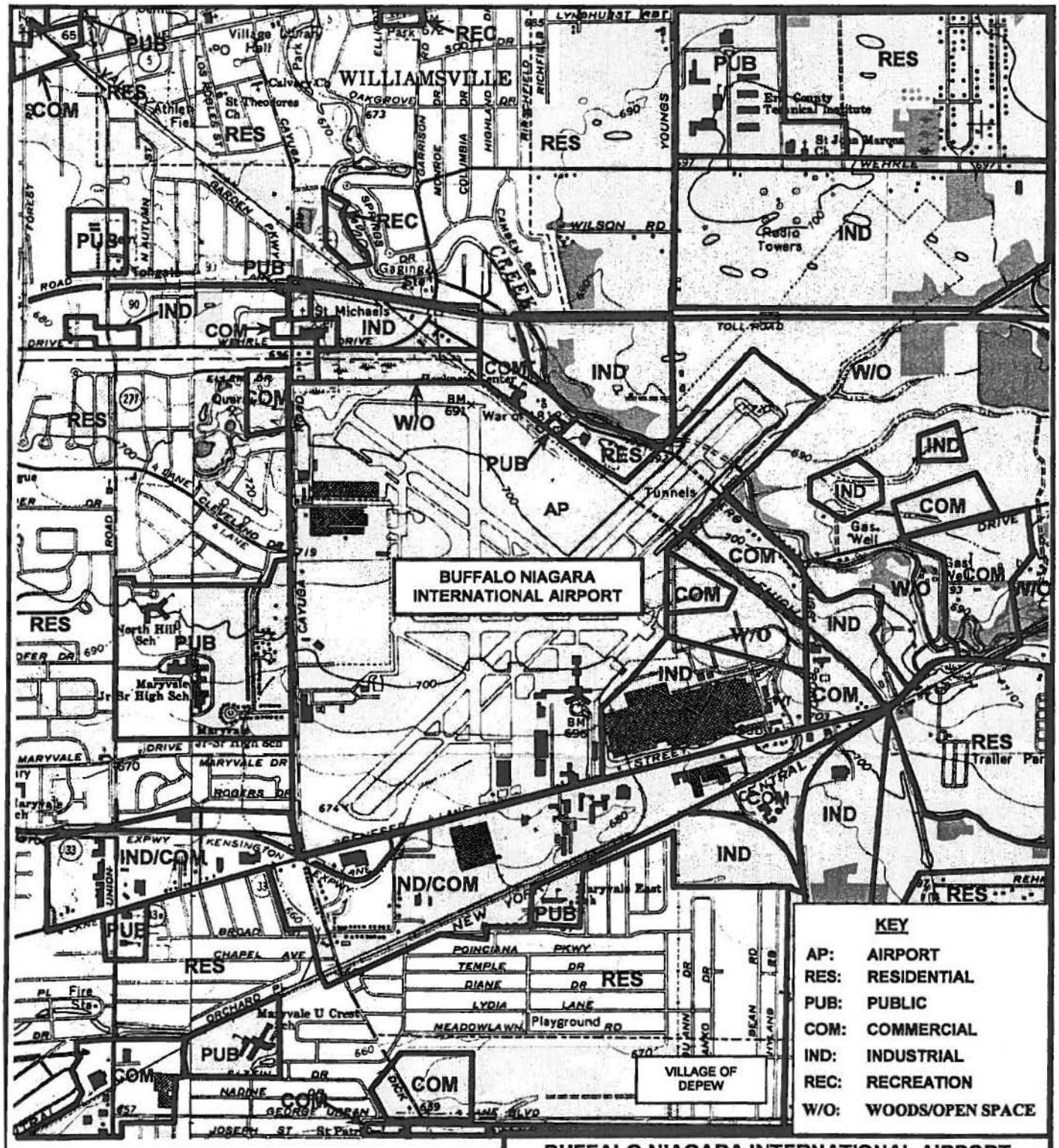


SCALE

0 2000 4000

FEET

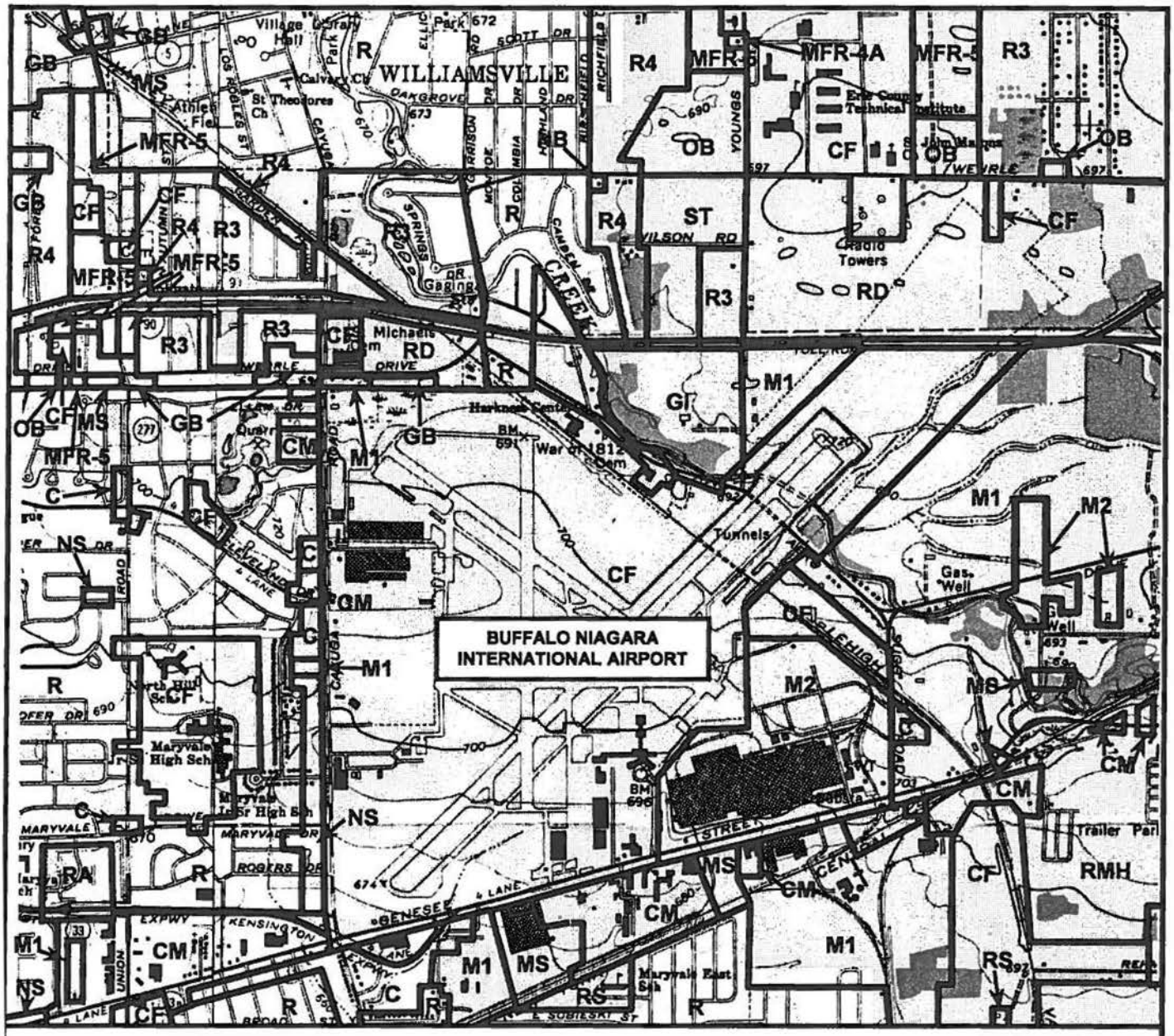
BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

LAND USE MAP

SCALE: AS SHOWN	DATE: 6/98	FIGURE: 2.8

McFarland-Johnson, Inc.

BUFFALO NIAGARA INTERNATIONAL AIRPORT



KEY

C:	RETAIL BUSINESS DISTRICT	MFR-4A:	MULTI-FAMILY RESIDENTIAL DISTRICT FOUR A	R3:	RESIDENTIAL DISTRICT THREE
CF:	COMMUNITY FACILITIES DISTRICT	MFR-5:	MULTI-FAMILY RESIDENTIAL DISTRICT FIVE	R4:	RESIDENTIAL DISTRICT FOUR
CM:	GENERAL COMMERCIAL DISTRICT	MS:	MOTOR SERVICE DISTRICT	RA:	APARTMENT DISTRICT
GB:	GENERAL BUSINESS DISTRICT	NB:	NEIGHBORHOOD BUSINESS DISTRICT	RD:	RESEARCH DEVELOPMENT DISTRICT
GI:	GENERAL INDUSTRIAL DISTRICT	NS:	NEIGHBORHOOD SERVICES DISTRICT	RMH:	RESIDENTIAL MOBILE HOME DISTRICT
M1:	LIGHT MANUFACTURING DISTRICT	OB:	OFFICE BUILDING DISTRICT	RS:	RESIDENTIAL SINGLE DISTRICT
M2:	GENERAL MANUFACTURING DISTRICT	R:	RESIDENTIAL DISTRICT	ST:	SCIENE TECHNOLOGY DISTRICT

SCALE

0 2000 4000

FEET

BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

ZONING MAP

SCALE: AS SHOWN	DATE: 6/98	FIGURE: 2.9

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BUFFALO NIAGARA INTERNATIONAL AIRPORT

To the west of the airport, on Union Road, is the Maryvale School Campus. Along Aero Drive there are a few scattered residences and a small cemetery, which borders the airport property. Bordering the airport to the north is the Town of Amherst. The areas of Amherst near the airport include a mixture of residential, light industrial, and commercial zones.

2.6.2 Zoning

Zoning regulations for the Town of Cheektowaga are contained in the *Zoning Law of the Town of Cheektowaga (January 1997)*. The Town's ordinance contains specific height regulations for the BNIA vicinity. According to the official zoning map BNIA is located in the Community Facilities District (CF) (See Figure 2.8). Permitted uses in the CF District include:

- Cemeteries
- Colleges, universities, technical and theological schools
- Government structures and land uses
- Human health-care institutions providing in-patient care
- Not-for-Profit institutions providing care and protection of persons
- Wildlife reservations or conservation projects, including related structures.

2.7 Socioeconomic Base

Buffalo is in the midst of a modest economic revival, with construction and renovation of area transportation facilities, the recent construction of a new downtown sports arena, development of an inner harbor plan, and continued expansion of the Amherst/Tonawanda Corridor. After experiencing steep declines in manufacturing employment during the 1970's and 1980's, the area economy has shifted to a greater reliance on service-related jobs.

Recently, the NFTA has opened a new $157 million airport terminal building and parking structure. In the downtown Buffalo area, construction has been completed on the Marine Midland Arena, a $120 million sports and entertainment complex that seats 20,000 people and is home to professional sports teams such as the Sabres, Blizzard, and Bandits. This development, combined with other infrastructure changes is transforming the lower Main Street area into a major commercial and recreational area. Ongoing or planned transit improvements have focused on bus replacement ($24.6 million), rail modernization ($74.4 million) and other infrastructure improvements. Many of these improvements are designed to attract new jobs and residents to the area.

For this study, economic trends and socioeconomic factors are one source of forecasting aviation transportation demand. These factors have been shown in numerous studies sponsored by the Federal Aviation Administration (FAA) to be related to an area's demand for aviation facilities and services. Among the most significant are trends in population, income, and employment. This section of the inventory identifies each of these factors and presents historical statistics and trends for the years 1980-1995 (the most current available statistics) for the Buffalo Niagara Falls Metropolitan Statistical Area (MSA).

2.7.1 Population

Analysis and projection of population are the basis for almost all major planning decisions. In many instances, they determine the level of demand for future facilities and serve as indices of most county and urban characteristics. Further, they have typically served as one of the best indicators of local aviation demand. Historical population, when compared to aviation demand statistics, has shown high correlation in many areas of the country. Until population growth or decline is compared to aviation demand statistics in the Buffalo area, it is uncertain whether or not population can be used as a prediction variable in the forecasting process.

Table 2.9 presents historical population statistics for the Buffalo Niagara Falls MSA. As shown in the table, overall population growth for the MSA has been negative since 1980, decreasing until a slight recovery in the 1988-1992 period. The 1993-1995 timeframe again showed negative growth. Population for the MSA declined from a high of 1,241,300 in 1980 to a low of 1,179,800 in 1987. Population for 1995 was only slightly higher at 1,182,000.

For the future, population is expected to grow to 1,278,000 - a total of 8.1 percent by the year 2020, or 0.31 percent per year. This slow growth represents a turnaround from recent history in the region, and is supported by the current and forecast economic trends that are revitalizing the Buffalo area.

2.7.2 Income

Similar to population, an area's income and economic activity has been shown to be positively correlated to the demand for aviation services and facilities in many parts of the country. Further, there is an assumed causal relationship between concentrated economic activity and demand for air transportation.

Income statistics commonly include Total Personal Income (TPI) and Per Capita Personal Income (PCPI). For aviation demand forecasting purposes, PCPI is the preferred statistic since it removes the population growth factor from the income growth factor. Thus, PCPI statistics for the Buffalo MSA were collected for the inventory. Table 2.8 presents a summary of Buffalo MSA PCPI levels in constant 1987 dollars for the 1980-1995 period. Real PCPI growth (without the effects of inflation) for the MSA increased 22.1 percent between 1980 and 1995. On a relative scale, estimates for 1995 showed Buffalo's PCPI at $16,849, which was only 2.4 percent less than the national average of $17,259.

For the future, it is estimated that PCPI will grow 23.1 percent overall (or 0.83 percent annually). This growth is only 2.5 percent less than the US growth during the same period (25.6 percent). In essence, the Buffalo region is forecast to keep pace with the national economy.

