aviation demand forecasts used in the Terminal Area Plan, which established the design parameters for the new terminal, projected a significantly higher level of growth than was actually realized. Table 4.6 presents a comparison of key elements in the two sets of forecasts. The slower than anticipated growth that has occurred at BNIA can be explained in large part by the major changes that have occurred in both the aviation industry and the local economy. Based on the Terminal Facility Requirements presented in the Terminal Area Plan, the total terminal building area of 314,062 square feet, with completion of the West Concourse expansion, could accommodate a level of annual enplanements approaching 2.2 million. While the status quo forecasts do not anticipate this occurring before the end of the planning period, business decisions by the airlines and other airport users could create demand for expansion. For example, new airline entrants to the BNIA market may want their own gates,

Table 4.6 Comparison of Aviation Forecasts

	1990 Master Plan/Terminal Area Plan Update[1]				1998 BNIA Master Plan Update (Low Fare Carrier)[2]			
Year	Operations		Enplanements		Operations		Enplanements	
	Annual	Peak Hour	Annual	Peak Hour	Annual	Peak Hour	Annual	Peak Hour
1990	85,620	25	2,216,000	847	90,614	--	1,703,696	--
1995	89,280	28	2,504,000	935	66,842	22	1,492,465	--
1997	--	--	--	--	62,663	17	1,496,931	660
2005	97,480	29	3,080,000	1,144	68,700 (83,700)	20 (28)	1,739,100 (2,365,500)	750 (1,125)
2010	--	--	--	--	71,600 (89,500)	21 (30)	1,908,400 (2,535,000)	916 (1,299)
2020	--	--	--	--	78,200 (96,200)	23 (33)	2,160,700 (2,937,500)	1,220 (1,507)

1. All values are forecasts.
2 Values for years 2005, 2010 & 2020 are forecasts, all other data are actual.

which would require terminal expansion.

.The Aviation Forecasts in this report also considered the possibility of a low fare carrier entering the Buffalo market at BNIA. Appendix 3A provides forecasts for that eventuality. These forecasts anticipate much higher levels of operations and enplanements than those made under the status quo assumptions, and as such will affect the forecast of terminal facility requirements. The facility requirements that were presented in the Terminal Area Plan projected the total square footage of terminal building requirements by design year. Comparison of the Terminal Area Plan forecasts with the current low fare carrier forecasts shows that the currently anticipated year 2020 activity is roughly of the same level as had been anticipated for the year 2005 in the Terminal Area Plan. The facility requirements which were anticipated in the earlier plan for the year 2005 are now seen as appropriate for 2020. Based on that document's facility requirements, a total terminal building size of from 321,000 to 404,000 square feet will be required to meet the 2020 needs under the low fare carrier scenario.

4.3.1.2 Airline Gates

If the low fare carrier forecasts are realized, the terminal facility most impacted will be the airline gates. The new terminal was initially built with a total of 15 airline gates. Additionally, the completion of the West Concourse extension adds two more gates for a total of 17 gates. The 1990 Terminal Area Plan recommended roughly a 1:1 relationship between the number of gates and the number of peak hour operations. Although growth in the level of operations has been below those master plan expectations, the ratio between gates and peak hour operations is holding relatively constant. Current statistics indicate that approximately 17 peak hour operations are being served by 15 gates. The current low fare carrier forecast of 33 peak hour operations by the year 2020, indicates that the ultimate number of gates recommended by the 1990 study (27-34) will not be required until 2020.

4.3.1.3 Auto Parking Requirements

Parking facility requirements are made up of three components: Parking needs of arriving and departing passengers, parking needs of airport employees, and parking needs of car rental agencies. Currently the Airport provides parking for airport and airline employees at a 324 space lot east of the new terminal building. Although there are close to 1,000 employee card holders with access to this parking, the nature of the work schedules is such that the lot meets employee parking needs while operating at a 60% capacity level. Other employee parking areas are provided around the airport, convenient to the work areas. Since airport employee parking needs are being adequately provided for, this component of parking demand will be omitted from the following analysis.

Facilities for passengers and the general public consist of a 1,433 space long term surface lot, and the second and third levels of the new parking garage, containing a total of 877 short term spaces. The first level of the garage provides 400 rental car spaces and 70 VIP spaces which are leased on an annual basis. Discussion with the parking facilities manager indicates that the garage accommodates approximately 2,000 cars per day and averages about 75% of capacity. The long term lot serves from 500-600 parkers per day and,

after a recent 342 space expansion, is operating at about 80% capacity. The only current problem reported by the parking facilities manager is that arriving passengers leaving the parking areas typically encounter delays at the five toll booths during afternoon/evening peak hours.

A suggested methodology for developing parking facility requirements is contained in AC 150/5360-13, Planning and Design Guidelines for Airport Terminal Facilities. This method relates the level of parking demand to the level of air carrier operations, and the level of passenger enplanements. Both peak hour and annual levels are utilized. This methodology, current aviation statistics, and the current estimates of utilization given above, were used to determine constants for "parking spaces per annual enplanement," and "parking spaces per peak hour enplanement," specific to BNIA. These ratios were applied to the forecasted activity levels at BNIA, and the resulting parking demand figures were compared to those presented in the 1990 Terminal Area Plan, and the more generic recommendations in the Advisory Circular (150/5360-13).

While there were variations among the three sets of results, all indicated that the parking facilities are adequate to meet current demand. Calculations based on the current parking utilization indicate that, under the status quo forecasts of enplaned passengers, the present facilities will reach capacity by 2005. By 2020 the parking demand will require an estimated 3,800 spaces. This is 1,500 spaces more than are currently available.

Estimates of parking demand under the low fare carrier forecasts indicate that there will be need for additional parking toward the end of the first planning phase. Estimated parking need by 2005 is for 3,500 spaces. By 2020 the estimated need will have grown to an estimated 4,700 spaces. Current capacity would be exceeded by 2,400 spaces. Table 4.7 presents the growth of parking demand under the two forecast scenarios.

Table 4.7 Terminal Auto Parking Facility Requirements
Status Quo Forecasts (Low Fare Carrier Forecasts)

Year	Current Spaces	Required Spaces	Surplus/Shortage (+/-)
1998	2,300	2,070	+200
2005	2,300	2,500 (3,500)	-200 (-1,200)
2010	2,300	2,800 (4,000)	-500 (-1,700)
2020	2,300	3,800 (4,700)	-1,500 (-2,400)

The current allocation between short and long term parking, about 35% to 65%, seems to be adequate and falls within industry guidelines. The number of toll booths currently in place also falls within industry guidelines for the level of peak hour enplanements. Due to the reported congestion in that area now, design of future parking facilities should examine this design guideline closely. Another possibly significant factor

affecting the future parking needs of passengers and employees at BNIA is the availability, and usage, of mass transit facilities. Currently, the Niagara Frontier Transportation Authority (NFTA) provides bus transit service to and from the airport, providing service for some airport employees and patrons. NFTA also operates a light rail rapid transit (LRRT) system in the city of Bufalo that carries some 27,000 riders per day. A potential extension of that LRRT system has been delineated which would extend to and serve the airport. Although the extension has the potential to carry significant transit ridership to and from the airport, there is no funding available for expansion of the light rail system. There are no plans to extend LRRT service to BNIA prior to 2020.