2.7.3 Employment

Employment statistics are another measure of economic activity and thus are related to the demand for air transportation facilities and services. Historical employment statistics

Table 2.9 – BUFFALO NIAGARA FALLS MSA SOCIOECONOMIC STATISTICS[1]			
Year	**Population**	**Employment**	**Income (PCPI)[2]**
1980	1,241,300	587,295	$13,802
1981	1,232,700	579,833	$13,795
1982	1,223,600	558,355	$13,710
1983	1,210,400	548,590	$13,913
1984	1,197,500	566,943	$14,799
1985	1,191,900	579,810	$15,105
1986	1,184,600	592,278	$15,572
1987	1,179,800	599,034	$15,658
1988	1,181,200	616,371	$15,969
1989	1,186,000	631,625	$16,054
1990	1,190,100	637,300	$16,084
1991	1,191,400	629,867	$15,848
1992	1,192,300	630,595	$15,901
1993	1,191,900	630,388	$15,898
1994	1,187,800	638,475	$16,469
1995	1,182,000	644,147	$16,849
Percent Change	-5.0%	+9.7%	+22.1%
Forecast			
2000	1,209,300	661,500	$17,206
2005	1,226,500	669,100	$18,205
2010	1,243,700	676,800	$19,119
2020	1,278,000	692,000	$20,689

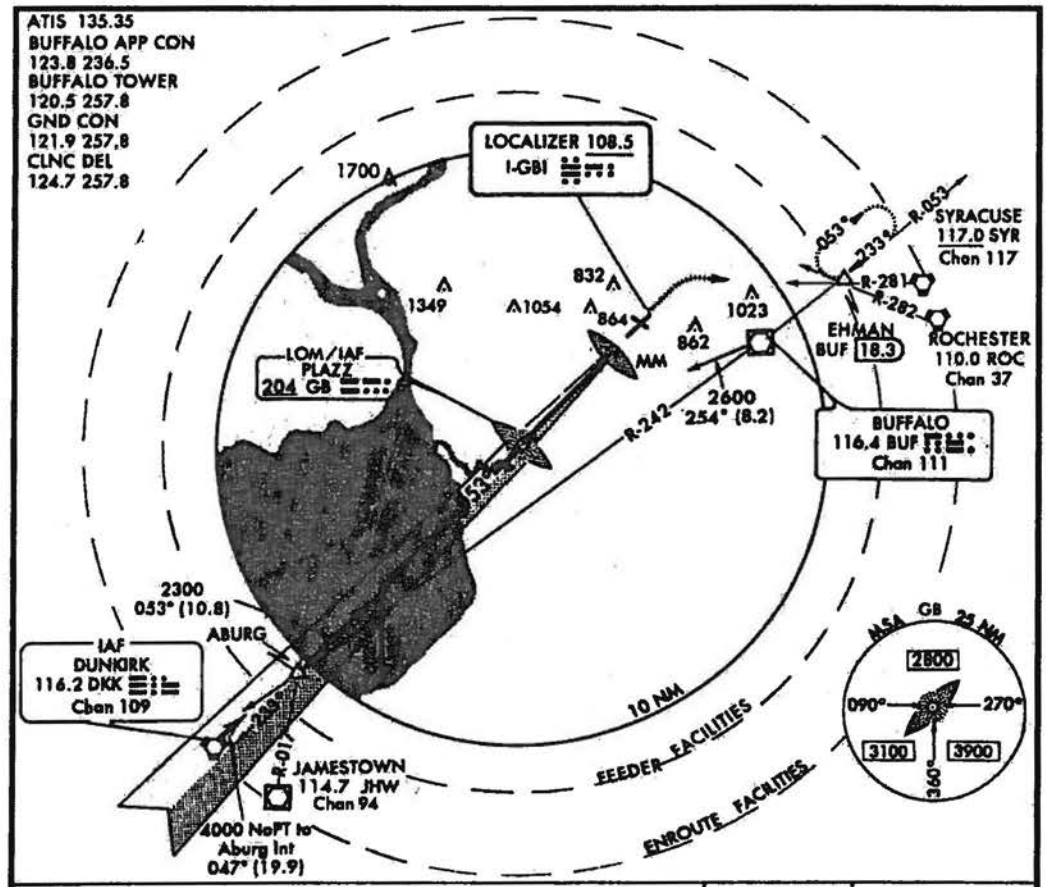
1 Source: History - U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, August 1997. Forecast Population and Employment from Niagara Frontier Transportation Committee, **Phase 2 Economic/Demographic Overview Study**, September, 1997.

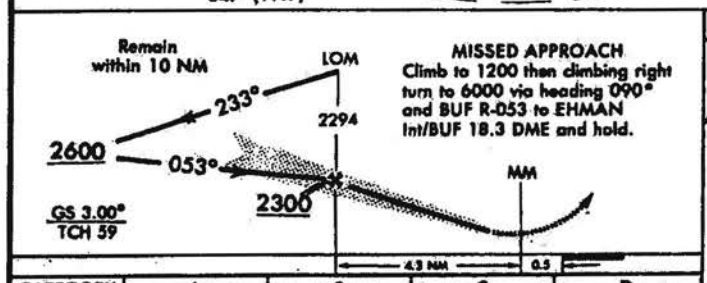
2 For PCPI, historical numbers were converted to 1987 dollars using U.S. Department of Commerce Personal Consumption Price Deflators, 1980-1995; for the forecast, Total Personal Income was converted to PCPI using forecast population numbers.

for the Buffalo MSA are presented in Table 2.9. Employment figures are given by place of work, rather than by place of residence.

As mentioned previously, the employment base in the Buffalo Niagara MSA has been in a state of transition since the early 1970's with the loss of significant numbers of manufacturing jobs. During the 26 year period between 1969 and 1995, Manufacturing jobs were cut almost in half, (from 180,300 to 94,100) while at the same time, jobs in the Services sector have more than doubled (from 91,800 to 201,500). This major shift in employment in the region has not been without its difficulties. However, the region is emerging from this change with renewed economic activity as growth is still focused on the four major economic sectors: Services, Retail Trade, Manufacturing, and Government.

As shown in Table 2.9, the region reflected the downturn in the economy with a decrease in employment between 1980 and 1984. A rebound between 1985 and 1990 was followed by another decline in the early 1990's. Current projections show modest growth of employment in the region through the long term as improvements in the local economy continue. Forecasts show that almost 48,000 new jobs will be created between 1995 and the year 2020 in the Buffalo region. This growth translates into an overall total of 7.4 percent, which is 0.7 percent less than population growth during the same period.



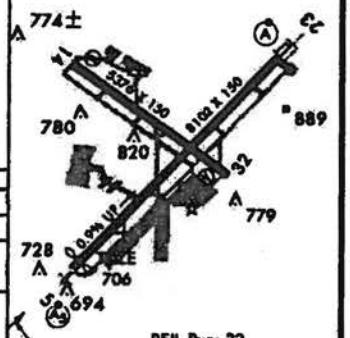


MISSED APPROACH
Climb to 1200 then climbing right turn to 6000 via heading 090° and BUF R-053 to EHMAN Int/BUF 18.3 DME and hold.

CATEGORY	A	B	C	D
S-ILS 5	906/18 200 (200-¾)			
S-LOC 5	1100/24 394 (400-½)			1100/40 394 (400-½)
CIRCLING	1220-1 496 (500-1)		1220-1½ 496 (500-1½)	1280-2 556 (600-2)

Cat D S-LOC visibility increased to RVR 5000 for inoperative MM.

ELEV 724
Rwy 5 ldg 7767'



053° 4.8 NM from FAF

REIL Rwy 32
TDZ/CL Rwys 5 and 23
MIRL Rwy 14-32
HIRL Rwy 5-23

FAF to MAP 4.8 NM					
Knots	60	90	120	150	180
Min:Sec	4:48	3:12	2:24	1:55	1:36

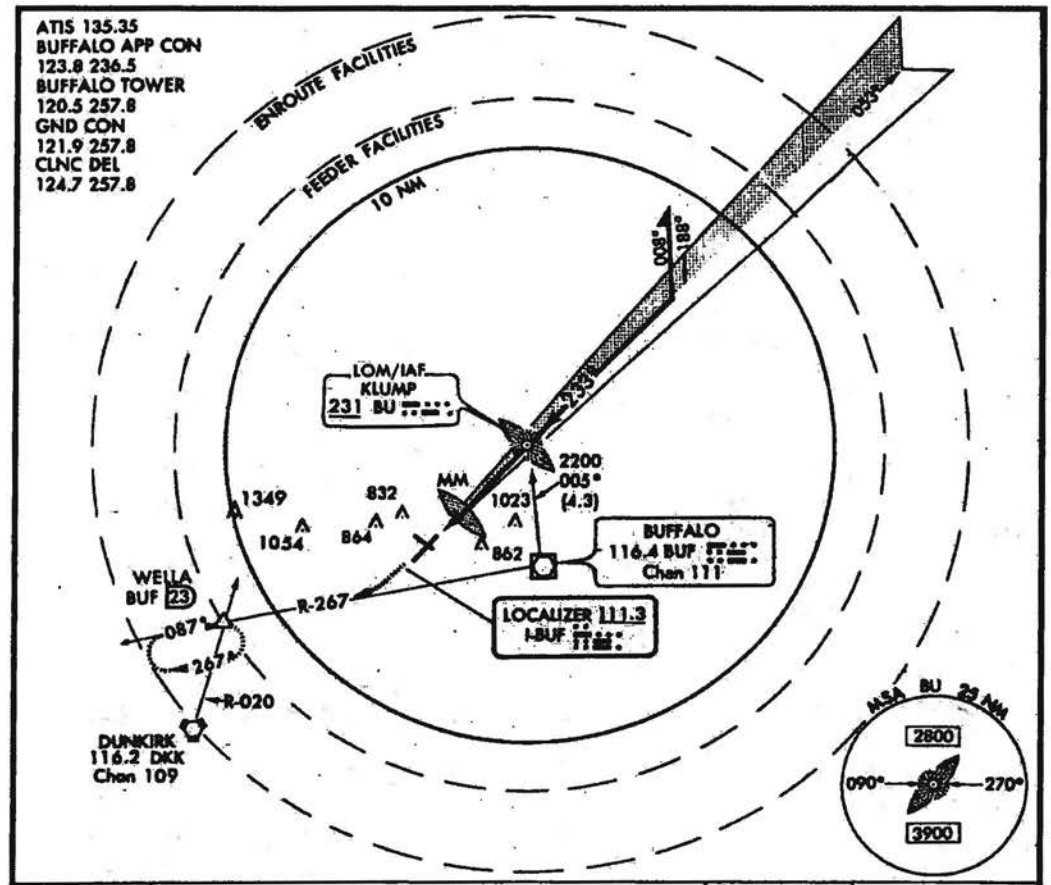
BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

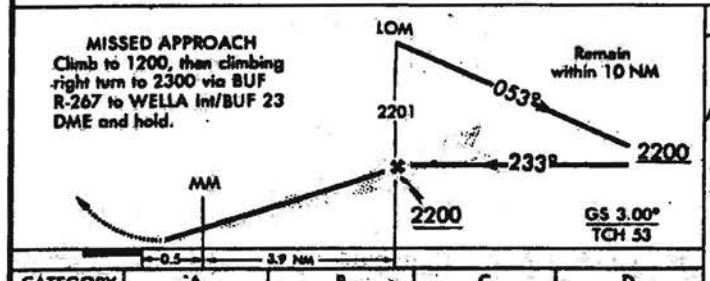
ILS RUNWAY 5

SCALE: N/A	DATE: 6/98	FIGURE: 2.10

McFarland-Johnson, Inc.

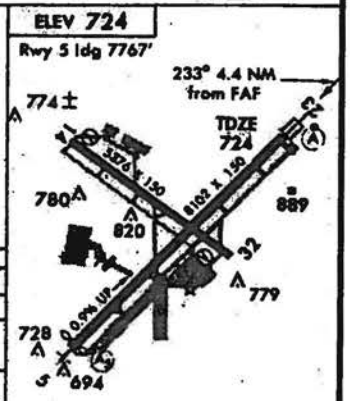
BUFFALO NIAGARA INTERNATIONAL AIRPORT





CATEGORY	A	B	C	D
S-ILS 23	924/18 200 (200-¾)			
S-LOC 23	1060/24 336 (400-½)			1060/40 336 (400-¾)
CIRCLING	1220-1 496 (500-1)		1220-1½ 496 (500-1½)	1280-2 556 (600-2)

Cat. D S-LOC RVR 5000 for inoperative MM or ALS.



FAF to MAP 4.4 NM					
Knots	60	90	120	150	180
Min:Sec	4:24	2:56	2:12	1:46	1:28

BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

ILS RUNWAY 23

SCALE: N/A	DATE: 6/98	FIGURE: 2.11

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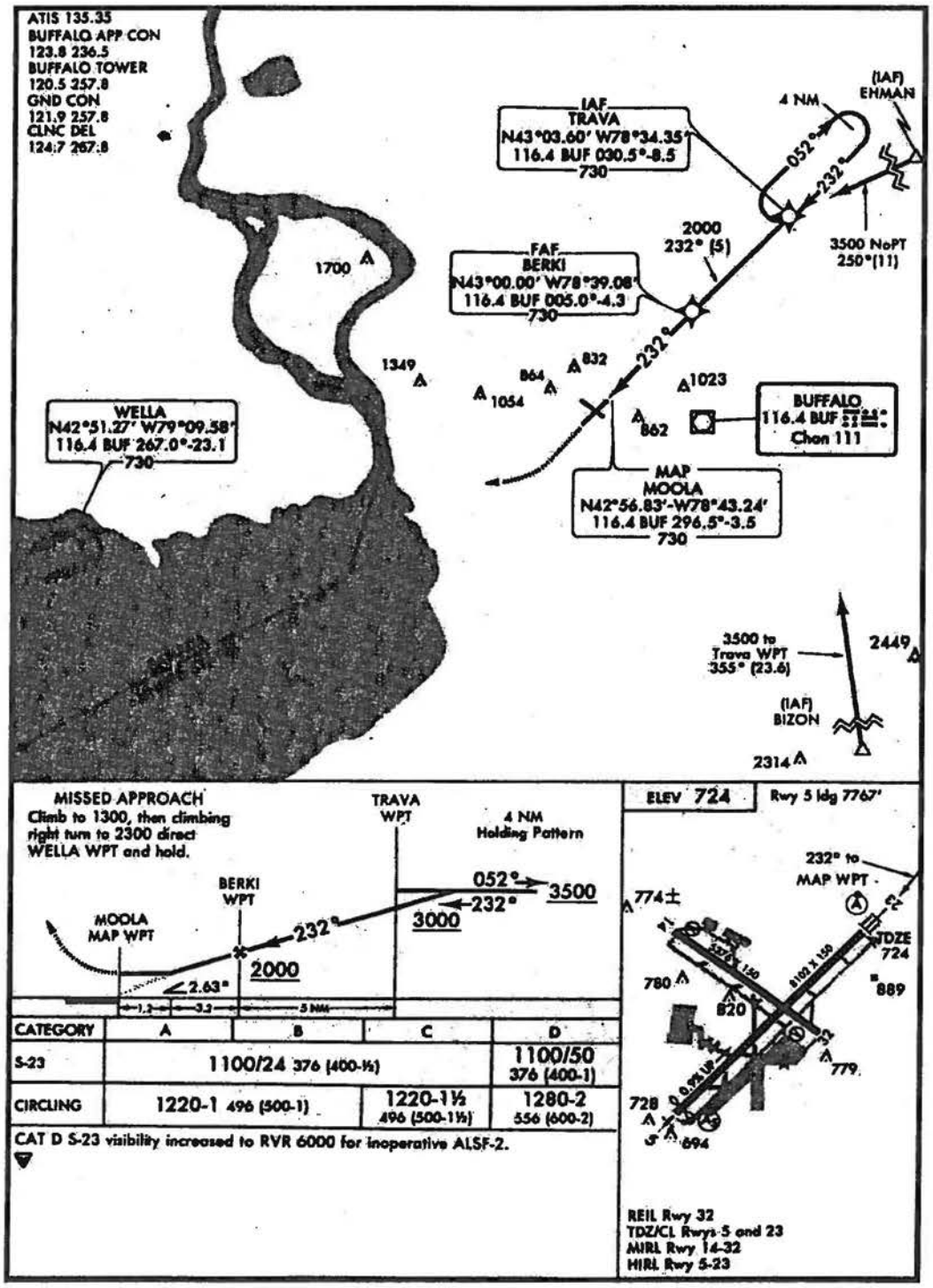
BUFFALO NIAGARA INTERNATIONAL AIRPORT



CATEGORY	A	B	C	D
S-23	1100/24 376 (400-½)			1100/50 376 (400-1)
CIRCLING	1220-1 496 (500-1)		1220-1½ 496 (500-1½)	1280-2 556 (600-2)

CAT D S-23 visibility increased to RVR 6000 for inoperative ALSF-2.

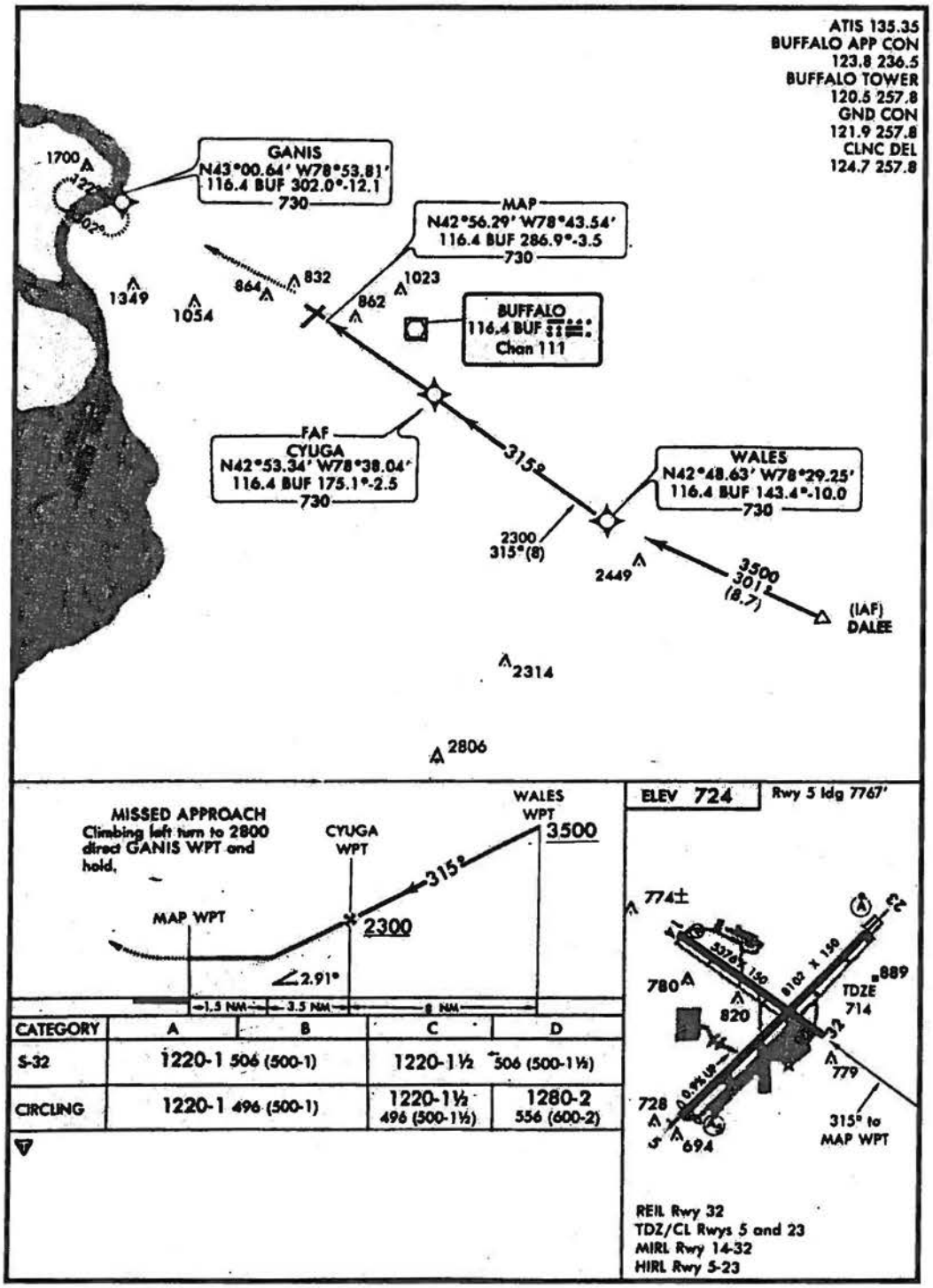
BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

VOR/DME RNAV OR GPS RUNWAY 23

SCALE: N/A	DATE: 6/98	FIGURE: 2.12

McFarland-Johnson, Inc.

BUFFALO NIAGARA INTERNATIONAL AIRPORT



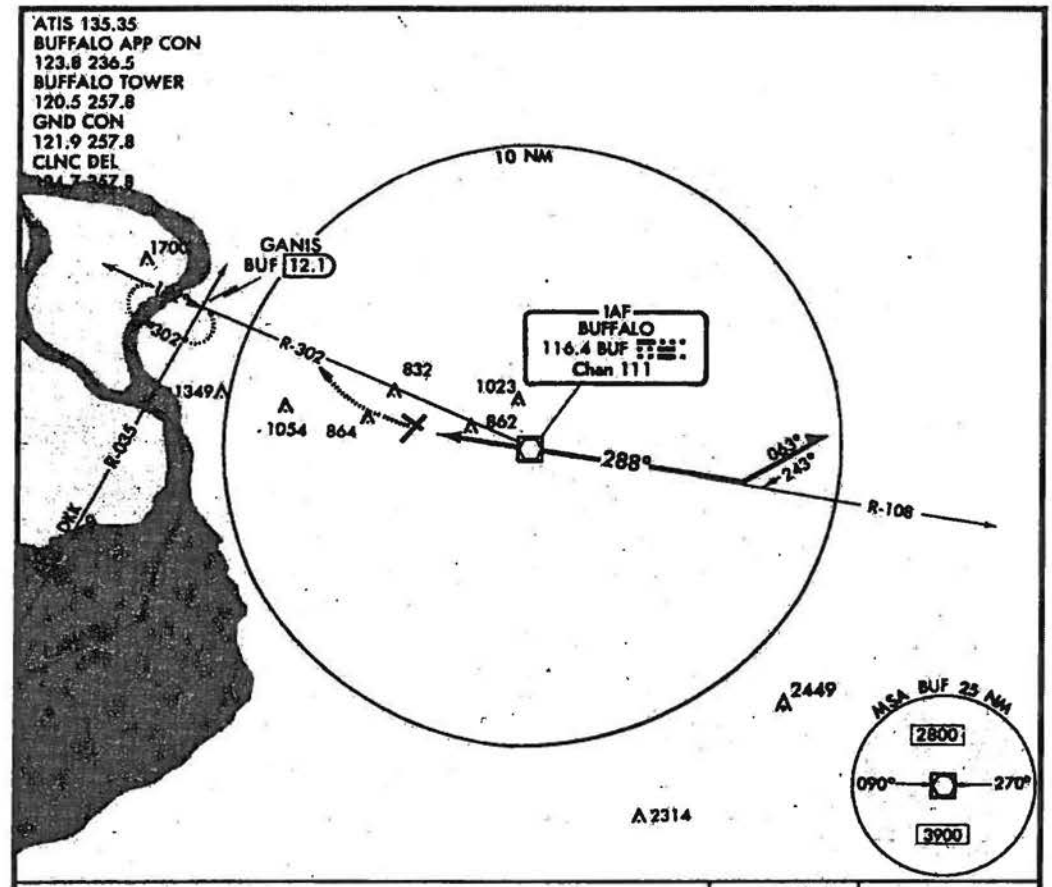
BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

VOR/DME RNAV OR GPS RUNWAY 32

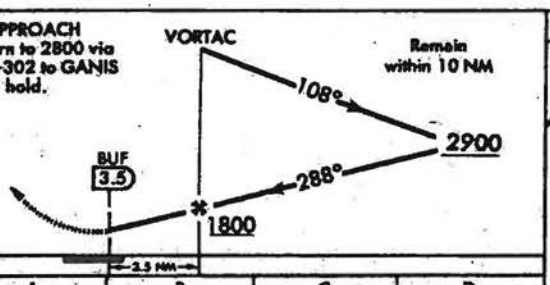
SCALE: N/A	DATE: 6/98	FIGURE: 2.13

McFarland-Johnson, Inc.

BUFFALO NIAGARA INTERNATIONAL AIRPORT

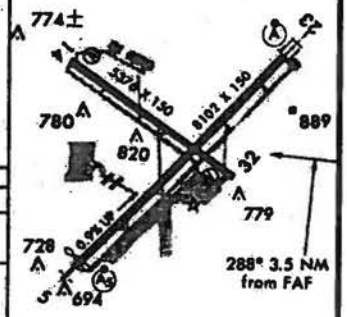


MISSED APPROACH
Climbing right turn to 2800 via BUF VOR/DME R-302 to GANIS Int/BUF 12.1 and hold.



CATEGORY	A	B	C	D
CIRCLING	1220-1 496 (500-1)		1220-1½ 496 (500-1½)	1280-2 556 (600-2)

ELEV 724
Rwy 5 ldg 7767'



REIL Rwy 32
TDZ/CL Rwys 5 and 23
MIRL Rwy 14-32
HIRL Rwy 5-23

FAF to MAP 3.5 NM					
Knots	60	90	120	150	180
Min:Sec	3:30	2:20	1:45	1:24	1:10

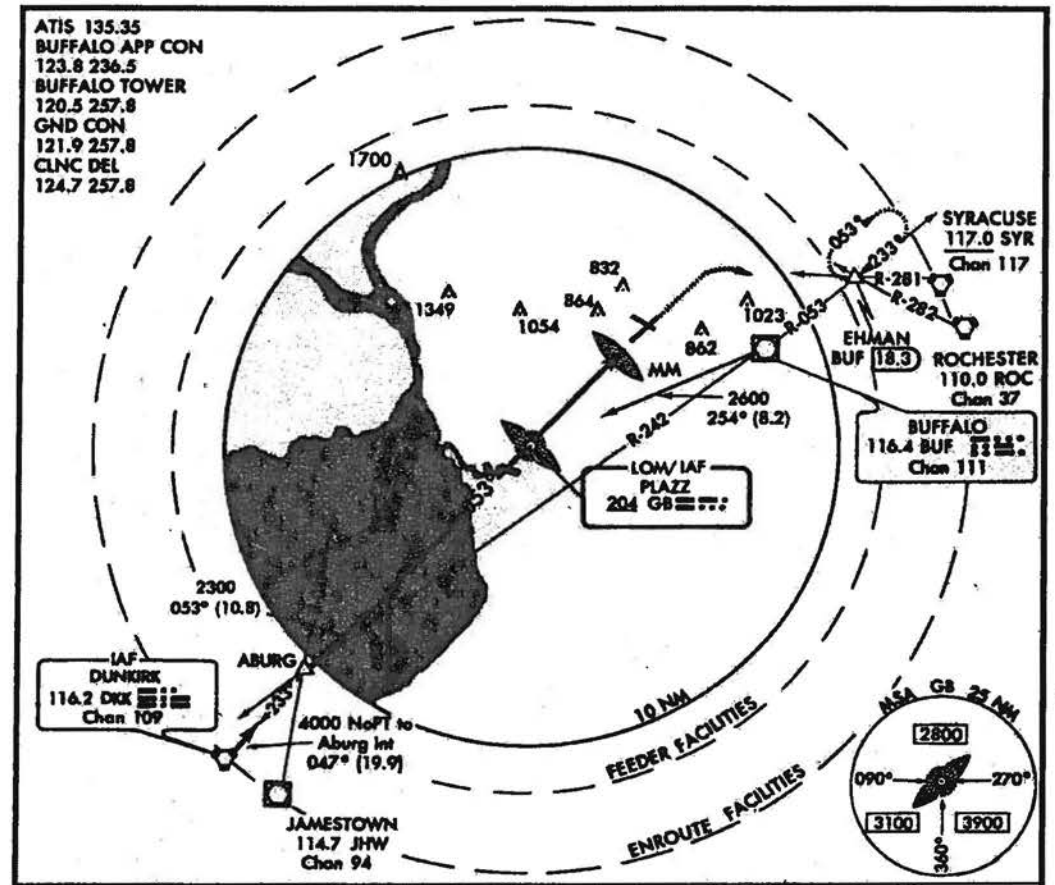
BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

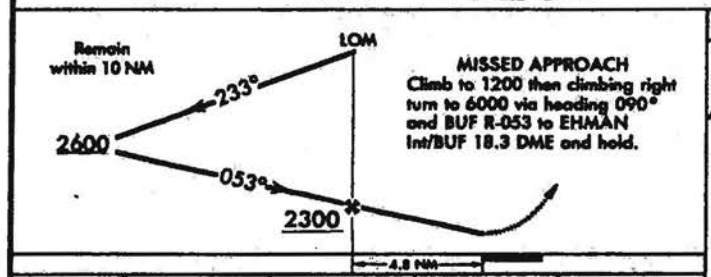
VOR OR GPS-A

SCALE: N/A	DATE: 6/98	FIGURE: 2.14

McFarland-Johnson, Inc.

BUFFALO NIAGARA INTERNATIONAL AIRPORT

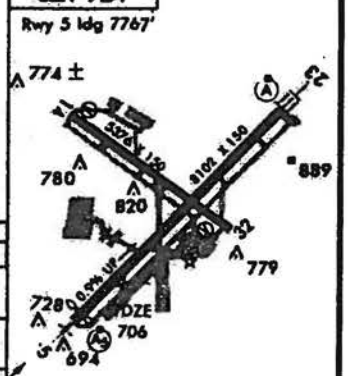




MISSED APPROACH
Climb to 1200 then climbing right turn to 6000 via heading 090° and BUF R-053 to EHMAN Int/BUF 18.3 DME and hold.

CATEGORY	A	B	C	D
S-5	1220/40 514 (500-¾)		1220/50 514 (500-1)	1220-1½ 514 (500-1½)
CIRCLING	1220-1 496 (500-1)		1220-1½ 496 (500-1½)	1280-2 556 (600-2)

ELEV 724
Rwy 5 ldg 7767'



REIL Rwy 32
TDZ/CL Rwys 5 and 23
MIRL Rwy 14-32
HIRL Rwy 5-23

FAF to MAP 4.8 NM					
Knots	60	90	120	150	180
Min:Sec	4:48	3:12	2:24	1:55	1:36

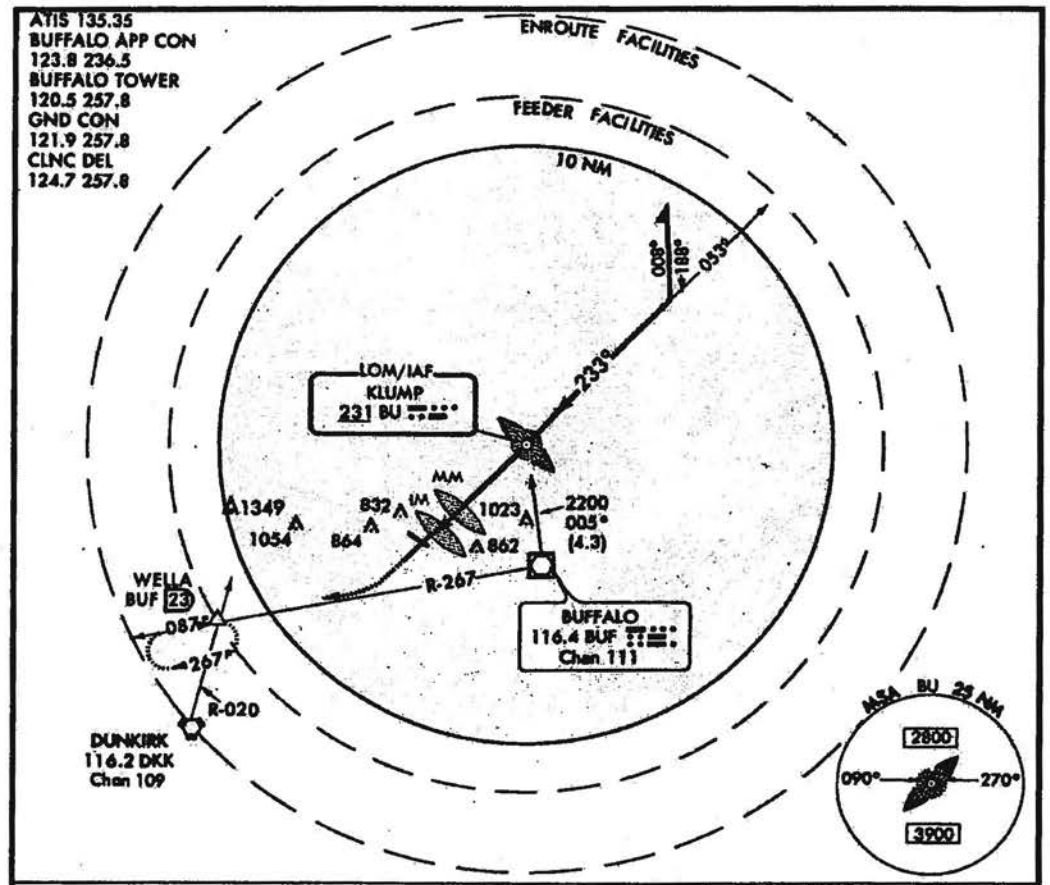
BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

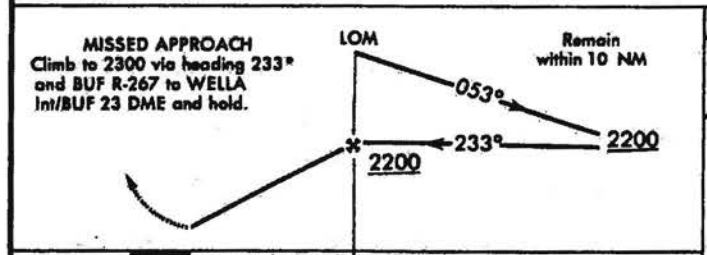
NDB OR GPS RUNWAY 5

SCALE: N/A	DATE: 6/98	FIGURE: 2.15

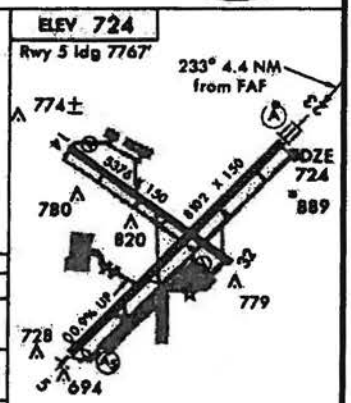
McFarland-Johnson, Inc.