4.3.2 Air Cargo Requirements

Air cargo activity at BNIA has been steadily growing over the last 8 to 10 years. This growth pattern is similar to that being experienced across much of the U.S. There have been a number of major changes in the air cargo industry during recent years that have affected the industry's growth and operation. These changes include the introduction of larger capacity aircraft for greater movement of cargo volumes; development of hub and spoke operations that utilize feeder aircraft to supply collections centers where higher capacity aircraft are based, which in turn supply the primary hub operations; and the development of more specialized equipment enabling cargo operators to transfer and process cargo more efficiently both on the ramp and in their processing centers. The most prominent examples of these changes can be seen by the operations conducted by the major air cargo operators such as FedEx, UPS, Emery, Airborne, and DHL.

The type of air cargo activity conducted at BNIA is similar to most airports its size and larger. The activity is segregated into two distinct types: all-cargo/chartered air cargo and belly-cargo operations. The all-cargo operators usually conduct their activities in a dedicated location, separate from the passenger terminal area, that is designed specifically to accommodate their aircraft and special cargo processing equipment on the apron area and in their warehousing/sorting buildings. The belly-cargo operators conduct a majority of their activities on the passenger terminal apron area, transferring, sorting, and relocating cargo between scheduled air carrier aircraft cargo compartments, as well as between the aircraft and the airline's cargo building operation.

Historically, BNIA has had several different all-air cargo operators conduct activity at the airport. Since 1988 there have been four primary all-air cargo operators. These include Airborne, FedEx, UPS, and the United States Postal Service (USPS). All of these operators conduct activities with their own aircraft except for the USPS, which contracts its transportation of freight and mail to a third party operator. Currently, Emery has the contract with USPS to supply transportation of their cargo.

A review of the enplaned air cargo activity between 1988 and 1997 reveals that the enplaned air freight has grown 67 percent, from 13,775 tons to 23,112 tons. Express mail has grown 264 percent, from 133 tons to 484 tons. Air mail has grown 16 percent, from 4,770 tons to 5,526 tons. Total growth in Air Cargo over that nine year period was 56 percent, an average annual growth rate of 6 percent. The forecast of enplaned air cargo, contained in

Section 3.5.2, projects a 41 percent growth in total air cargo over the 23 year period, an annual growth rate of 2 percent. The forecasts project a 43 percent growth of air freight, 9 percent growth of express, and 36 percent growth of air mail by the end of the planning period. Table 4.8 presents the forecast of enplaned air cargo.

Table 4.8 Air Cargo Forecast (Enplaned Tons)[1]

Cargo Type	1997	2005	2010	2020
Air Freight	23,111.7	25,210	27,860	33,150
Express	484.2	500	510	530
Air Mail	5,525.8	6,240	6,680	7,490
Total	29,121.7	31,990	35,050	41,160
% Growth From 1997		9.85%	20.35%	41.35%
% Annual Growth		1.41%	4.07%	4.14%

1. Forecasts rounded to nearest ten.

4.3.2.1 Air Cargo Apron

The existing air cargo center is located on the west side of the airport, north of Runway 5 approach end, off of Cayuga Road. This location is strategically located across the runway from the passenger terminal area. The proximity of these activity centers helps the efficiencies of transferring air cargo between them. Before the development of the existing air cargo area, these activities were conducted on the Prior (FBO) ramp and on the south ramp, which has since been replaced by the current passenger terminal.

In 1988 the current air cargo apron and USPS building were constructed, which began the development of the existing air cargo apron. The size and design of this apron must provide several basic functions including ingress and egress for aircraft, aircraft parking, ground support equipment areas, vehicle ramp service drives, cargo processing equipment areas and cargo ground movement vehicles. The existing apron is approximately 731,250 sq. ft. (975' x 750') with taxiway access at the midpoint of the eastside of the apron. The apron currently accommodates approximately 13 aircraft each day on a regular basis.

Cargo operators house several large pieces of equipment on the ramp including static racks, loading/sorting machine, and other processing equipment. During the cargo operator's ramp activity periods, late evening and early morning, an assortment of tugs, tractors, carts, and other vehicles actively operate on the apron. With a large number and diverse type of vehicles and equipment on the apron, space allocation and movement areas can become congested during peak activity periods.

The cargo apron, which was rehabilitated in 1990/1991, is currently in excellent condition. As previously mentioned, the apron accommodates 13 parked aircraft daily, nine (9) of these aircraft are commercial jets and four (4) are turboprop aircraft. The breakdown of these aircraft are: four (4) B727-200 operated by FedEx, two (2) B757-200

operated by UPS, one (1) B727/ B757 contingency flight by UPS, one (1) DC9-30 operated by Airborne, one (1) B727-200 operated for USPS, one (1) F27/ C-208 Caravan operated by FedEx, and three (3) Banderiantes operated by UPS. It should be noted that the USPS operates a Cessna Cargo Master that shares the B727 parking position and is turned around within a short period of time each day and, therefore, does not require its own parking position. Occasionally, Superior Cargo Aircraft Loading will provide services to charter air cargo aircraft on the air cargo apron. Though the charter air cargo aircraft type will vary over a period of time, it has been determined that the most likely dominant aircraft type used in these occasional air cargo operations is the B727.

Discussions with, and surveys of, the current all air cargo operators revealed that two operators anticipate expanding their operations at BNIA within the next 5 years. This may affect the future ramp space requirements. FedEx is anticipating an expansion of its current operation which would require one to two additional B727-200 aircraft parking positions. UPS is planning an expansion of its services which would require two (2) additional aircraft parking spaces, one (1) for a DC-8 and one (1) for an additional Banderainte. Both UPS and FedEx indicated that it would be possible to foresee their need for at least one additional aircraft parking position beyond the 5 year period. The USPS and Airborne did not indicate the need for additional aircraft parking spaces in the future. For planning purposes, however, one additional aircraft parking space will be anticipated. Table 4.9 presents the projected air cargo apron requirements over the planning period.

Table 4.9 Air Cargo Apron Requirements

	1997		2005		2010		2020	
	No.	Sq. Yds.	No.	Sq. Yds.	No.	Sq. Yds	No.	Sq. Yds
B727-200/ DC-9	7	29,200	9	37,500	9	37,500	10	41,700
B757-200	2	9,700	2	9,700	2	9,700	3	14,500
Banderainte/ F27/C-208	4	3,200	5	4,500	5	4,100	6	5,000
DC-8	-	-	1	5,600	1	5,600	1	5,600
Movement Area/ Static Areas	-	29,300	-	37,000	-	37,000	-	44,300
Total Area Needed	13	71,400	17	93,700	17	93,700	20	111,100
Existing Area	-	86,000	-	86,000	-	86,000	-	86,000
Net Area	-	14,600	-	(7,700)	-	(7,700)	-	(25,100)

The forecast of required air cargo apron area indicates that a 37 percent increase in aircraft parking area may be needed by the end of the planning period. It should be noted that changes in the future aircraft types utilized by the air cargo operators could significantly alter the projected needs of this area.

4.3.2.2 Air Cargo Buildings

The air cargo area currently has four apron accessible buildings. The majority of these buildings were built in recent years and are in good condition. These buildings include the FedEx Building, the USPS Building, the Freight House, and the Flex Building. The Freight House is a multi-tenant building providing space for air cargo handlers, operators, and airline cargo operations. UPS operates out of a building located near the air cargo area, but it is not adjacent to the air cargo apron. Table 4.10 presents the breakdown of space in the various buildings.