BUFFALO NIAGARA INTERNATIONAL AIRPORT





CATEGORY	A	B	C	D
S-23	1180/40 456 (500-¾)			1180/60 456 (500-1¼)
CIRCLING	1220-1 496 (500-1)		1220-1½ 496 (500-1½)	1280-2 556 (600-2)



FAF to MAP 4.4 NM					
Knots	60	90	120	150	180
Min:Sec	4:24	2:56	2:12	1:46	1:28

BUFFALO NIAGARA INTERNATIONAL AIRPORT
ERIE COUNTY, NEW YORK

NDB RUNWAY 23

SCALE: N/A	DATE: 6/98	FIGURE: 2.16

McFarland-Johnson, Inc.

BUFFALO NIAGARA INTERNATIONAL AIRPORT

AVIATION FORECASTS

3.0 AVIATION DEMAND FORECASTS

Forecasts of aviation demand are a key element in all airport planning. Demand forecasts, based upon the desires and needs of the service area, provide a basis for determining the type, size, and timing of aviation facility development and are a platform upon which this master planning study will be based. Consequently, these forecasts influence virtually all phases of the planning process. Major sections of this chapter include:

- Purpose
- Aviation Demand Elements
- Forecast Framework
- Approach
- Aviation Demand Forecasts
- Aviation Demand Forecast Summary: Status Quo Scenario
- Comparisons With Other Forecasts

3.1 Purpose

The aviation demand forecasts will serve four purposes in the development of this master plan. Specifically, they provide the basis for:

- Determining the necessary capacity of the airfield, passenger terminal area, general aviation area, and ground access system serving the airport.
- Determining the airport's future facility size and type of expansion needed.
- Evaluating potential environmental effects of alternative airport development layouts.
- Evaluating the financial feasibility of alternative airport development scenarios.

3.2 Aviation Demand Elements

Forecasts of aviation demand can be developed for numerous elements. In the case of Buffalo-Niagara International Airport, the key demand elements focus on scheduled airline passenger traffic and operations and general aviation descriptors such as based aircraft and operations. Other important elements are derived from these basic indicators. For this study aviation activity forecasts were prepared for:

- ***Airline Passenger Enplanements:*** Defined as air travelers who have boarded departing airline aircraft.
  - Total Annual
  - Peak Hour

- ***Airline Aircraft Operations:*** This type of operation is either a takeoff or a landing of an airline aircraft. A takeoff and landing are two operations.
  - Total Annual
  - Fleet Mix
  - Peak Hour

- ***Registered Aircraft:*** Defined as being either fixed or rotary wing aircraft, operated in non-airline service with a current registration.

- ***Based Aircraft:*** Defined as a general aviation aircraft which is stationed at an airport on a permanent basis.
  - Based Aircraft Fleet Mix

- ***General Aviation Enplaned Passengers:*** Defined as air travelers who have boarded departing general aviation aircraft.

- ***General Aviation Aircraft Operations:*** This type of operation is either a takeoff or a landing of a general aviation aircraft.
  - Total Annual
  - Local Versus Itinerant
  - Fleet Mix
  - Peak Hour

- ***Military Aircraft Operations:*** This type of operation is either a takeoff or a landing of a military aircraft.

- ***Instrument Approaches:*** This type of operation is recorded only during Instrument Meteorological Conditions (IMC) by aircraft completing the Instrument Flight Rules approach procedures.

3.3 Forecast Framework

Development of a forecast framework will result in the identification of an "outlook" for the future of aviation in Buffalo. This outlook incorporates aviation industry trends, economic outlook, local airline perspectives, the impact of low fares, and Buffalo's historical aviation activity growth. The outlook will influence the way in which the projected aviation activity is interpreted for forecasting purposes. Each of the topics discussed below are important in the development of a forecast outlook for Buffalo.

3.3.1 Aviation Industry Trends

Because air transportation involves a system there are, by definition, numerous components. Buffalo-Niagara International aviation activity is influenced by local and national trends that sometimes have little to do with what is going on directly in Buffalo. For this reason, a knowledge of what is shaping the aviation demand landscape in the United States is important. This section examines both the commercial aviation sector and the general aviation sector.

Commercial Aviation Sector

Changes in the airline industry continue to occur rapidly and have the potential to impact forecasts of aviation demand at Buffalo. With the majority of airline consolidations completed, the number of major/national airlines has dwindled to the point where mergers will only

occur mostly for international market share penetration. There may still be large, mega-mergers, such as those reported between Northwest/Continental, or American/USAirways, but those are speculative at best. Presently, the domestic airline market is concerned with three primary phenomena:

- Low-fare carriers
- Airline cost-cutting/downsizing
- Regional jet airplanes

Low-Fare Carriers

The FAA has documented that benefits to American consumers by low-fare airlines has reached $6.3 billion annually.[1] Southwest Airlines has led the way in developing low cost, low-fare airline service that has consistently been rated highest in on-time performance and customer satisfaction. The "Southwest Model" has been used successfully and unsuccessfully by numerous start-up carriers. More recently, major airlines such as United, Delta, and USAirways have moved to create low-fare airlines within their own airlines to compete directly against the low-fare threat of Southwest and similar airlines. United's West Coast shuttle service, Delta's Delta Express, and USAirway's MetroJet are all designed to compete in the low-fare market. Key to their success is the ability to operate in the 7.5 cent/available-seat-mile range.

With the expansion of these major airlines (all of which serve Buffalo) into the low-fare market, the "threat" of Southwest Airlines serving Buffalo could set off a price war that would result in much higher than anticipated forecast numbers of passengers for the Airport. In each city where Southwest Airlines has recently expanded service, there has been an immediate and severe growth in passengers (Louisville, Baltimore, Providence, etc.). Table 3-1 presents examples of before/after growth associated with the initiation of service by Southwest Airlines.

Currently, AirTran Airlines, a low-fare carrier, serves BNIA. The Airline represents a merger between Valujet and AirTran Airways. AirTran Airways provides service to Orlando and in April, 1998, AirTran began service to Atlanta for $88 one-way. Delta has matched that price and it is sure to stimulate air travel in that market.

The overall impact of low fares in Buffalo market will be to increase the number of annual passengers. The effects of low fares have been documented in Buffalo in 1994 when Continental introduced CALite (a low-fare airline within Continental Airlines). In that year, enplanements jumped by 200,000. When CALite was scrapped the following year, enplanements dropped by 250,000.

1 **FAA Aviation Forecasts,** Fiscal Years 1998-2009. (Washington, DC: US Department of Transportation, Federal Aviation Administration, FAA-APO-98-1, March, 1998) p. III-18.

Table 3-1 - Enplanement Comparison of Before and After Arrival of Southwest Airlines

AIRPORT	BEFORE SWA YEAR/ENPLANEMENTS	WITH SWA YEAR/ENPLANEMENTS	% GROWTH	US % GROWTH FOR SAME PERIOD
Baltimore, MD	1992/ 4,011,100	1997/ 6,705,300	67.2%	24.2%
Birmingham, AL	1986/ 912,000	1997/ 1,585,100	73.8%	46.8%
Cleveland, OH	1991/ 3,864,700	1997/ 5,602,700	45.0%	29.4%
Columbus, OH	1991/ 1,645,100	1997/ 3,468,000	110.8%	29.4%
Indianapolis, IN	1988/ 2,633,500	1997/ 3,544,400	34.6%	32.6%
Louisville, KY	1992/ 1,043,300	1997/ 1,907,500	82.8%	24.2%
Providence, RI	1995/ 1,083,997	1997/ 2,036,648	87.9%	8.7%

Given the explosive growth associated with low-fare carriers, one of the forecast scenarios must deal with the possibility that a significant service segment in Buffalo be made up of low-fare airline activity.

Airline Cost-Cutting/Downsizing

The response to low-fare carriers by other airlines is to impose cost-cutting measures. Many high-cost carriers are restructuring in an attempt to reduce their unit costs to the levels achieved by the most efficient airlines. The restructuring has included route realignments, reducing service or withdrawing from unprofitable hubs, seeking work rule changes and wage concessions, purchasing more efficient aircraft, and increasing productivity.[2]

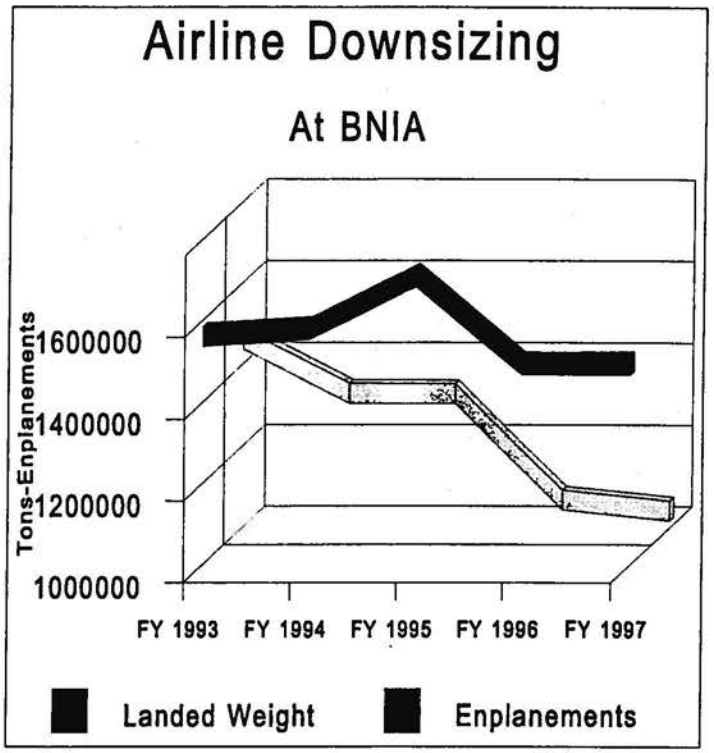
The main impact of airline cost-cutting to Buffalo has been route realignments or reductions in service with some major airlines. In many of these cases, replacement service is offered by Regional carriers using smaller aircraft equipment. The loss of jet service on low density routes and replacement with turboprop aircraft has not been viewed by consumers favorably. The impact of this in Buffalo is that the landed weights at BNIA have continued to drop even as enplanements grow or remain level. An example of this phenomenon is presented in Figure 3.1.

2 FAA Aviation Forecasts, Fiscal Years 1998-2009 (Washington DC: US Department of Transportation, Federal Aviation Administration Office of Policy and Plans, March, 1998) p. III-18.

Regional Jet Airplanes[3]

Regional Jets or RJ's cover a number of different aircraft types. In generic terms, a regional jet includes any turbo-fan powered airplane seating 100 or fewer passengers. The first wave of these aircraft seat between 50-88 passengers, while orders are being taken for 32 and 37 seat versions. A secondary characteristic is that these planes have mostly been operated by feeder airlines rather than the major carriers.

Figure 3.1 – AIRLINE DOWNSIZING



RJ's are used in five primary roles:

- *Large Jet Replacement* - Carriers that cannot profitably operate larger 100+ seat aircraft in multiple daily nonstop frequencies may offer these routes to their affiliates to operate with RJ's.

- *Off-peak Scheduling* - RJ's can be used in scheduling off-peak periods of the day or week as appropriate to the smaller size of the aircraft.

- *Hub Extension* - RJ's provide significantly longer range capability relative to turboprop aircraft and can serve to comfortably extend the reach of low-density markets to a carrier's hub.

- *Turboprop Growth* - Some markets will outgrow 30-seat aircraft during peak periods. These markets are eligible for supplemental scheduling of RJ's.

- *Point-to-Point (Hub Bypass)* - There are some low density markets that will support point-to-point non-stop service with RJ's. Traditionally, these markets have been joined through spoke-and-hub routings.

Given the aviation industry's excitement with the RJ and its immediate acceptance by the traveling public, manufacturers are building the aircraft as fast as they can produce

[3] Material for this section from: "The Impact of Regional Jet Aircraft on the Development of American Air Service", by Douglas E. Abbey in **Handbook of Airline Marketing** (Aviation Week Group, A Division of the McGraw-Hill Companies, 1998) pp. 259-266.

them. There were more than 750 units either in service or on order in 1997. It is estimated that the number of RJ's in U.S. carrier service could surpass 1,000 units by the year 2001.

All of this movement to RJ aircraft will impact smaller hubs such as Buffalo. Lower density markets can be served with jet aircraft, which should be viewed positively by the traveling public. Whether demand is stimulated by such service is yet to be demonstrated in the Buffalo market. However, the forecasts of fleet mix will take the regional jet into account.

General Aviation Sector

The general aviation industry has undergone very broad and profound structural changes since 1978. During that year, a total of 17,811 aircraft units were sold. By 1996, only 1,093 units were sold. Even though the number of aircraft sold is only a fraction of the peak, the revenue per aircraft sold continues to increase from year to year. In 1996, revenues topped $3.1 billion. In the first three quarters of 1997, general aviation activity shipments totaled 954, an increase of 30.7 percent over the same period in 1996.

There is increased optimism in the entire general aviation industry. In January 1997, Cessna delivered their first new single-engine piston aircraft since 1986. Production of aircraft at Cessna was expected to be 1,000 units in 1997 and 2,000 in 1998. Piper announced plans to manufacture the Meridian, a single-engine turboprop scheduled for delivery in 2000. Overall, an increase of 4,000 new aircraft units is expected to be produced each year in the future in the U.S., replacing roughly 2,000 retired aircraft annually.