Table 4.10 Current Air Cargo Buildings

Building	Area (Sq. Ft.)
FedEx	74,000
Flex Building	28,000
USPS	26,000
Freight House	66,250

From the forecast of enplaned tonnage, it was determined that existing spatial areas can accommodate projected future volumes of cargo activity. However discussions with the air cargo operators revealed that their current plans anticipate some spatial area increases in the future. The 5-year projections of spatial needs by air cargo operators indicate that for some operators, expectations regarding future business development will have to be realized to justify the anticipated expansion.

FedEx is anticipating its next major expansion of its BNIA operation when service begins to the new FedEx regional hub at Greensboro Piedmont Triad International Airport. FedEx is planning to almost double its building size to accommodate its anticipated market development.

UPS indicated that, though it recently moved into a larger space, it is in need of additional space for aircraft parts storage, crew lounge, and cargo sorting. UPS will be replacing some older sorting/processing equipment with newer, higher capacity devices in the near future, which will require more space than the existing equipment.

The USPS indicated that the only building area needing expansion is the storage area for mail carts dropped off by the air carriers. Table 4.11 presents projections of spatial needs in the air cargo building area.

Table 4.11 Air Cargo Building Requirements			
Area	**Existing (sq. ft.)**	**Future (sq. ft.)**	**Difference (+/-)**
FedEx	74,000	150,000	+76,000
Flex Building	28,000	28,000	0
USPS	26,000	30,000	+4,000
Freight House	66,250	66,250	0
UPS	12,000	17,000	+5,000
Total	**206,250**	**291,250**	**+85,000**

From this analysis it can be concluded that most of the current air cargo tenants have adequate space to conduct their operations, although some expansion will be necessary to enhance operations. FedEx is the only operator anticipating significant expansion requiring space that will necessitate the development of an additional structure in the air cargo area. Although no new air cargo operators have expressed interest in establishing an operation at BNIA, there is the possibility in the future that a new entrant may emerge requiring space at the Airport. Options for providing expansion of cargo facilities will be explored in the alternatives analysis.

4.3.3 General Aviation Requirements

In addition to providing facilities for airline and air cargo activity, BNIA is an important center for general aviation activity in the Buffalo area. The facilities must be able to serve a wide range of aircraft, from small, privately owned aircraft used for recreational travel, through the largest corporate jet aircraft used for international business travel. Air taxi and private charter flights are also considered to be general aviation activities, and the facilities must be able to handle the wide range of aircraft used in those operations. Currently, an area in the northeast quadrant of airport property is reserved for general aviation activities.

Landside facility requirements for the general aviation (GA) activities at BNIA were calculated based on the forecasts of aviation demand, interviews with airport users and personnel, FAA guidelines, and industry standards. The following facilities were examined in this analysis:

- Aircraft Hangar Area
- General Aviation Apron
- General Aviation Terminal Building
- GA Auto Parking

4.3.3.1 Aircraft Hangar Area

Of the total 311,400 square feet of conventional hangar space in use at BNIA, the airport's FBO, Prior Aviation, manages a total of 55,400 square feet in two conventional hangars. These two hangars are used for storage of general aviation based aircraft, aircraft maintenance, and the maintenance of ground support equipment which Prior owns and

operates. Since hangar space is at a premium for the FBO, it is managed in such a way as to allow the maximum flexibility among the various uses. The 25,500 square foot Executive Hangar is used for aircraft maintenance as well as based and transient aircraft storage. The 29,900 square foot "Hangar 2" is also used for based aircraft storage, including Prior's fleet, and vehicle maintenance and storage. For planning purposes it is estimated that approximately 30,400 square feet are used for based aircraft storage, 5,000 square feet are held for transient rental, 15,000 square feet are used for aircraft maintenance, and 5,000 square feet are used for storage and maintenance of ground equipment.

The remainder of the airport's hangar space is controlled by two private corporations whose businesses require access to the airfield. These two corporations, Calspan SLR Corp., and Sierra Technologies, perform modifications to aircraft and conduct research and avionics testing. Some of the aircraft used in their businesses are included in the airport's based aircraft total. Since they are stored at the companies' facilities, they are not considered to be part of the based aircraft population utilizing general aviation hangars.

Hangar requirements are typically a function of the number and type of based aircraft, owner preferences, hangar rental costs, and the climate conditions in the region. Owners of large and expensive aircraft will tend to prefer hangar storage to outdoor storage, and the preference for enclosed storage will also increase when the weather conditions are severe. Based on experience with other airports having similar climate, and the current and anticipated fleet mix, the following assumptions have been made as to the desired level of hangar storage and space requirements of based aircraft at BNIA:

Aircraft Type	Desired Type of Storage	Requirement/Aircraft
Turbo-Jet	100% Hangar	2,500 sq. ft.
Multi-Engine Aircraft	100% Hangar	1,600 sq. ft.
Single Engine Aircraft	75% Hangar, 25% Apron	1,200 sq. ft.

The calculation of hangar facility requirements is based on the space and preference standards given above, and on the number of based aircraft at the airport. Records provided by BNIA officials show a total of 48 based aircraft at BNIA. A total of 11 of these based aircraft are adequately housed at the Calspan and Sierra Technologies hangars, which are private facilities.

Applying the above planning parameters to the existing and forecasted mix of based aircraft (Table 3-13), hangar space requirements sufficient for the anticipated number of based aircraft were estimated. Table 4.12 shows that the existing 30,400 square feet of available hangar space does not meet the current estimated based aircraft need of 54,300 square feet. A shortfall of 23,900 square feet presently exists.

The forecasted increase in the number of based aircraft over the planning period will increase this hangar storage deficiency. By 2020 it is estimated that based aircraft will require a total of 75,800 square feet of hangar space, 40,400 square feet more than is

currently available. Another factor to be considered when projecting future need is the FBO's current practice of trying to reserve space to meet the occasional demand for hangar storage of transient aircraft, which is typically required on short notice. The projection of hangar requirements assumes that this practice will continue. Table 4.12 presents the general aviation hangar facility requirements through 2020.

Table 4.12 General Aviation Hangar Requirements (sq. ft.)[1]

Year	Based Aircraft Need	Reserve for Transient Use	Total Recommended Need	Existing Area[2]	Additional Facility Needs
1997	54,300	5,000	59,300	35,400	23,900
2005	63,400	5,000	68,400	35,400	33,000
2010	66,900	7,500	74,400	35,400	39,000
2020	75,800	7,500	83,300	35,400	47,900

1. Table assembled from individual annual forecasts based on fleet mix
2. Sum of estimated based aircraft storage and transient reserve areas

It is important to realize that this is an unconstrained, or "best case," forecast. Limitations to hangar development were not considered. In this regard, the provision of additional hangar space will be examined in light of airport space constraints, possible changes of use in existing facilities, and cost later in the Alternatives section of the Master Plan.

4.3.3.2 General Aviation Apron

There are four components of need that determine the required apron area for general aviation uses. These are:

- Based aircraft,
- Transient aircraft,
- Staging and Maneuvering Areas
- Other required apron activities.

The sum of these components will determine the total area of apron required to meet the forecasted level of general aviation activity at BNIA.

Based Aircraft

The first component, parking area for based aircraft, is dependent upon how much of the anticipated hangar storage need will be met. Since the additional provision of hangar space is currently unknown, this component of apron demand will be calculated under the assumption that all of the projected hangar demand will be met. Since the preferred storage option of aircraft owners at BNIA is overwhelmingly for hangar storage, this results in very few based aircraft being stored on the apron. If the projected hangar requirements

are not met, additional apron space, above the need projected in this section, will be required. The FAA publication AC1500/5300-13, Airport Design, recommends a design standard of 300 sq. yd. per aircraft for based single engine and light twin aircraft, which is the aircraft type expected to use apron parking. If the above hangar needs are met, it is anticipated that the following based aircraft apron needs will exist:

Year	Number of Aircraft	Apron Area Requirement
1997	2	600 sq. yd.
2005	2	600 sq. yd.
2010	2	600 sq. yd.
2020	1	300 sq. yd.

Transient Aircraft

From interviews with the airport's FBO, a large percentage of the transient aircraft that use the airport's facilities are visiting Buffalo for business purposes. Peak use periods occur in the middle of the week, and in the middle of the day. Transient activity is relatively steady throughout the year; the winter months do not display significant downturns in activity. Transient aircraft parking is needed on a short term basis, typically ranging from a few hours to several days.

The forecast of the amount of apron space required to provide adequate parking for these aircraft is based on the number of itinerant operations at the facility. This methodology is described in the FAA publication AC 150/5300-13, Airport Design. Some of the parameters were adjusted after consultation with industry experts and interviews with FBO staff in order to more accurately describe specific conditions at BNIA. The methodology is as follows:

- From the general aviation demand forecasts (Table 3-14), calculate the average number of daily itinerant landings.
- Assume that a busy day is 10 percent busier than the average day.
- Assume that 50 percent of the itinerant landings are by transient aircraft needing apron parking.
- Calculate the transient apron area requirements using a factor of 600 square yards per aircraft.
- The resulting area is increased by a contingency factor of 10%.
- Finally, the total area is reduced by the amount of space allocated to hangar storage of transient aircraft desiring such a service.

This methodology yields the number of parking spaces, and the apron area required, to meet the transient parking demand on a busy day. Applying this approach to the forecast of general aviation itinerant operations yields the facility requirement for transient aircraft parking shown in Table 4-13.

Table 4.13 Transient Aircraft Apron Requirements

Year	Annual Itinerant Operations	Busy Day Landings[1]	Transient Spaces	Transient Parking Area[2]
1997	62,694	94	47	28,000 sq. yd.
2005	64,300	97	48	29,000 sq. yd.
2010	67,900	102	51	30,000 sq. yd.
2020	73,700	111	56	32,000 sq. yd.

1. Annual itinerant operations/2 / 365 * 1.1
2. Adjusted to remove space allotted to hangars, rounded to the nearest thousand

Staging and Maneuvering Areas

Adequate space for the safe maneuvering of aircraft about the apron, and from hangars and parking areas to taxiways, must also be included in any forecast of apron requirements. The variety of aircraft which presently use the apron, and the required flexibility of use, make it difficult to quantify this need prior to the actual design of the recommended apron layout. This component of apron need will be estimated through use of the "hangar apron." Hangar apron area is typically equal to the total hangar area, and provides space for aircraft movement and maneuvering. Hangar apron requirements in this report are based on the assumption that the recommended hangar facility need will be met for each of the forecast years.

Other Required Apron Activities

In addition to the above year round uses of the general aviation apron, in the winter months space is required for use of the airport's radiant heat de-icing facility, currently located in the southeast corner of the apron. When in use, sufficient maneuvering space is required for an aircraft to pull into the facility, and then to have an unimpeded route to taxiway "Q," which gives access to the runways. Approximately 7,000 square yards are required to be kept free of parked aircraft for this activity as it is currently sited.

Summary of GA Apron Requirements

Table 4.14 summarizes the projected general aviation apron requirements for the planning period. It must be remembered that these projected apron requirements are closely linked to the provision of hangar space. A shortfall in hangar space will necessitate an increase in apron space.

Table 4.14 GA Apron Facility Requirements Summary (sq. yd.)

Year	Based Aircraft Apron	Transient Aircraft Apron	Staging & Maneuvering Area	De-Icing Area	Total GA Apron Requirements	Existing Apron	Excess (Shortfall)
1997	600	28,000	6,600	7,000	42,200	31,000	(11,000)
2005	600	29,000	7,600	7,000	43,700	31,000	(12,700)
2010	600	30,000	8,300	7,000	45,700	31,000	(14,700)
2020	300	32,000	9,300	7,000	49,000	31,000	(18,000)

The general aviation apron currently contains approximately 31,000 square yards, 10,800 square yards less than the current requirement. By the end of the planning period however, the shortfall is expected to grow to 18,000 square yards.

4.3.3.3 General Aviation Terminal Building

A general aviation terminal building provides space for management offices, pilot lounge areas, rest rooms, food services, flight planning, and other areas for the needs of pilots, passengers and employees. The general aviation terminal at BNIA is a modern 9,000 square foot building located adjacent to the GA apron, on the airport's Perimeter Road. Approximately 6,000 square feet of this building are used for terminal purposes; the remaining one third of the building space serves as administrative offices for the fixed based operator.

An accepted approach for calculating building requirements for this type of facility relates the calculated number of peak hour operations, and the number of pilots and passengers per operation, to terminal square footage guidelines presented in AC 150/5300-13, Airport Design. These guidelines recommend a design standard of 50 square feet of terminal space for each pilot or passenger anticipated to use the terminal during the peak hour of demand. Records kept by Prior Aviation show that, over the last three years, an average of 2.4 persons was aboard each general aviation departure. The aviation demand forecast projects an unadjusted total of 41 peak hour general aviation operations by the year 2020. The terminal will thus be expected to serve a peak hour total of 99 pilots and passengers. Applying this to the design standard of 50 square feet results in a recommended area for the general aviation terminal building of 4,950 square feet. The current facility is adequate to meet the anticipated 2020 demand.

There are, however, occasions in which the general aviation terminal does not currently meet demand. These occur when large charter tours depart from the general aviation apron. These tours, often to Las Vegas, Atlantic City and Florida, are booked by local travel agencies and utilize aircraft such as the Boeing 737 and MD 80, which carry from 130 to 170 passengers. The general aviation terminal is not designed to handle such activities, and interviews with the FBO indicate that boarding, deplaning, and baggage handling can present problems or inconveniences. Plans are under way to move these operations to a gate at the airline terminal better equipped to handle them. The only large aircraft charter that is expected to remain at the general aviation terminal is that of the Buffalo Bills football team.

These occasional and predictable occurrences are not seen as sufficient to require the expansion of the general aviation terminal area.

4.3.3.4 GA Auto Parking

The number of automobile parking spaces required at a general aviation terminal is dependent upon the level of peak hour aviation activity, plus the number of FBO and other employees working at the terminal. In calculating the parking demand at the BNIA general aviation terminal, demand generated by occasional special events was also included. The methodology used to compute parking demand was as follows:

- Number of peak hour aircraft operations (non-airline)
- Plus, two thirds the number of FBO employees,
- Plus, any special event parking need,
- Times a contingency factor of 1.10.