A significant indicator of the future of general aviation demand is the number of active pilots including the number of student pilots. Intuitively, as the active pilot pool increases or shrinks, the future demand for general aviation facilities and services will similarly increase or decrease.

By the end of 1997, the total pilot population was 616,340, which is 5,924 fewer than in 1996. The one area of optimism is the number of student pilots (96,101) which increased 1.3 percent in 1997. In addition, the number of airline transport pilots (130,858) was up 2.6 percent in 1997. It is anticipated that the industry programs sponsored by the General Aviation Manufacturing Association (GAMA), National Business Aviation Association (NBAA), Aircraft Owners and Pilots Association (AOPA), and the National Air Transportation Association (NATA), are working to increase the number of student pilots, thereby feeding the entire pilot population.

One upshot of these factors has been to cause FAA to increase the optimism of their general aviation forecasts. Many of these forecasts are used in producing forecasts for Buffalo, and thus, the national trends will impact the local forecasts in this master plan.

Key General Aviation Assumptions

From the above discussion of trends, there are several key assumptions about the future of general aviation demand specifically in Buffalo. They include the following:

- ***Aviation Activity:*** The growth in general aviation aircraft production and sales in the U.S. will result in increased operational activity nationally. In addition, the FAA's optimism over growth in the number of active pilots is another reason to anticipate some growth or turnaround in the general aviation activity trends. Spillover of this national growth will impact Buffalo to a certain degree. Local factors will impact this growth.

- ***Tower Counts:*** Discussions with the FAA control tower at BNIA indicated that there are as much as 10 percent of total operations recorded for the Airport are actually overflights or other aircraft activity. As a result, the forecasts for general aviation activity were decreased by 10 percent in the final forecast table.

- ***Local Factors:*** These factors include, but are not limited to, the general level of airfield capacity at the airport and the cost of landing at the facility. As activity levels reach capacity, more general aviation pilots will choose other local airports. Similarly, as prices associated with landing and other airport services at BNIA increase relative to other local airports, pilots will select alternative airports. The baseline forecasts will assume a constant cost level and will not impose capacity constraints. Later, in an alternative analysis, these factors may be adjusted to analyze different scenarios and the sensitivity of aviation demand to such factors.

3.4 Approach

The approach used in developing aviation demand forecasts for BNIA focused on two scenarios: the Status Quo, and the Low-fare Carrier. The Status Quo projections were based upon historical performance at BNIA and employed a variety of methods of forecasting. The results of these different methods were compared to see if "reasonable" or "consensus" projections of activity indicators emerged. Consideration of these factors, supplemented with survey information (where available) or interviews with aviation users, provided the basis for selecting a preferred projection. If more than one projection appeared valid, or if the true forecast was believed to fall between an upper and lower range, the selected or preferred forecast became an average of the projections.

For the Low-fare Carrier scenario, a comparative analysis was used that projected passenger enplanement growth at BNIA based upon similar situations at other airline airports along with the historical CALite experience at BNIA. These projections are speculative and would only be realized if a low-fare carrier began or expanded operations at BNIA. The Low-fare Carrier scenario projections are contained in Appendix 3A.

The results of the forecasts will be two distinct projections of demand. The Status Quo projection will represent a low range forecast of demand that assumes a continuation of historical trends. This conservative forecast will be used in developing financial projections and facility recommendations. The Low-fare Carrier projection, on the other hand, will be a high range forecast that will be significantly higher than previous trends in Buffalo. This high range forecast can be used for contingency planning to ensure that NFTA has plans for accommodating the higher level of activity that would accompany a low-fare carrier.

3.4.1 Status Quo Projection Forecasting Methods

The Status Quo Projection forecasting methods all employed traditional means of extrapolating historical aviation trends at the airport or in the airport service area into future time frames. For this projection method, the airport service area for both airline and general aviation demand has been defined as the Buffalo-Niagara Falls Metropolitan Statistical Area (MSA).

Forecasting techniques such as market share, socioeconomic regression, trend analysis, and survey analysis were used to project forecasts of demand. Each of these projection techniques are discussed below.

Market Share Projection

Market share projections are developed by calculating historical shares of aviation activity measures and projecting these respective shares into future time frames. This method of projection reflects demand based upon trends occurring in Western New York and the entire U.S. (Socioeconomic and per capita projections, on the other hand, are based upon local factors). Market share projections reflect historical trends and may include static (constant) or dynamic (increasing or decreasing) future market shares.

Socioeconomic Regression Analysis

The socioeconomic regression projection is based upon an assumed causal relationship between population, income, or employment and aviation activity in a particular area. To obtain this projection of demand, socioeconomic data are related via regression analysis to aviation activity. The resulting set of regression equations, coupled with independent projections of future socioeconomic data, produces a projection of aviation activity.

Socioeconomic variables collected for use in this study included population, income, and employment. Both historical and forecast variables were available for use in the forecasting model. Socioeconomic Regression Analysis was used in forecasting airline enplanements and general aviation registered aircraft. The R^2 statistics are used to gauge the significance of the regression. An R^2 of 0 means there is no statistical correlation between the passage of time and the growth or decline of enplanement activity. R^2 values near 1 indicate a significant relationship and trend. For this study, the threshold R^2 value accepted as reasonable was 0.64.

Trend Analysis

Trend projections use historical data to formulate predictions of future activity. For this study, two trend analysis methods were used to project baseline aviation activity - double exponential smoothing and least squares linear trending.

The double exponential smoothing process produces projections by combining the forecast for the previous period with an adjustment for past errors. It is desirable to correct for past

errors when the error results from changes in the trend. In this case, correcting for past errors will put the forecast back on track. Double exponential smoothing is appropriate when the time series contains a linear trend. It functions by calculating two smoothed series - a single and a double smoothed value. Both will lag behind any trend. However, the difference between them indicates the size of the trend. This difference is used to adjust the forecast for the trend.

The second trend method used was least squares linear trend. This method uses aviation activity regressed against time to produce a projection. No assumptions about the causes of trends are included in the trending methodology.

Survey Analysis

Surveys are perhaps the only method of projection having nearly universal application. In the absence of usable historical data, surveys can be developed that will indicate present and future levels of aviation demand. Several survey instruments were used in this forecasting effort, including interviews with airlines and other airport tenants, on-site observation, and polling data. The surveys and their results are discussed in detail in the inventory chapter (Chapter 2).

3.4.2 Low-fare Carrier Projection Forecasting Methods

The Low-fare Carrier Projection was based upon a comparative analysis of other cities' growth rates before and after the advent of low-fare service. Because Southwest Airlines is the largest of the low-fare carriers, cities that received their service were analyzed. It was reasoned that Southwest Airlines would likely create the largest demand scenario of any of the low-fare carriers and, for planning purposes, this would help put forth ultimate growth contingencies.

To project demand, the before and after growth rates of seven cities that received Southwest Airlines service were examined. From this base, an average growth percentage was estimated. It was noted that in cases like BWI and Providence, the larger metropolitan areas of Baltimore-Washington and Boston are being served, and thus there is a larger potential market; whereas Birmingham, Cleveland, Columbus, Indianapolis, and Louisville are themselves the metropolitan areas being served.

Key to Southwest Airlines success has been the willingness of passengers to drive as many as three and four hours to reach a Southwest Airlines service point. At BNIA the Canadian market would figure prominently in any planned service by an airline such as Southwest. In this regard, it is estimated that the Canadian population within 2 hours drive of BNIA is 3.5 million. This extended service area is a normal drive for Southwest Airlines users, as would be the drive from the Rochester area and the Southern Tier, New York, area. In essence, the advent of a low-fare carrier such as Southwest Airlines pushes the market boundaries far beyond the Buffalo-Niagara Falls MSA. Large portions of western and southern New York State, along with portions of Canada reaching to Toronto, would become available to the Buffalo market. The Low-fare Carrier forecasts are contained in Appendix 3A.

3.5 Aviation Demand Forecasts

Aviation demand forecasts were developed for all of the demand elements listed earlie: in the Aviation Demand Elements section. As such the following major components are addressed:

- Status Quo Airline Demand Forecasts
- Air Cargo Demand Forecasts
- General Aviation Demand Forecasts
- Military Aircraft Operations
- Aviation Demand Forecast Summary: Status Quo Scenario
- Comparisons With Other Forecasts

3.5.1 Status Quo Airline Demand Forecasts

The Status Quo forecasts of airline demand for Buffalo-Niagara International Airport focus on enplanements as the driving force for all of the other components of airline demand. Thus, if the number of annual and peak hour enplanement forecasts is realistic, all of the other portions of demand should be reasonable, as well. Components of the airline forecast include:

- Airline Passenger Enplanements
  - Total Annual
  - Peak Hour
- Airline Aircraft Operations
  - Total Annual
  - Fleet Mix
  - Peak Hour

Airline Enplanement Forecast

Because of its importance in the overall master planning process, the Status Quo Projection of airline enplanements used several different means of projecting airline enplanements to see if consistent trends evolved. Methods used in the forecasting process included:

- Market Share
- Socioeconomic Regression
- Trend Analysis

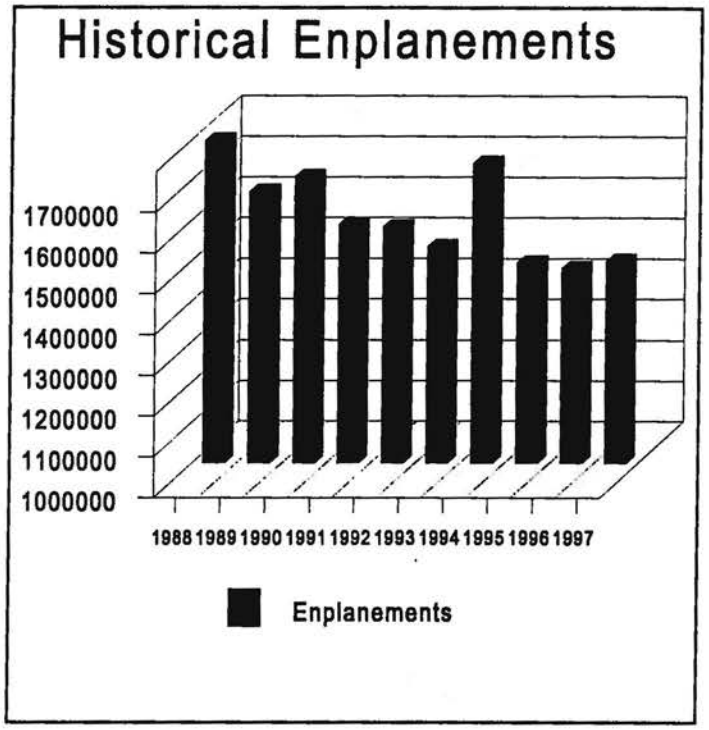
In selecting a preferred Status Quo Projection, results of the appropriate survey efforts were used as inputs to help establish reasonableness.

Figure 3-2 shows the historical trend of passenger enplanements at Buffalo-Niagara International Airport since 1988. Remarkable is the 1994 jump in enplanements that was related to Continental's CALite operation in Buffalo. The increase of 200,000 or more passengers over the previous year was attributable to the low fares offered by CALite.

Market Share Projections

The market share projection examined historical enplanements at Buffalo-Niagara International Airport and compared these numbers to the United States enplanement totals. This comparison revealed that the enplanement market share at Buffalo-Niagara International has generally declined as a percent of total U.S. enplanements, since the mid-1980s. This trend indicates that enplanement growth at Buffalo-Niagara International has not kept pace with other parts of the nation. Factors creating this slow growth, such as air service quality and price, the local business climate, etc., are not considered in the market share forecasting method - only the trends for historical market share. Other causative factors are considered in subsequent projection methods.

Figure 3.2 – HISTORICAL ENPLANEMENTS



To obtain a forecast, projected market shares were applied to the Federal Aviation Administration's (FAA) latest forecast of total U.S. enplanements. Both static and dynamic market shares were evaluated. The static market share was calculated based upon the last year of available data carried forward into future time frames. The dynamic share was estimated using a trended projection of market share for the 20-year forecast period. Table 3-2 presents the market share projections of airline enplanement demand for Buffalo-Niagara International Airport.

Socioeconomic Regression Projections

A total of three socioeconomic regression projections were developed for Buffalo-Niagara International Airport. These projections are used to correlate causative factors and their growth, to the growth of airline enplanements. The socioeconomic regressions used population, employment, and income statistics from the airline passenger service area as defined previously. The socioeconomic statistics were regressed against airline enplanements and projections were made based upon the resulting regression equations. Table 3-2 presents the socioeconomic regression projections of airline enplanements for Buffalo-Niagara International. Also presented are the regression R^2 values for each projection.

Trend Projections

Trend projections use historical enplanement data to formulate predictions of future activity. For this study, two trend analysis methods were used to project airline enplanement activity - double exponential smoothing and least squares linear trending. As discussed previously, trend

projections use statistical methods to extrapolate projections. Table 3-2 presents a summary of trend projections of enplanements and resulting statistics.

Selection of Preferred Enplanement Forecast

Table 3-2 presents a summary of all of the projections of airline enplanement demand at Buffalo-Niagara International Airport. As shown, there is a wide range in the projection numbers. To select a preferred forecast, a systematic process that incorporated statistical methods with intuitive judgment was used. The analytical method first examined the equational statistics for each projection. In this regard, the R^2 statistic (minimum of 0.64) was used for the socioeconomic regression equations and Theil's U (maximum of 1.15) was used for the exponential smoothing trend equation.

Table 3-2 - Forecast of BNIA Enplanements

PROJECTION/FORECAST	1997	2005	2010	2020	R SQUARED OR (THEIL'S U)
MARKET SHARE					
Constant	1,496,931	2,008,300	2,384,200	3,105,500	
Dynamic	1,496,931	1,691,200	1,857,200	1,961,400	
SOCIO-ECONOMIC					
Population	1,496,931	1,577,800	1,546,400	1,483,900	0.10
Employment	1,496,931	1,559,800	1,550,500	1,532,300	0.15
Income	1,496,931	1,589,600	1,575,600	1,551,500	0.03
TREND ANALYSIS					
Linear Trend	1,496,931	1,517,900	1,483,700	1,415,300	
Exp. Smoothing	1,496,931	1,273,300	1,141,000	876,300	(1.015)
"REASONABLE" FORECASTS					
High/Low Average	1,496,931	1,763,100	1,934,000	2,260,400	
Multi-Average	1,496,931	1,739,100	1,908,400	2,160,700	
PREFERRED FORECAST	1,496,931	1,739,100	1,908,400	2,160,700	

From a statistical standpoint, none of the socioeconomic regression projections had R^2 statistics greater than 0.15. The Exponential Smoothing Trend declined by almost 42 percent and cannot be considered reasonable. This left the market share projections and the least squares trend line as reasonable projections of potential demand.

To select a preferred forecast, two projections were created from the pool of "reasonable" projections (i.e., of the market share projections and the least squares trend line). The first "hybrid" projection was an average of the high and low reasonable projections. This projection was a mid-range estimate of enplanement demand. Because there were three viable projections, an average of all was taken to create a second "hybrid" forecast of enplanement demand. This method (multi-average) reduced the influence of a single high or low projection if the other two projections were in the opposite direction.

The preferred enplanement forecast is presented in Table 3-2. For Buffalo-Niagara International, it was determined that the Multi-Average Projection was best suited to the Status Quo scenario of airline passenger demand. This forecast selects a middle-road growth trend for the future that is slightly lower than the High/Low Average. As shown, airline enplanements are anticipated to grow from 1,496,931 in 1997 to 2,160,700 by the year 2020 - a modest 44 percent overall growth (1.6 percent annually).