The parking need generated by the FBO employees is a major component of this parking demand. Prior Aviation currently employs 165 persons; they work at various locations on the airport. Only about 60 employees work and park at the general aviation terminal. Prior's employment is projected to increase at a rate of 1% per year. Special event parking need at BNIA arises from the charter operations which use the GA apron. The Part 135 charter operations, which are operated by Prior Aviation, use relatively small aircraft and do not generate excess parking demand. The large aircraft excursions however, can occasionally create parking shortages, particularly the Buffalo Bills charters which are expected to remain at the general aviation apron. The FBO indicates that these occasional flights generate a need for an additional 100 parking spaces. Table 4.15 below summarizes the anticipated general aviation parking facility requirements.

Table 4.15 Summary of GA Parking Needs

Year	Peak Hour GA Operations[1]	Total FBO Employees[2]	Special Event Parking	Contingency Factor	Total Required Spaces
1997	31	60	100	1.10	188
2005	32	65	100	1.10	193
2010	33	68	100	1.10	196
2020	36	75	100	1.10	205

1. Table 3.14
2. Includes only employees at general aviation terminal

Auto parking for general aviation use is currently provided in two paved areas adjacent to the GA terminal building. There are currently 100 spaces in an area of approximately 3,900 square yards. The year 2020 GA parking facility requirement of 205 spaces

is 105 spaces more than is currently available in a paved lot. Using a planning standard of 35 square yards per space, an expansion of approximately 3,700 square yards will be required.

4.3.4 Other Facility Requirements

This section covers the facility requirements of those activities that directly support aircraft operations. They are not specifically associated with any of the airport activity areas, but occur at all areas of the airport. These support activities include:

- Fuel Storage and Distribution
- Air Traffic Control (ATC)
- Airport Rescue and Fire Fighting (ARFF)
- Airfield Maintenance
- Aircraft Maintenance
- Ground Support Equipment (GSE) Maintenance
- Deicing
- Airfield Security Systems
- Land Acquisition Requirements

4.3.4.1 Fuel Storage and Distribution

The evaluation of fuel facility requirements at BNIA is based on interviews with airport personnel, and a review of airport fuel records. The recommendations contained in the FAA publication AC 150/5230-4, Aircraft Fuel Storage, Handling and Dispensing on Airports, and National Fire Protection Association (NFPA) #407 and # 415, relating to the location and specifications of aircraft fueling facilities were also consulted.

Fuel storage facilities at BNIA consist of a tank farm on the north side of the airport property, and two distribution sites. A remote Jet A fuel dispensing facility is located on the apron northeast of the terminal building near the former Westinghouse property. Another dispensing facility, where all three types of fuel (Jet A, AVGAS & MOGAS) are available, is adjacent to the fuel farm. Fuel is currently delivered to the storage facility by tanker truck, and transferred from the distribution facility to commercial, air cargo, and general aviation users by fueling vehicles. Fueling occurs at all three apron areas: airline, air cargo, and general aviation. The fuel storage and dispensing facilities are owned by BNIA. Prior Aviation is responsible for the delivery of fuel to most aircraft, and owns and operates all but a small portion of the fueling vehicle fleet.

Fuel Storage

In order to ensure that the airport has adequate supplies of fuel to meet future demands, projections of future fuel usage have been made. These projections have been made using the number of aircraft operations in 1996 and 1997, and airport fuel records for that period, in order to obtain an average of fuel use per operation. This factor was calculated individually for users of both Jet A and AVGAS fuel. This factor was then applied to the forecasted level of operations to arrive at an estimate of future fuel use. This was done for each

of the forecast years. This analysis showed that the airport's storage capacity for AVGAS would provide in excess of thirty day supply for well beyond the planning period. Due to the increasing use of Jet A fuel, however, the airport's present storage capacity is expected to provide a steadily decreasing level of reserve supply. Table 4.16 shows the number of days supply (at peak month usage) the current storage facilities would provide for Jet A fuel as activity increases: 7.8 days in 2005, 7.4 days in 2010, and 6.7 days in 2020.

Table 4.16 Jet Fuel Use Projections[1]

Status Quo Forecasts (Low Fare Carrier Forecasts)

Year	Annual Jet Operations[2]	Fuel Use Factor (gal/operation)	Annual Fuel Usage (gallons)	Supply at Peak Month Usage (# Days)
1997 (Actual)	91,509	285.6	26,133,414	8.3
2005	97,300 (112,300)	285	27,730,500 (32,005,5500)	7.8 (6.8)
2010	103,100 (121,000)	285	29,383,500 (34,485,000)	7.4 (6.3)
2020	113,700 (132,600)	285	32,404,500 (37,791,000)	6.7 (5.7)

1. Source, Tables 3-15, 3-20 and BNIA Fuel Farm Records
2. Sum of Major/National Airline, Regional, Air Cargo, Military and General Aviation Jet Operational Forecasts (includes turboprops), Tables 3-15, 3-20 , status quo projections

The Aviation Forecasts prepared as a part of this report discussed the possibility of a low fare carrier entering the Buffalo market at BNIA. Operational forecasts for that eventuality were prepared in order that the Airport could establish contingency plans. Those forecasts anticipate a significant increase in the level of annual airline operations. The rate of fuel usage would also increase. Using the same methodology as above, reserve supply would be reduced to 6.8 days in 2005, 6.3 days in 2010, and 5.7 days in 2020.

BNIA has never had a problem with fuel availability, and airport staff does not feel that the current level of storage is a problem. The provision of seven days reserve supply of fuel will be used as a planning guideline in preparing facility requirements. The status quo aviation forecasts do not anticipate this seven day reserve guideline being exceeded before 2010. The arrival of a low fare carrier, however, would be expected to require additional fuel storage capacity immediately. Table 4.17 shows the Jet A fuel storage capacity recommended for BNIA under both the status quo and the low fare carrier scenario.

Table 4.17 Recommended Jet Fuel Storage Capacity[1]
Status Quo Scenario/(Low-Fare Carrier Scenario)

Year	Existing Capacity	Required Capacity	Surplus/Shortage (+/-)
1997	675,000 gal.	570,500 gal.	+104,500 gal.
2005	675,000 gal.	605,400 gal. (698,700 gal.)	+69,600 gal. (-23,700 gal.)
2010	675,000 gal.	641,500 gal. (752,800 gal.)	+35,500 gal. (-77,800 gal.)
2020	675,000 gal.	707,400 gal. (825,000 gal.)	-32,400 gal. (-150,000 gal.)

1. Seven days supply at peak month usage.

An additional fuel storage need arises from the fact that the airport has only one AVGAS storage tank. If that tank should fail or become contaminated no backup supply would be available. An additional tank would provide a safety factor, and would also facilitate the periodic inspection and cleaning that all fuel tanks require. An additional AVGAS tank of 30,000 gallon capacity would increase both fuel handling safety and reliability of supply. Iit is also recommended that the AVGAS system be reconfigured to (1) add a recirculating system, and (2) provide for filtration of deliveries as well as dispensed fuel. This would not only help to improve fuel quality, but would prolong the life of the tank. An additional recommendation is that an epoxy coating be applied to the secondary containment area so that any spill could be recovered (which would avoid reprocessing and also prevent having to dig out underlying clay and rock in case of a spill).

A building need relating to fuel storage has been identified through interviews with BNIA personnel. A major focus of the airport's fuel storage is a strict quality control program. The current storage space available in the 2,350 square foot control building is inadequate for storage of the replacement filters and other required equipment. An additional 1,200 sq. ft. of storage is presently needed. As the volume of fuel handled at the airport increases, this storage need is expected to increase proportionately, and a total control building facility requirement of 4,000 square feet is recommended.

Fuel Distribution

The existing fuel dispensing facilities are conveniently located to the major use areas. The remote Jet A dispensing facility serves airline and air cargo operations, while general aviation is served usually through the local dispensing facility near the tank farm. Fueling vehicles servicing aircraft on the air cargo apron must utilize the perimeter road to reach that area, but the daily schedules of those aircraft operations is such that the route does not cause delay. The remote dispensing facility is near the Westinghouse property, and may be affected by the pending acquisition of that property. Relocation of this facility may be required if terminal expansion or other proposed uses would create a conflict with fueling operations. Criteria for the re-siting will include proximity to major fueling areas, and sufficient space for the maneuvering

of aircraft fueling vehicles. Provision also must be made, either near the dispensing facility or at another airport location, for overnight parking areas for the fueling trucks. In order to contain any fuel spills or leakage, a paved and drained overnight parking area with adequate vehicle separation should be provided for this purpose. An area containing 1,200 square yards would be adequate to park 15 fueling trucks (the current 13 plus an anticipated fleet growth of 2) with the required ten feet of separation between vehicles.

4.3.4.2 Air Traffic Control Facilities

Air traffic control facilities at BNIA were previously described in Chapter 2. As noted, these facilities are relatively new, having been constructed in 1994. The air traffic control tower and associated TRACON are modern facilities that will not require any improvements or modifications during the planning period. These facilities are capable of accommodating all projected demand.

4.3.4.3 Aircraft Rescue and Fire Fighting Station

The Aircraft Rescue and Fire Fighting (ARFF) station at BNIA was constructed in 1970 with five apparatus bays and a total floor area of approximately 8,000 square feet. In 1984, the ARFF station was expanded to approximately 10,600 square feet. The expansion provided separate men's and women's dormitory areas and created a large classroom training area. The station currently conforms to FAA requirements but is nearing 30 years of age.

Based on discussions with the station's Fire Chief, two improvements to the facility are needed: storage space for equipment and materials and drive-through apparatus bays.

Review of as-built drawings for the station reveal that expansion of the existing building is possible, as is the construction of drive-through apparatus bays. It is recommended that the existing bay nearest the operations area be converted to storage space and that a new bay and additional storage space be constructed at the far end of the station. The bay nearest the operations area could accommodate the storage of equipment that is currently stored along the back wall of the station that would be displaced by construction of drive-through bays. The construction of a new bay would accommodate equipment that is displaced from the bay nearest the operational areas, while a new storage room could accommodate supplies that are not needed on a daily basis.

Construction of drive-through bays could be accomplished through structural modification of the building and paving the existing grass area behind the station. This would provide an operational convenience that is common at most other ARFF stations.

Due to the fact that the ARFF station is old and that expansion of the air cargo apron is required, the potential for relocation of the ARFF station should be explored. Therefore, the option of replacing this facility versus making the improvements described above should be considered as part of the alternatives analysis.

4.3.4.4 Airfield Maintenance

Maintenance of the runways, taxiways and aprons, particularly in Buffalo's inclement weather, is a very important part of airport operation. This and other maintenance needs require a great deal of specialized equipment that must be maintained and stored. A modern and efficient airport needs sufficient facilities for the storage of equipment and materials, equipment maintenance, and administrative offices. Many of these use areas are not now clearly defined, and the total operational areas are crowded.

Presently, a total of four buildings, containing just over 45,000 square feet, are devoted to airfield maintenance activities. The maintenance buildings lie within a triangular 6.5 acre area bounded by the Air Cargo facilities to the north, highway commercial development to the west, and the airfield to the southeast. Access to the main terminal is via an airport perimeter road that skirts the southwest end of Runway 5-23, and to the GA terminal via the perimeter road around the northwest end of Runway 14-32. This 6.5 acres also contains a 9,600 square foot building leased to USAirways, which uses the building and surrounding area for storage and maintenance of its ground support equipment. A small building used by the NFTA Engineering Division is also located here. The perimeter road runs through this area, leaving an estimated five acres for the siting of airfield maintenance facilities.

Inspection of the maintenance building area, and interviews with maintenance staff indicate that a number of facility deficiencies now exist. Material storage areas are not consolidated. Sand is presently stored in a heated bay of the Maintenance Garage, urea is stored in 100# bags on pallets in a parking bay, and salt is stored in a separate building. The salt storage building is designated as a temporary structure due to its location adjacent to the proposed GA parallel runway (5L-23R). This building's location is also undesirable in light of the need to keep salt away from all aircraft operational areas. Improved facilities are also needed for equipment maintenance. Of the three service bays in the maintenance garage, only two are usually available year round for vehicle maintenance, while the wash bay is used to park the salt truck in winter. Indoor or covered equipment storage space is inadequate for the current and anticipated mix of equipment. At least twenty pieces of equipment are stored outside due to lack of covered storage. The recent terminal and apron projects have added approximately one million square feet of pavement area (for a total of about 7.5 million) which will all need to be maintained, and may require additional equipment. Finally, maintenance staff indicate that the perimeter road which provides access to the terminal area typically becomes quite congested during the winter months, particularly at the peak of snow removal and de-icing operations.

Additional maintenance division facilities are recommended in order to meet both current and anticipated needs. Industry standards call for the identification of discreet use areas for material storage, equipment maintenance, and equipment storage, as well as sufficient outdoor space for circulation, deliveries, employee parking, and expansion. Due to the age of present facilities, space constraints at the existing site, and the potential apron access problems posed by the perimeter road, it is recommended that a new location for the maintenance facilities be considered. Based on evaluation of a well designed maintenance facility at a similar airport (Port of Columbus, Ohio), a site containing approximately 7-10 acres

would be sufficient. Based on industry standards, and guidelines contained in AC 150/5220-18, Buildings for Storage and Maintenance of Snow and Ice Control Equipment and Materials, a well organized facility can be designed containing a total of from 60,000 to 70,000 square feet. The site should be located near the major snow removal areas: i.e., the main terminal aprons and Runway 5-23. The site should not be overly reliant on a single access route to reach other necessary areas.

4.3.4.5 Aircraft Maintenance

As an early aviation manufacturing and training center, BNIA once housed a number of aircraft maintenance facilities. The planning work that led up to the construction of the new airline terminal resulted in the relocation of many airport facilities, and improved overall airport operations through the identification of various airport use areas. As part of this process, the obsolete hangars which had housed aircraft maintenance operations were demolished. Since there was not an immediate need for such facilities, they have not been replaced. Presently, the only aircraft maintenance performed at BNIA is done by the airport's FBO at its Executive Hangar on the general aviation apron. The operation serves primarily general aviation aircraft, though some contract maintenance is done for larger commercial aircraft.

The last several years have produced a number of start-up airlines that rely on private contractors or other airlines to perform the required scheduled maintenance on their aircraft. Two of these airlines which operate out of BNIA have expressed interest in establishing a maintenance base at the airport. Interviews with NFTA and Prior Aviation personnel indicate a perceived need for facilities to support such a maintenance operation. In the event that a low fare carrier begins operations at BNIA, the anticipated increase in operations would increase the airport's attractiveness to smaller, specialized air carriers, and make the prospect of providing expanded maintenance services more likely.