Major/Regional Carrier Split of Enplanements

In forecasting airline demand, it was important to project the split between Major (including National) carrier enplanements and Regional carrier enplanements. This split can then be used to forecast airline operations by fleet type more easily. The projection of Major and Regional carrier enplanements was based upon historical trends and a knowledge of future U.S. growth of both of these segments of demand. In this regard, FAA forecasts show the Regional carrier demand is growing at a much higher rate than the Major carriers. Table 3-3 presents a summary of the allocation process, using historical data for the years 1988-1997 and the previously selected enplanement forecasts as control totals for each forecast year.

Table 3-3 - Split Between Major/National Enplanements and Regional Carrier Enplanements

Year	Major/National Enplanements	Percent Share	Regional Enplanements	Percent Share	BNIA Enplanement Totals
1988	1,768,205	98.6%	24,907	1.4%	1,793,112
1989	1,613,725	96.8%	53,408	3.2%	1,667,133
1990	1,592,640	93.5%	111,056	6.5%	1,703,696
1991	1,516,644	95.6%	69,869	4.4%	1,586,513
1992	1,455,684	92.1%	124,291	7.9%	1,579,975
1993	1,361,381	88.9%	170,319	11.1%	1,531,700
1994	1,598,538	92.0%	138,388	8.0%	1,736,926
1995	1,300,389	87.1%	192,076	12.9%	1,492,465
1996	1,270,474	85.9%	208,286	14.1%	1,478,760
1997	1,289,581	86.1%	207,350	13.9%	1,496,931
FORECAST					
2005	1,452,100	83.5%	287,000	16.5%	1,739,100
2010	1,545,800	81.0%	362,600	19.0%	1,908,400
2020	1,674,500	77.5%	486,200	22.5%	2,160,700

Airline Aircraft Operations Forecast

A forecast of airline operations is required to assess the adequacy of the terminal and airfield system throughout the planning period and to help determine the financial impact and the environmental effects associated with future air traffic levels.

For the purposes of this forecast, annual airline aircraft operations were further subdivided into categories for major/national airlines and regional airlines. Table 3-4 presents the historical level of airline operations, including the split between major/national airlines and regional airlines. As shown, there has been significant growth in the regional airline operations component over the last 10 years. Also included in Table 3-4 is a ratio called enplanements per departure.

Table 3-4 - Split Between Major/National Carrier Operations and Regional Carrier Operations

Year	Major/National Enplanements	Major/National Operations	Enplanements /Departure	Regional Enplanements	Regional Operations	Enplanements / Departure
1988	1,768,205	**60,955**	58.0	24,907	**4,435**	11.2
1989	1,613,725	**57,672**	56.0	53,408	**7,281**	14.7
1990	1,592,640	**56,017**	56.9	111,056	**16,597**	13.4
1991	1,516,644	**54,182**	56.0	69,869	**14,969**	9.3
1992	1,455,684	**53,425**	54.5	124,291	**21,656**	11.5
1993	1,361,381	**47,020**	57.9	170,319	**27,838**	12.2
1994	1,598,538	**48,131**	66.4	138,388	**19,870**	13.9
1995	1,300,389	**39,346**	66.1	192,076	**27,496**	14.0
1996	1,270,474	**37,057**	68.6	208,286	**27,491**	15.2
1997	1,289,581	**36,112**	71.4	207,350	**26,221**	15.8
FORECAST*						
2005	1,452,100	**38,300**	75.8	287,000	**30,400**	18.9
2010	1,545,800	**39,400**	78.5	362,600	**32,200**	22.5
2020	1,674,500	**39,900**	84.0	486,200	**38,300**	25.4

* Forecast operations rounded to the nearest 100.

The forecast of annual airline operations, each operation consisting of one takeoff or landing, was derived from the forecast of annual enplaned passengers for each respective component of airline demand. The methodology used consisted of the following steps:

- Determine the historical ratio of enplaned passengers to airline departures for both the major/national carriers and the regional carriers ((enplanements/operations) times 2);
- Project changes in the enplaned passengers per departure ratio for the planning period for each component of demand;
- Apply the projected enplaned passengers per departure ratios to the forecasts of annual enplaned passengers to calculate airline operations, ((enplanements/enplanements per departure) times 2).

The key component of the forecast, therefore, is the projection of a reasonable enplanement per departure ratio. In this regard, the historical record provides insight into the long-term trends at Buffalo-Niagara International Airport. In this regard, the number of enplanements/departure has grown rapidly for both the major/national airlines and for the commuter airlines. This growth is reflective of a number of concurrent trends including:

- The move of major airlines to let their regional affiliates serve the less dense markets.
- The move of regional airlines to take this challenge and increase their available seats by purchasing larger aircraft, including regional jets.

Thus, the major and national carriers are optimizing the use of their aircraft equipment in the denser markets, which tends to increase the enplanements/departure ratio. At the same time, the regional airlines are increasing the average number of available seats per departure by purchasing regional jets and larger commuter aircraft. This tends to increase the number of enplanements/departure on the regional carriers, even if load factors remain the same.

For the future, it was assumed that the enplanements per departure ratio would continue to grow at Buffalo-Niagara International Airport. The rate of growth differed by airline category. For example, it is believed that the major/national carrier growth in enplanements per departure would begin to slow somewhat after the initial transition of routes to their affiliates has been implemented. The aircraft fleet mix forecast for the majors/nationals is expected to grow slowly in the Buffalo market (this forecast is presented later), so long-term movement in the enplanements/departure ratio was roughly one-third the growth rate of the immediate past ten years. Forecasts of this ratio show growth from 71.4 in 1997 to 84.0 by the year 2020.

For the regional carriers, the aircraft fleet mix is anticipated to grow in terms of average aircraft size and available seats. This growth, combined with new markets will result in a growth of the enplanements/departure ratio somewhat faster than the growth rate of the immediate past ten years. Forecasts of this ratio show a growth from 15.8 in 1997 to 25.4 by the year 2020.

As shown in the forecast, the number of regional airline operations at Buffalo-Niagara International Airport will approach the number of major/national airline operations by the year 2020. In 1997, the ratio was 58 percent major/national and 42 percent regional carrier. Total airline operations at the Airport are anticipated to grow from a 1997 level of 62,333 to a year 2020 level of 78,200 - a 25.4 percent growth over the period. This level reflects the fact that airlines serving Buffalo-Niagara International will continue to match the size of the individual markets to the appropriate aircraft size. In particular, the regional carriers will likely increase the number of markets served, and in so doing, increase the frequency of service, pushing the overall number of operations upward.

Airline Fleet Mix

Related to the number of airline operations at BNIA is the size and make up of each airline's fleet serving the market. Forecasting the airline fleet mix permits planners to estimate the need for airport facilities in terms of runway length, strength, and terminal building requirements.

Table 3-5 presents a summary of scheduled annual airline aircraft operations by aircraft type for 1996 and 1997. As shown, the B-737-200 has been the aircraft of choice in the Buffalo market, operating roughly one-third of all airline flights. For the future, it is anticipated that some aircraft will be retired or taken out of service to Buffalo such as the B-727-200, the B-737-100, the DC-9-10/20, and the F-28. Increased utilization is anticipated for larger aircraft such as the B-757 (BNIA's critical aircraft for facility planning). Other increases are expected for the B-737 series (300's through the 800's). It should be noted that the forecasts of fleet mix are dependent upon airline decisions, fleet

purchases, and future market potentials.

The FAA's forecast for the average number of seats for the domestic airline fleet is anticipated to grow by about 1.3 percent per year, while the regional airline fleet itself is anticipated to grow at 2.2 percent per year. The average regional airline aircraft size has grown significantly over the past ten years and is anticipated to continue as aircraft such as the 50-seat Canadair and Embraer Regional Jets and 70-seat Canadair Regional Jets are introduced into the fleet. As mentioned, even with these growth trends, the replacement service by regional airlines of major/national routes will dampen the overall growth in the average number of seats per departure (a surrogate measure of aircraft fleet mix). The average number of seats per departure trends at BNIA include the following:

	Ave. Seats/Dep.
• 1997	81.8
• 2005	83.6
• 2010	85.5
• 2020	84.0

To understand the characteristics of the airline fleet mix at Buffalo-Niagara International Airport, two basic components must be recognized: 1) both the major/national airline fleets and the regional airline fleets are growing in the number of average available seats (larger aircraft); 2) even with this growth, regional airlines are expected to take over more routes from the larger airlines. The net result of this shift will cause the overall number of average seats per departure at BNIA to decline slightly during the long term planning period (from 85.5 to 84.0).

Peak Period Airline Activity

Airline activity is subject to peak period movements. Measures of this activity include peak hour operations and peak hour enplanements. These indicators are used by airport planners to estimate airfield layouts and terminal building and parking area size and configurations. Because airline operations are scheduled, it is easier to track peak period activity than similar measures for general aviation activity. Discussed below are the methods used to forecast peak period airline activity, along with the forecasts themselves.

Peak Hour Airline Operations

Airline peak hour operations are defined as the highest number of operations to occur during any one hour in any one calendar year. For this study, FAA Control Tower records were examined and it was determined that the consistent airline peak months for BNIA are July and

Table 3-5 - Airline Fleet Mix Forecast

		1996		1997		2005		2010		2020	
Aircraft	**Seats**	**Departure**	**Percent**	**Departure**	**Percent**	**Departure**	**Percent**	**Departure**	**Percent**	**Departure**	**Percent**
Majors/Nationals											
ATR-72	64	0	0.0%	36	0.2%	479	2.5%	610	3.1%	718	3.6%
B-757	182	0	0.0%	0	0.0%	594	3.1%	985	5.0%	1,296	6.5%
B-737-800	162	0	0.0%	0	0.0%	958	5.0%	1,575	8.0%	2,293	11.5%
B-737-500	110	408	2.2%	271	1.5%	1,245	6.5%	1,477	7.5%	2,013	10.1%
B-737-400	146	445	2.4%	343	1.9%	1,648	8.6%	1,792	9.1%	1,994	10.0%
B-737-300	128	2,501	13.5%	1,228	6.8%	2,241	11.7%	2,146	10.9%	2,691	13.5%
B-737-200	112	3,243	17.5%	6,645	36.8%	2,586	13.5%	2,855	14.5%	2,093	10.5%
B-737-100	95	4,354	23.5%	921	5.1%	613	3.2%	0	0.0%	0	0.0%
B-727-200	141	2,205	11.9%	2,329	12.9%	1,609	8.4%	985	5.0%	0	0.0%
BaE-146	85	0	0.0%	0	0.0%	575	3.0%	788	4.0%	1,156	5.8%
DC-9-30	102	2,446	13.2%	2,004	11.1%	2,337	12.2%	2,462	12.5%	2,213	11.1%
DC-9-10/20	83	19	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
F-100	95	1,019	5.5%	1,426	7.9%	1,111	5.8%	709	3.6%	319	1.6%
F-28	68	74	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
MD-88	140	1,816	9.8%	2,853	15.8%	3,161	16.5%	3,308	16.8%	3,150	15.8%
Totals		***18,529***	***100.0%***	***18,056***	***100.0%***	***19,157***	***100.0%***	***19,692***	***100.0%***	***19,935***	***100.0%***
Average Seats		***114.4***		***118.5***		***123.6***		***125.9***		***127.4***	
Regional/Commuter											
15-19 Seats	19	3,601	26.2%	2,989	22.8%	3,234	21.3%	2,675	16.6%	1,933	10.1%
20-40 Seats	34	9,773	71.1%	9,348	71.3%	9,961	65.6%	10,218	63.4%	11,772	61.5%
41-60 Seats	50	371	2.7%	774	5.9%	1,777	11.7%	2,143	13.3%	3,675	19.2%
61-80 Seats	70	0	0.0%	0	0.0%	213	1.4%	1,080	6.7%	1,761	9.2%
Totals		***13,746***	***100.0%***	***13,111***	***100.0%***	***15,185***	***100.0%***	***16,116***	***100.0%***	***19,142***	***100.0%***
Average Seats		***30.4***		***31.3***		***33.2***		***36.1***		***38.9***	
Airport Ave. Seats		**78.6**		**81.8**		**83.6**		**85.5**		**84.0**	

August. With this in mind, a data base was compiled of recent August airline schedules for Buffalo-Niagara International Airport. Table 3-6 presents the historical peak period airline activity indicators for the period 1994-1997.

To forecast the peak hour, the highest number of hourly arrivals and departures was divided by the total number of daily arrivals and departures. The resulting average was then applied to the average day of the peak month for the forecast period. Since 1994, the peak month has averaged 9.2 percent of the yearly total. During that same time, the peak hour percentage of average day (of the peak month) operations has averaged 9.9 percent. This relatively low percentage indicates that much of the airline activity at BNIA is spread throughout the day. To forecast the peak hour operations, the static peak hour percentage projection (9.9%) was applied to the forecast average day of the peak month to derive peak hour operations for future years. Table 3-6 presents the forecast of peak hour airline operations.

Table 3-6 - PEAK PERIOD AIRLINE ACTIVITY

Year	Peak Month Operations[1]	Average Day of Peak Month[2]	Peak Hour Operations
1994	6,670	196	21
1995	6,306	202	22
1996	6,257	193	18
1997	5,941	194	17
FORECAST			
2005	6,319	204	20
2010	6,588	213	21
2020	7,190	232	23

1 Historical peak month operations taken from FAA tower records.

2 Historical average day operations were estimated from the airline schedules. Future average day operations were estimated by dividing peak month operations by 31.

Peak Hour Airline Enplanements

Peak hour airline enplanements are defined as the peak number of enplanements during any one hour period in a calendar year. Estimating the peak hour in a non-survey method is relatively simple using inputs already generated by this forecasting methodology. Normally, peak hour departures times the peak number of enplanements per departure will yield peak hour enplanements. For this analysis, it was assumed that peak number of enplanements per departure was 20 percent greater than the average number of enplanements per departure. Mathematically the following relationship can be inferred:

Peak hour enplanements = (average enplanements per departure) times 1.2 times (peak hour departures)

At Buffalo-Niagara International Airport, the peak hour airline departures were divided between major/nationals and regional airlines (using the airline schedule), since there is a vast difference in the number of enplanements per departure between the two. The forecasts noted that departures tend to peak at the 6:00-8:00 am period and again at the 10:00-11:00 am period. These departure peaks do not correspond equally with the arrival peaks, which tend to favor the 9:00-10:00 pm and 9:00-10:00 am periods. These differences were taken into account in the forecast of peak hour departures shown in Table 3-7.

Table 3-7 shows the estimate of 1997 actual peak hour enplanements, based upon the airline schedule. For the forecast period, peak hour enplanements are anticipated to grow from 660 in 1997 to 1,120 by the year 2020 - a 70 percent increase over the period (2.3 percent per year).

Table 3-7 - Peak Hour Enplanement Forecast

YEAR	MAJOR/NATIONAL PEAK HOUR DEPARTURES	MAJOR/NATIONAL PEAK HOUR ENPLANEMENTS	REGIONAL PEAK HOUR DEPARTURES	REGIONAL PEAK HOUR ENPLANEMENTS	TOTAL PEAK HOUR ENPLANEMENTS
1997	6	562	5	98	660
FORECAST					
2005	7	637	5	113	750
2010	8	754	6	162	916
2020	9	907	7	213	1,120

3.5.2 Air Cargo Demand Forecasts

Buffalo-Niagara International Airport is served by all of the major air cargo carriers (FedEx, UPS, Airborne, Emery, and various cargo divisions of airlines) and a host of air freight forwarders. Air cargo carried by these airlines is categorized into three main components: air mail, express mail, and air freight. Both the air mail and express mail are U.S. Post Office categories, while air freight includes overnight small package delivery and bulk freight.

Enplaned Air Cargo Tonnage

Table 3-8 presents a fifteen-year history of air cargo activity at BNIA. As shown, the level of air cargo enplaned tonnage in 1985 was not surpassed until 1996. Observations about the historical levels of air cargo indicates that air freight has been the major share of activity at the airport. When air freight levels declined significantly in 1987, total air cargo at the airport reached the lowest level of the 15-year historical period. The rebound in air freight has meant the recovery in overall air cargo enplaned tonnage at the airport. Express mail, on the other hand has been somewhat hurt by the growth of the overnight air freight market. In this regard, 1983 was the high year for express mail and by 1997 it had not yet recovered to that level. Air mail growth has been relatively slow over the historical period, as year-to-year changes in enplaned tonnage range fluctuate between a high of about 6,230 tons and a low of about 4,030 tons.

Table 3-8 - Historical Air Cargo Enplaned Tonnage

Year	Air Freight	Express Mail	Air Mail	Totals
1983	15,427.5	579.8	4,541.8	20,549.1
1984	19,418.8	184.2	5,192.1	24,795.1
1985	21,134.6	249.2	5,462.9	26,846.7
1986	11,930.3	175.1	5,059.0	17,164.3
1987	9,954.1	140.4	4,782.6	14,877.1
1988	13,774.8	132.9	4,769.9	18,677.5
1989	16,673.6	165.8	4,254.3	21,093.7
1990	17,227.7	250.8	4,042.3	21,520.8
1991	18,128.1	189.4	5,337.0	23,654.5
1992	16,115.9	200.2	5,594.5	21,910.6
1993	16,879.4	318.0	5,823.0	23,020.4
1994	19,814.7	414.7	6,227.9	26,457.4
1995	19,696.3	420.7	5,853.4	25,970.4
1996	22,726.2	440.4	5,864.5	29,031.0
1997	23,111.7	484.2	5,525.8	29,121.7

Forecasts of air cargo enplaned tonnage relied on trend analysis and survey responses as the primary method for projecting demand. Currently, neither the FAA nor the U.S. Department of Transportation publish forecasts of domestic air cargo demand. This prevents the use of market share forecasting techniques. As a result, historical trend analysis was performed using time series linear regression analysis and double exponential smoothing methods. Table 3-9 shows the results of the two projections. Of the two projections, the Linear Trend was selected as being the most reasonable. The Selected Forecast then, breaks down the component parts to show where the anticipated growth will occur.

Table 3-9 - Forecast of Air Cargo Demand: Enplaned Tons

Projection/Forecast	1997	2005	2010	2020
Linear Trend	29,121.7	31,989.8	35,047.6	41,163.3
Exponential Smoothing	29,121.7	39,107.6	45,208.6	57,410.4
Selected Forecast				
Air Freight	23,111.7	25,210.8	27,856.5	33,148.0
Express Mail	484.2	495.1	508.4	527.3
Air Mail	5,525.8	6,283.9	6,682.7	7,488.0
Linear Trend Total	29,121.7	31,989.8	35,047.6	41,163.3

All-Cargo Aircraft Operations

All-cargo aircraft are defined as aircraft devoted only to carrying air cargo. This would include cargo carriers such as FedEx, UPS, etc. Not included in this definition are the scheduled airlines (USAirways, United, American, Delta, etc.) that carry "belly cargo" routinely in their cargo holds. Historical aircraft operations conducted by all cargo aircraft are presented in Table 3-10. As shown, aircraft operations have declined overall as a result of greater capacities and loads. For the future, it is anticipated that the level of enplaned tons per operation will continue to increase. Operations themselves are anticipated to grow only slightly, due to the capacity of the existing all-cargo aircraft fleet. Forecasts show operations growing from 4,159 in 1997 to 4,600 by the year 2020.

Table 3-10 - Forecast of All-Cargo Aircraft Operations

Year	Enplaned Tons	Aircraft Operations	Tons/Operation
1989	21,093.7	4,392	4.80
1990	21,520.8	5,450	3.95
1991	23,654.5	6,026	3.93
1992	21,910.6	4,824	4.54
1993	23,020.4	4,314	5.34
1994	26,457.4	4,558	5.80
1995	25,970.4	4,546	5.71
1996	29,031.0	4,620	6.28
1997	29,121.7	4,159	7.00
Forecast*			
2005	31,989.8	4,200	7.60
2010	35,047.6	4,300	8.10
2020	41,163.3	4,600	9.00

* Operations rounded to the nearest hundred.

3.5.3 General Aviation Demand Forecasts

The general aviation demand forecasts are composed of the following aviation demand descriptors:

- Registered Aircraft
- Based Aircraft
  - Based Aircraft Fleet Mix
- General Aviation Enplaned Passengers
- General Aviation Aircraft Operations
  - Total Annual
  - Local Versus Itinerant
  - Fleet Mix
  - Peak Hour

Study Area Registered Aircraft

The number of aircraft based at Buffalo-Niagara International Airport is dependent, in part, upon the nature and magnitude of aircraft ownership in the study area surrounding the airport. Therefore, the first step in forecasting the number of aircraft based at Buffalo-Niagara International Airport was to determine the number of registered aircraft within the study area.

The airport service area defined for general aviation users includes Erie and Niagara Counties. By way of definition, a registered aircraft is a civil aircraft, either fixed or rotary wing, that has been flown one or more hours during the previous calendar year. Excluded are aircraft owned and operated in regularly scheduled, nonscheduled, or charter service by commercial air carriers. Much of the historical information used to develop the registered aircraft forecast is based on data compiled by the FAA and published annually in the *Census of Civil Aircraft*.

Preparation of the study area registered general aviation aircraft forecast began with a review of historical aircraft ownership within the study area counties. To arrive at an acceptable forecast, seven projections were made using market share, socioeconomic regression, and trend analysis methodologies. Once tabulated, two derivative "reasonable" projections were developed - a high/low average and a multiple projection average. Both of these were below the static market share projection, (meaning that the Buffalo market is not anticipated to keep pace with the US trend). Of the two derivative projections, the multiple projection average was selected as preferred. Table 3-11 presents a summary of the different projections of registered aircraft for the BNIA general aviation service area.

The resulting forecast indicates a slow growth of registered aircraft in the region from 632 in 1997 to 753 by the year 2020. This conservative forecast recognizes a 19 percent growth over the forecast period - a 0.76 percent growth per year.

Table 3-11 - Forecast of Registered Aircraft: Buffalo-Niagara Falls MSA

PROJECTION TYPE	1997	2005	2010	2020	R SQUARED (Theil's U)
MARKET SHARE					
Static	632	685	719	787	
Dynamic	632	698	754	884	
SOCIOECONOMIC REGRESSIONS					
Population	632	637	631	620	0.15
Employment	632	651	651	652	0.18
Income	632	656	660	665	0.06
TREND					
Linear	632	644	643	642	
Exponentially-Smoothed	632	622	610	587	(1.13)
REASONABLE FORECASTS					
High/Low Average	632	660	682	736	
Multi-Average	632	668	694	753	
PREFERRED FORECAST	**632**	**668**	**694**	**753**	

Based Aircraft

By definition, a based aircraft is a general aviation aircraft that is stationed at an airport. Forecasting based aircraft at Buffalo-Niagara International Airport proceeded through the same process as all other demand elements: an analysis of historical data followed by forecasting into future years. Research into historical records for Buffalo-Niagara International Airport revealed that one primary published source was available: the Federal Aviation Administration's Form 5010-1, Airport Master Record. A second source of information used for the forecast of based aircraft was an informal survey of the airport's Fixed Base Operator (FBO).

To generate the historical data for based aircraft, the FAA's Form 5010-1 and the discussions with Airport Management concerning a census of existing based aircraft were used. To produce the baseline forecast, a constant market share methodology was employed. In this regard, the forecast of study area registered aircraft was used as the "market" and the based aircraft at Buffalo-Niagara International Airport constituted the "share." The selected forecast used the 15-year average of 8.3 percent as the selected market share. Table 3-12 presents the forecast of based aircraft at the airport.

Table 3-12 - Forecast of Based Aircraft

YEAR	SERVICE AREA REGISTERD AIRCRAFT	BNIA BASED AIRCRAFT	MARKET SHARE*
1983	622	53	8.5%
1984	645	53	8.2%
1985	662	53	8.0%
1986	674	53	7.9%
1987	662	53	8.0%
1988	660	51	7.7%
1989	669	53	7.9%
1990	661	53	8.0%
1991	626	56	8.9%
1992	646	56	8.7%
1993	630	56	8.9%
1994	638	56	8.8%
1995	646	58	9.0%
1996	656	55	8.4%
1997	632	48	7.6%
FORECAST			
2005	668	55	8.3%
2010	694	58	8.3%
2020	753	63	8.3%

* Market share represents 15 year historical average of 8.3 percent.

Based Aircraft Fleet Mix

The forecast of the based aircraft fleet mix is based upon national trends adjusted to reflect local conditions. For this study, aircraft fleet mix categories are described as: single-engine, multi-engine, turbojet, rotorcraft, and other. Because of the relative slow growth of based aircraft at the airport, change in the current fleet mix will likely occur slowly over the forecast period. Table 3-13 presents the historical and forecast based aircraft fleet mix for Buffalo-Niagara International Airport.

Table 3-13 - Forecast of Based Aircraft Fleet Mix

YEAR	SINGLE ENGINE	MULTI ENGINE	TURBO JET	ROTORCRAFT	OTHER	TOTAL
1997	10	33	5	0	0	48
FORECAST						
2005	12	36	7	0	0	55
2010	11	37	9	1	0	58
2020	10	41	11	1	0	63

Annual General Aviation Operations

The annual general aviation operations forecast was derived for both local and itinerant operations through the use of an operations per based aircraft (OPBA) ratio. By definition, local operations are performed by aircraft that operate within the local traffic pattern or within site of the airport. They can also be assigned to aircraft arriving or departing from local practice areas within 20 miles of the airport. In essence, local operations are associated with pilot training. Itinerant operations, on the other hand, are all other aircraft operations other than local operations.

For this study, historical FAA tower operations counts were used to develop OPBA ratios that could then be forecast throughout the planning period. Later discussions with the FAA Airport Tower personnel indicated that the published operational counts for BNIA are actually 10 percent higher than actual airport operations due to the counting of aircraft overflights. Therefore, the final general aviation forecast numbers were decreased by 10 percent relative to the historical numbers. Discussions with the FBO and airport management were used in a judgmental manner to establish whether or not the OPBA ratios could be expected to increase or decrease over the period. Given this input, the ratio was held constant over the planning period.

The projection method took into account the forecast growth in the number of based aircraft at BNIA and the historical OPBA trends, but did not impose constraints based upon airfield capacity issues. Table 3-14 presents the 1997 OPBA ratios for local and itinerant operations at Buffalo-Niagara International Airport. As shown in the table, both the ratios of local and itinerant operations per based aircraft are expected to remain constant over the period. Growth in the overall level of general aviation operations, nevertheless, is expected to occur as a natural outgrowth in the number of based aircraft and business and corporate use of the Airport. The results of the general aviation

operations forecast show a growth from 76,642 in 1997 to 90,700 in 2020.

Table 3-14 - Forecast of Local and Itinerant General Aviation Operations

YEAR	BASED AIRCRAFT	LOCAL		ITINERANT		TOTAL	
		Number	OPBA	Number	OPBA	Number	OPBA
1997	48	13,948	291	62,694	1,306	76,642	1,597
FORECAST							
2005	55	14,900	270	64,300	1,170	79,200	1,440
2010	58	15,600	270	67,900	1,170	83,500	1,440
2020	63	17,000	270	73,700	1,170	90,700	1,440

GA Operational Fleet Mix

The operational fleet mix forecast presents a breakdown of aircraft operations by aircraft type. Table 3-15 presents the forecast of operational fleet mix for general aviation aircraft using the Buffalo-Niagara International Airport. The forecast was derived through discussions with FAA tower representatives. In this regard, the FAA provided an estimate of current operational fleet mix at the airport. These numbers were then extrapolated into future time periods.

Table 3-15 - Forecast of General Aviation Operational Fleet Mix

YEAR	SINGLE ENGINE PROP	MULTI-ENGINE PROP	TURBO-JET	ROTORCRAFT	OTHER	TOTAL
1997	7,664	49,625	19,161	192	0	76,642
FORECAST						
2005	7,900	51,300	19,800	200	0	79,200
2010	7,500	52,800	22,600	600	0	83,500
2020	7,300	55,400	27,200	800	0	90,700

GA Operational Peaking Characteristics

Since a number of the airport's facility needs are related to the levels of activity during peak periods, forecasts were developed for general aviation peak month and peak hour operations. At airports such as Buffalo-Niagara International, general aviation operations are interspersed with scheduled airline operations, yielding an overall peak hour number that is higher than either individual component. Thus, it is important to estimate peak hour general aviation operations and add this total to the airline peak hour in order to estimate the total potential airfield peak demand.

For this study, discussions with FAA tower representatives were used to develop a base year peak hour general aviation operations total. This estimate was then extrapolated into future years to provide a comprehensive forecast of general aviation operational peaking characteristics. Table 3-16 presents the forecast of peak hour and peak month operations at Buffalo-Niagara International Airport.

Table 3-16 - General Aviation Peak Period Operations Forecast

YEAR	ANNUAL GA OPERATIONS	GA PEAK MONTH OPERATIONS	GA PEAK HOUR OPERATIONS
1997	76,642	7,979	31
FORECAST			
2005	79,200	8,245	32
2010	83,500	8,693	33
2020	90,700	9,442	36

General Aviation Enplanements

Forecasts of annual general aviation enplaned passengers can be used by Airport Management and FBO's to determine the need for such landside facilities as the general aviation terminal building sizes and the amount of automobile parking areas and access roads. This activity indicator is often ignored due to the lack of historical data. At BNIA, a record of passengers is kept by the FBO, along with their total number of flights. Over the past 3 years, the FBO has recorded an average of 2.4 passengers per general aviation departure. This is in line with the 1995 Aircraft Owners and Pilots Association (AOPA) estimated average of 2.5 passengers per general aviation itinerant departure.

To forecast general aviation enplaned passengers, an aircraft occupancy rate (2.4) was multiplied by the number of itinerant general aviation departures from the airport. Table 3-17 presents a forecast of general aviation enplanements at Buffalo-Niagara International Airport.

Table 3-17 - Forecast of General Aviation Enplaned Passengers

YEAR	ITINERANT OPERATIONS	ITINERANT DEPARTURES	ENPLANEMENTS PER DEPARTURES	GA ENPLANEMENTS
1997	62,694	31,347	2.4	75,233
FORECAST				
2005	64,300	32,150	2.4	77,200
2010	67,900	33,950	2.4	81,500
2020	73,700	36,850	2.4	88,400

Instrument Approaches

A necessary task in assessing the need for new or improved landing aids is a forecast of the levels of instrument approaches at the airport. An instrument approach can be defined as a series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually.

Information concerning instrument approaches is contained in the FAA's *Air Traffic Activity Statistics*, through the year 1994. Information for the years 1995-1997 are available via the Internet. At Buffalo-Niagara International Airport, a ten-year history was used in developing a ratio of instrument approaches to total operations. In the period between 1988 and 1997, instrument approaches have fluctuated from year to year, with a high of 10,389 in 1996 and a low of 6,278 in 1991. For forecasting purposes, it was assumed that the relationship between total operations and instrument approaches would remain constant at the 1997 level of 6.5 percent through the forecast period. Applying this percentage to the forecast of total airport operations yields the projection on Table 3-18.