It would be prudent to identify a site for such a maintenance facility in the event that a firm proposal is offered. The most likely aircraft to be served by such a facility would be the Boeing 737 or similar medium sized jet aircraft suitable for medium haul operations. A hangar providing space for the simultaneous accommodation of two such aircraft would be desirable. This extra capacity would allow an operator to contract for scheduled maintenance in addition to emergency, or breakdown, maintenance with the assurance that sufficient hangar space would be available. A structure containing approximately 53,000 square feet (230 ft. x 230 ft.) would meet this need and it is recommended that space be reserved for such a facility. Siting criteria should include adequate taxiway and apron strength for large aircraft, and the site should not impinge on areas used by smaller, general aviation aircraft.

4.3.4.6 Ground Support Equipment (GSE) Maintenance

Ground support services required by commercial and general aviation aircraft include: transporting passenger baggage to and from the aircraft, freight and air cargo handling, maneuvering the aircraft on the aprons (push out service), and numerous other services which require specialized equipment. This equipment needs to be stored and

maintained. Ground support services are provided at all of the airport's operational areas, the majority occurring at the airline gates and air cargo areas. In the terminal area, a majority of these services are presently performed by the airlines at their own gates. Prior Aviation Services provides some of these services on a contract basis for several airlines, and at the general aviation terminal. In the Air Cargo area, Prior also provides ground and package handling services to several of the companies there.

When not in use, most GSE is stored as near as possible to where it is used. Storage for the majority of the equipment used in air cargo operations is available in the air cargo buildings. Storage for equipment used at the airline gates, however, is more of a problem. While some gates have sufficient terminal frontage to find places to park GSE equipment, the wedge shaped gates at the end of the concourses provide very little terminal frontage, and equipment storage is difficult.

Presently the only dedicated facility for the maintenance of GSE is operated by USAirways in a 9,600 square foot building in the center of the airfield maintenance area. Prior Aviation maintains the equipment it owns at its Hangar #2, where the space required for that function competes with space needed for aircraft storage. It is recommended that additional space be provided for maintenance and storage of GSE and other airport vehicles. Based on the amount of space dedicated to GSE by USAirways, and the percent of BNIA flights operated by that carrier, a current total need for GSE maintenance facilities of 20,000 square feet has been estimated. As aviation activity increases over the next twenty years, GSE needs can be expected to increase proportionately. Annual air carrier operations are forecast to increase by nearly 50% under the high activity scenario (low-fare carrier), therefore total GSE facility needs for 2020 can be estimated at approximately 30,000 square feet. Since the utilization of this proposed facility has yet to be more precisely defined, additional planning will be needed to identify the precise size, type, and location of future GSE facility space.

4.3.4.7 Aircraft Deicing Operations

Review of deicing operations at BNIA revealed that there are four primary issues of concern. These issues include the following:

- Capture of spent deicing fluid from the air cargo ramp,
- Containment of glycol contaminated snow from the passenger terminal apron and air cargo apron and,
- Siting of a radiant energy deicing facility on the south side of the airport.
- Siting of a deicing area closer to Runway 25.

Each of these issues will be addressed in the following paragraphs.

With respect to the capture of spent deicing fluids, the existing system of inlets and pipes at the passenger terminal will adequately address the capture of glycol from this area. However, spent glycol on the air cargo apron is currently vacuum swept and then deposited into the glycol storage tanks. This method of operation continues to increase in cost

and does not appear to be the best long-term solution. Therefore, the construction of inlets to adequately collect the glycol and a pipeline to transport the glycol to the storage tanks located near the approach end of Runway 5 appears to be the best solution to long-term management of this issue and is recommended. Studies to assess the necessary expansion of the storage tanks to handle the increased flow from the air cargo ramp are currently being conducted and will be incorporated into this study when available.

The second issue is the containment of glycol contaminated snow. In the past, snow from the passenger terminal apron and air cargo apron has been plowed and stored at designated areas around the airport. Measurements of effluent from the airport's drainage outfalls indicate that some of the melting snow contained glycol. In order to resolve this problem the concept of a snow storage pad has been suggested. Such a pad would consist of a hard paved surface that contains inlets for collecting the melting snow and glycol. Transport of the water and glycol to the existing storage tank area via a new pipeline could be considered if the pad is located within a reasonable distance.

A snow storage pad could be placed at several sites on the airport. However, due to the fact that the majority of snow that would go to the pad would come from the passenger terminal ramp and the air cargo ramp, it is more desirable from an operational perspective to locate a pad near these facilities. Potential sites for a snow storage pad areas adjacent to the perimeter road just north and south of Taxiway M, as well as an area near the fuel farm.

Consultation with airport operations personnel indicated that snow could be piled to a height of approximately 15 feet with existing equipment. This height is low enough to eliminate any potential for interference with the airport's radar system. A site just north or south of Taxiway M also offers the benefit of being close to the air cargo apron. If a pipeline is constructed to transport spent glycol from the cargo apron it would be very economical to connect this pipeline to a snow storage pad due to the short additional distance required.

Issues that must be considered when placing a snow storage pad include separation requirements from operations areas, and vertical limitation imposed by FAR Part 77. Using a height of 20 feet, a snow melt pad could be located no closer than 640 feet from the centerline of any runway that has, or is planned to have, a precision approach, and no closer than 390 feet from the centerline of a runway with a non-precision approach

The third issue to be addressed is the siting of a potential deicing area closer to the end of Runway 23. Runway 23 is the predominant runway used by commercial air carriers for takeoffs. Given its distance from the terminal and the trend toward more stringent standards for glycol applications, it is likely that a deicing area closer to Runway 23 will be needed in the future. The siting of such a facility will be addressed in the alternatives analysis.

With respect to the issue of radiant energy deicing, the placement of such a facility on the south side of the airport has been examined in the past. Placement of a radiant energy deicing facility in this area would provide a convenient alternative for air carrier

aircraft at the passenger terminal and has the potential to reduce the airlines' use of glycol. A site east of the passenger terminal has been suggested, however this site conflicts with the long-range plans for expansion of the passenger terminal and may, or may not, be the optimal site once the Westinghouse property is purchased and redeveloped for airport use. To insure that the suggested site is compatible with both the planned expansion of the passenger terminal and the redevelopment of the Westinghouse property, it is recommended that the analysis of the placement of a radiant energy deicing facility be accomplished in conjunction with the alternatives analysis. This will insure that the ultimate site is compatible with planned use of existing and future airport property.

4.3.4.8 Airfield Security Systems

BNIA has in place an FAA approved security program meeting the requirements of FAR Part 107, Airport Security, overseen by the Airport Security Coordinator. The program is responsible for the maintenance of sterile areas at the airline terminal, which includes the screening of passengers and baggage. The security program delegates certain responsibilities to airport tenants, such as airline companies and other airport related businesses which operate on airport property. All of these delegated responsibilities are overseen and coordinated by the NFTA Transit Police, a trained, uniformed and armed service with full arrest authority. It performs the primary response to all security incidents on airport property. The Transit Police also has responsibility for maintaining access control to all areas of the airfield.

Access control includes the security training of all airport and other personnel who have access clearance to any area of the airfield. Access clearance is provided by the issuance and maintenance of identification media which can allow access to the entire airport property, or restrict that access to certain airport areas at certain times.

Facilities required for operation of the security system include office space for the Transit Police, security fencing around the entire airfield area, and access control facilities which ensure that only individuals with appropriate access clearance are allowed to enter various airport areas. Interviews with the NFTA Police indicate that the current office facilities, the main station at 247 Cayuga Road and a satellite office in the terminal building, provide sufficient space for current and projected personnel and operational needs. Security fencing and access control facilities are presently adequate, but as other airport facilities are enlarged or relocated, and additional property is acquired, additions and changes will need to be made. The identification of additional facilities and equipment, or the need for such facilities, is regarded by the FAA as security sensitive information and will not be detailed in this report.

4.3.4.9 Land Acquisition

Key to the provision of facilities required to meet anticipated aviation demands at BNIA is the identification of sufficient space in which to locate these facilities. Probably the most important of these facility requirements relate to the need for runway improvements and provision of related safety areas. As discussed in the analysis of airside facilities, improvements are recommended to Runway 14-32 in order to improve airport safety, and to improve that runway's capacity in the event that the main runway, 5-23, should

have to be temporarily closed for any reason. These improvements are contingent upon the pending acquisition of the former Westinghouse property on Genesee Street. The acquisition and subsequent demolition of this structure will allow for the provision of a standard Runway Safety Area at Runway End 32, and for additional runway length.

Clearance of this old industrial facility will also remove a constraint to anticipated terminal area development, and will allow for the provision of more efficient internal circulation at the airport. The acquisition of more land will also provide for much needed flexibility in the siting of future landside facilities, several of which are forecasted to experience considerable growth. Although the general aviation area seems to have sufficient land area available to meet foreseen needs, future air cargo and airfield maintenance facility requirements may produce space conflicts if additional well sited locations are not available.

In addition to the Westinghouse property, a number of other privately owned parcels exist within the perimeter of the airport property as defined by the following roads: Gennessee Street, Cayuga Road, Wherle Drive, Aero Drive, and Holtz Road. The examination of future facility requirements has shown that several areas of the airport will soon be experiencing space constraints. It is therefore recommended that the airport acquire these parcels as they become available in order that the recommended use areas identified in this master plan can be further developed. Lands in the eastern quadrant of the airport will be particularly important, as the pending Westinghouse acquisition makes possible the development of a unified area for airport uses.

In addition to providing sufficient land for required airport operations, FAA guidelines provide for a number of extended areas in which airports need to exercise various levels of control. These areas have been designated in order to provide for the safety of both aircraft pilots and passengers, and the general public. Various options exist by which the airport can exercise the level of control required to prevent incompatible development in these areas. One option is the enactment of specific provisions in the community's zoning code which prohibit certain uses, and set height restrictions for trees and structures in the vicinity of an airport. Another option is the purchase of avigation easements from the owners of affected property. These easements restrict the ways in which the owners (present and future) are permitted to use the property in order to ensure airport compatible development. Finally, the most effective means of ensuring the control and compatible use of impacted property is for the airport to purchase it in fee simple.

These impacted areas range from the Runway Safety Area (RSA) and Runway Object Free Area (OFA) immediately surrounding the runways, to the land underlying the various airspace areas and the flight paths aircraft must use during takeoff and landing. These areas, described above in Section 4.2, can extend for thousands of feet beyond the runway, and include both airport and privately owned property. The precise location of these areas is dependent upon the orientation of the airport's runways, the level of operations expected to occur on those runways, and the particular navigational aids that are or will be installed. As the preferred alternatives are identified, recommendations will be made as to the preferred means of ensuring airport compatible use of the impacted areas.

Presently the airport owns property under the Runway Protection Zones (RPZ) beyond both Runway 5 and 23 ends. The Runway 23 approach end is completely owned by the airport with the exception of the New York State Thruway, and a triangular portion north of the Thruway on which the airport owns an avigation easement. The RPZ at the southwest end of Runway 5-23 overlies an existing urbanized area, and the airport owns only a portion of this property. That land was acquired in the 1960s when the introduction of jet aircraft made some property acquisition necessary. The airport property roughly follows the extended center line of Runway 5-23, and also serves as the site of the airport's approach lighting system (MALSR). The airport presently owns no easements on the remaining portions of this land. The RPZs at either end of Runway 14-32 lie mostly on airport property within the perimeter roads, with the exception of the Westinghouse property, which is expected to be acquired soon. The airport neither owns property nor easements under areas of those RPZs which lie beyond the perimeter roads.

To improve the safety of airport operations, acquisition of either fee simple title or avigation easements to land underlying the RPZs of all active airport runways is recommended.

4.4 Facility Requirements Summary

Table 4.18 summarizes the facility requirements identified above by estimated year of need and functional area.

Table 4.18 Airside and Landside Facility Requirements Summary

Item	Existing Facility	Facility Requirements			
		Current	2005	2010	2020
Airside Facilities					
Runway 5-23					
Length (ft.)	8,102	8,102	8,102	8,102	8,102
Width (ft.)	150	150	150	150	150
Strength (1,000 lb .)	195 dual/ 450 tandem	195 dual/ 450 tandem	195 dual/ 450 tandem	195 dual/ 450 tandem	195 dual/ 450 tandem
Runway 14-32					
Length (ft.)	5,373	7,000	7,000	7,000	7,000
Width (ft.)	150	150	150	150	150
Strength (1,000 lb.)	150 dual / 240 tandem	150 dual / 240 tandem	150 dual / 240 tandem	150 dual / 240 tandem	150 dual / 240 tandem
Airline Taxiways			High Speed Exits		
General Aviation Taxiways		Improve Taxiway P2			
		Improve Intersection P/Q			
				Construct Taxiway K	
Air Cargo Taxiways		Improve Taxiway M			
Landside Requirements					
Terminal Square Footage*	314,062	267-314,000	290-338,000	290-338,000	321-404,000
Terminal Gates*	17	17	28	30	33
Terminal Parking (Spaces)*	2,300	2,100	3,500	4,000	4,700
Air Cargo					
Apron (sq. yd.)	86,000	71,400	93,700	93,700	111,100
Buildings (sq. ft.)	206,250	206,250	291,250	291,250	291,250
GA Hangar Space (sq. ft.)	35,400	59,300	68,400	74,400	83,300
GA Apron (sq. yd.)					
Based Aircraft Parking	-	600	600	600	300
Transient Aircraft Parking	-	28,000	29,000	30,000	32,000
Staging & Maneuvering	-	6,600	7,600	8,300	9,300
Deicing	7,000	7,000	7,000	7,000	7,000
Total	31,000	42,200	43,700	45,700	49,000
Fuel Storage (gal.)					
Jet A *	675,000	571,000	699,000	753,000	825,000
AVGAS	42,000	54,000	54,000	54,000	54,000
Control Building (sq. ft.)	2,350	3,500	4,000	4,000	4,000
Airfield Maintenance					
Structures (sq. ft.)	45,000	65,000	65,000	65,000	65,000
Land Area (acres)	5	10	10	10	10
GSE Maintenance (sq. ft.)	9,600	20,000	20,000	30,000	30,000
Aircraft Maintenance	15,000	30,000	30,000	30,000	30,000
De-Icing					
Radiant Heat	GA (1)	GA (1) Airline (1)	GA (1) Airline (1)	GA (1) Airline (1)	GA (1) Airline (2)
Glycol Containment	Airline Apron	Airline Apron Snow Pad	Airline & Cargo Aprons Snow Pad		
ARFF		Additional storage and equipment bays			
GA Parking (spaces)	100	188	193	196	205

* Based on low fare carrier projections