Table 3-18 - Forecast of Instrument Approaches

YEAR	TOTAL AIRPORT OPERATIONS*	INSTRUMENT APPROACHES	INSTR. APPROACH RATIO
1997	148,990	9,630	6.5%
FORECAST			
2005	156,700	10,190	6.5%
2010	164,000	10,660	6.5%
2020	178,100	11,580	6.5%

* Includes Airline, Air Cargo, General Aviation, and Military operations.

3.5.4 Military Aircraft Operations

Military aviation at Buffalo-Niagara International Airport consists of Air Force C-130 and KC-135 transports, F-16 and F-18 fighters, National Guard helicopter flights, and other miscellaneous military aircraft types. Operations for these aircraft at Buffalo-Niagara International Airport are primarily for training and military personnel transport. No military aircraft are based at the airport. Over the past 10 years, military operations have fluctuated between a high of 5,856 in 1997 and a low of 3,431 in 1995. The ten year average has been 4,606 annual operations. Local and itinerant splits have averaged 34%-66% respectively.

The level of future military operations is a function of Defense Department policy and Congressional spending. Without a clear knowledge of this future policy or Congressional spending levels, it was assumed that future military operations at Buffalo-Niagara International will

continue at the same average level as it has over the past 10 years. The forecast of military operations shows a total of 4,600 per year, extended into future periods.

Table 3-19 - Forecast of Military Operations

YEAR	LOCAL MILITARY OPERATIONS	ITINERANT MILITARY OPERATIONS	TOTAL MILITARY OPERATIONS
1997	2,090	3,766	5,856
FORECAST			
2005	1,560	3,040	4,600
2010	1,560	3,040	4,600
2020	1,560	3,040	4,600

3.6 Aviation Demand Forecast Summary: Status Quo Scenario

Table 3-20 presents a summary of the aviation demand forecasts for Buffalo-Niagara International Airport. These forecasts are considered reasonable and achievable and will be used throughout the master plan to help in the development of facility requirements and the identification of alternatives.

Table 3-20 - Aviation Demand Forecast Summary

	ACTUAL	FORECAST		
Aviation Demand Element	1997	2005	2010	2020
ENPLANEMENTS				
Airline	1,496,931	1,739,100	1,908,400	2,160,700
Major/National	1,289,581	1,452,100	1,545,800	1,674,500
Regional	207,350	287,000	362,600	486,200
Airline Peak Hour Eps.	660	750	916	1,120
General Aviation	75,233	77,200	81,500	88,400
AIRCRAFT OPERATIONS				
Airline	62,333	68,700	71,600	78,200
Major/National	36,112	38,300	39,400	39,900
Regional	26,221	30,400	32,200	38,300
Air Cargo	4,159	4,200	4,300	4,600
General Aviation	76,642	79,200	83,500	90,700
GA Local	13,948	14,900	15,600	17,000
GA Itinerant	62,694	64,300	67,900	73,700
Military	5,856	4,600	4,600	4,600
TOTAL AIRPORT	148,990	156,700	164,000	178,100
Annual Instrument Approaches	9,630	10,190	10,660	11,580
PEAK PERIOD OPERATIONS				
Airline Peak Hour	17	20	21	23
GA Peak Hour	31	32	33	36
Military Peak Hour	5	5	5	5
TOTAL AIRPORT	53	57	59	64
GENERAL AVIATION AIRCRAFT				
Service Area Registered Aircraft[1]	632	668	694	753
Based Aircraft	48	55	58	63

1 Service area includes Erie and Niagara County registered aircraft.

3.7 Comparisons With Other Forecasts

One method of estimating the reasonableness of a set of forecasts is to compare them with other previous forecasts. Most of the previous forecasts for BNIA are outdated significantly, including the previous Airport Master Plan (1982), the Master Plan/Terminal Area Plan Update (1990), and the Access Improvement Study (1991). Each of these studies significantly overestimated the actual level of enplanements or aircraft operations at BNIA.

Only one forecast is updated annually - the FAA's Terminal Area Forecasts (TAF). For this section, then, a comparison was made between the most recent TAF and the forecasts generated in this Master Plan Update. Key comparisons involved the forecasts of airline enplanements and overall airport operations. These comparisons are shown in Table 3-21 and Figures 3.3 and 3.4.

As shown, the Status Quo forecast of enplanements in this Master Plan is significantly lower than the FAA's TAF projection. On the other hand, the Low-fare Carrier projection of enplanements is much higher than the FAA projection. Total aircraft operations are relatively consistent in the short and intermediate range between the Status Quo and the TAF; however, in the long term, the extrapolated TAF grows faster than does the Status Quo projection.

The main difference, then, between this Master Plan forecast and the TAF is the optimism of the TAF relative to passenger enplanements. It is believed that the conservatism of the Master Plan forecasts is justified by the last decade of performance. It is also important to note that should a Low-fare Carrier such as Southwest Airlines enter the Buffalo market, potential forecasts of demand have been prepared. These forecasts are higher than the TAF and will equip the NFTA with the means of planning for and accommodating such a contingency. On this basis, the forecasts developed in this Master Plan can be considered reasonable.

Table 3-21 - FORECAST COMPARISONS

FORECAST/COMPONENT	ACTUAL	FORECAST		
FAA Terminal Area Forecasts (1998)	1996	2005	2010	2020*
Enplanements	1,478,800	1,884,600	2,188,900	2,673,700
Total Aircraft Operations	146,700	164,800	176,700	197,500
Master Plan Update (1998)				
Status Quo Enplanements	1,478,800	1,739,100	1,908,400	2,160,700
Status Quo Aircraft Operations	146,700	156,700	164,000	178,100
Low-fare Scenario Enplanements**	1,478,800	2,365,500	2,595,000	2,937,500
Low-fare Scenario Operations**	146,700	171,700	181,900	196,100

* Year 2020 values are extrapolated for Terminal Area Forecasts
** Information taken from Appendix 3.A.

FIGURE 3.3 – ENPLANEMENT COMPARISON

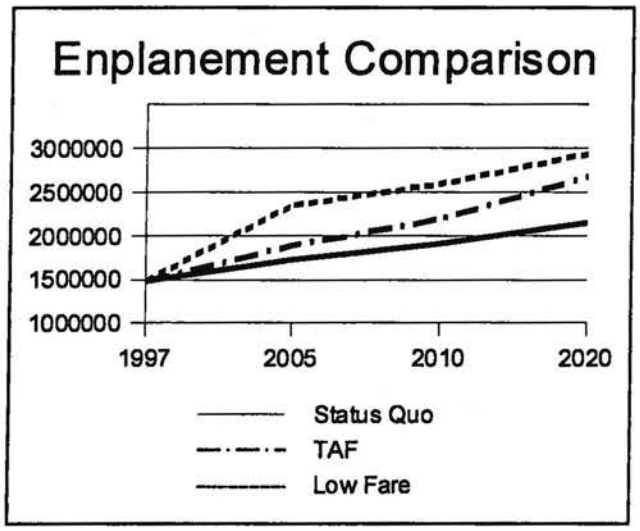
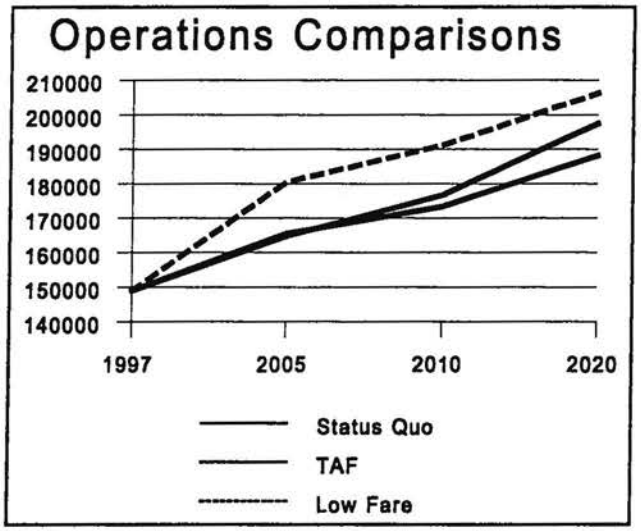


FIGURE 3.4 – OPERATIONS COMPARISON



APPENDIX 3 A - LOW-FARE CARRIER AIRLINE DEMAND FORECAST

The prospect of attracting a low-fare air carrier to Buffalo brings with it the opportunity for significantly increased numbers of passenger enplanements. For this analysis, it was assumed that the largest low-fare carrier - Southwest Airlines - would be attracted to Buffalo-Niagara International Airport. This assumption permits the use of comparative data from other hubs that have received Southwest Airlines service. It also presents the highest case or high range scenario in terms of passenger enplanements. For planning purposes, the advent of Southwest Airlines service would test the future capacities of the airfield and terminal area configurations.

By way of background, the geographic service area for a low-fare carrier airport is significantly larger than that for a conventional airport without low fares. For example, when Southwest Airlines began service to Birmingham, Alabama, a survey of the parking lot showed that 15 percent of the cars were from Georgia. In a similar manner, Parkersburg, West Virginia has estimated that more than 50 percent of their traffic is now driving to Columbus, Ohio to fly Southwest or America West Airlines. In essence, the automobile is the "commuter" feeder for Southwest and other low-fare airlines.

In Buffalo, a direct result of expanding the service area is the capture of new Canadian markets. It is estimated that roughly 3.5 million Canadians live within a two-hour drive of Buffalo-Niagara International Airport. This drive is normal for many Southwest Airlines users. In addition, market expansion for Buffalo means greater competition for passengers using the Rochester airport and airports in the Southern Tier. Also, lower fares also open up markets that were not previously prone to use air travel. Many first-time flyers are attracted by low fares.

All of these factors will be considered in the development of potential airline demand forecasts. To adequately address the issue of low-fare carrier impact, this appendix is organized to include the following sections:

- Potential Airline Enplanements
- Major/Regional Carrier Split of Enplanements
- Potential Airline Aircraft Operations Forecast
- Potential Airline Fleet Mix Forecast
- Potential Peak Period Airline Activity Forecast
- Instrument Approaches
- Aviation Demand Forecast Summary: Low-fare Carrier Scenario

3.A.1 Potential Airline Enplanements

To estimate the number of potential airline enplanements that might be generated by Southwest Airlines, a relatively simple method would be to start with the minimum number of daily flights that Southwest places in a market (10), times a seating capacity (124), times an average load factor (say 70 percent) = 316,800 annual passenger enplanements. However, it is not as simple as that.

In markets where Southwest has entered, there has been an increase in all of the airline traffic, not just that of Southwest Airlines. Part of this non-Southwest increase is due to the fact that other carriers must reduce their fares in competing markets with Southwest, and part of the increase is

due to the fact that there is more connecting traffic caused by the low prices.

To forecast potential airline enplanements for the low-fare carrier scenario, two methods were used: a "bottom-up" process similar to the method described above, and a comparative process, where the growth in other cities is examined and compared to the Buffalo case. Each of these methods are described in the following sections.

Bottom-Up Method

As mentioned above, a simplistic method that can be used is to apply the Southwest activity model to Buffalo and estimate the number of passengers that would be generated due to the new service. Important in this process is the understanding that a certain percentage of Southwest's passengers would have flown on other airlines and thus do not represent "new" passengers in the market. In Louisville, Kentucky, for example, Southwest introduced new service beginning with 10 flights in late May, 1993, increasing to 12 by the end of the year.

Using the bottom-up method, it would be anticipated that an average of 10 daily flights (some weekend flights do not operate), times the average number of seats on the B-737 equipment (124), times an average load factor (assume 70 percent), times 7 months = roughly 185,000 enplanements. During 1993, there was an overall growth of 147,600 enplanements over 1992. Theoretically, 20 percent of the Southwest Airlines traffic was not new growth, but passengers switching from other airlines. Adding potential natural growth of about 3 percent, along with variations in potential load factors to the equation, it was assumed that roughly 25 percent of Southwest enplanements are existing passengers that have switched airlines. Thus, it was assumed that 75 percent of the Southwest enplanements represent new growth.

To forecast Buffalo-Niagara International Airport enplanements using this method, it was assumed that introductory air service levels would involve 10 flights per day. This would increase to 16 within 2 years, to 20 within 5 years, and to 25 for the long term period. It was also assumed that the earliest that a low-fare carrier such as Southwest could enter the market would be the year 2001. The final assumption was that natural growth in the Buffalo market (from the Status Quo forecasts) would be in addition to the growth caused by a low-fare carrier. Table 3.A-1 presents the calculated number of enplanements using the Bottom-Up method.

Table 3.A-1 – FORECAST OF POTENTIAL BNIA ENPLANEMENTS: BOTTOM-UP METHOD

YEAR	LOW-FARE FLIGHTS	LOW-FARE ENPLANEMENTS	REDUCTION FACTOR	STATUS QUO FORECAST	TOTAL PROJECTED ENPLANEMENTS
2001	10	316,800	(79,200)	1,618,000	1,855,600
2005	20	633,600	(158,400)	1,739,100	2,214,300
2010	22	697,000	(174,300)	1,908,400	2,431,100
2020	25	792,100	(198,000)	2,160,700	2,754,800

Comparative Method

The second method used in developing potential forecasts of airline enplanements was a comparative method that examined seven other airports that have received Southwest Airlines service in recent years. It was anticipated that an initial large boost in enplanements at these airports would be followed by much lower, normal rates of growth. These rates and patterns of growth, then could be used to anticipate the impacts of a low-fare carrier in the Buffalo market.

Table 3.A-2 presents a listing of seven cities that received Southwest Airline service in the recent past. Shown in the Table are the number of enplanements the year before Southwest entered the market, along with the numbers from the first full year of Southwest service. Impacts to cities varied, with Indianapolis having the least impact and Providence having the greatest impact. On average, there was a 42.3 percent spike in the number of airline enplanements in these markets. Assuming a 3 percent natural growth rate can be discounted, the "pure" and immediate impact of Southwest Airlines on a market is about 36 percent.

Table 3.A-2 – FIRST YEAR IMPACTS OF SOUTHWEST AIRLINE SERVICE

AIRPORT	YEAR	YEAR BEFORE SWA ENPLANEMENTS	YEAR	FULL YEAR OF SWA ENPLANEMENTS	% GROWTH
Baltimore	1992	4,011,100	1994	6,050,300	50.8%
Birmingham	1986	912,000	1988	1,146,500	25.7%
Cleveland*	1991	3,864,700	1994	5,025,300	30.0%
Columbus, OH	1991	1,645,100	1993	2,722,100	65.5%
Indianapolis	1988	2,633,500	1990	2,965,100	12.6%
Louisville	1992	1,043,300	1994	1,677,600	60.8%
Providence	1995	1,084,000	1997	2,036,600	87.9%
Totals		15,193,700		21,623,500	42.3%

* Real growth in the market did not occur until 1994.

The question then arises, "What happens after the initial growth period?" Table 3.A-3 presents a summary of the growth occurring in the same cities after the first full year of Southwest Airline service. As shown, the weighted average annual growth at these cities was only slightly higher than the United States average growth from 1988-1997. From this data, it can be inferred that after the initial growth caused by lower fares, airports receiving service from Southwest revert to slower natural growth trends in their respective markets. These slower growth rates are in line with the national rate of growth of all enplanements.

Table 3.A-3 – GROWTH AFTER INITIATION OF SOUTHWEST SERVICE

AIRPORT	YEAR	1ST FULL YR. SWA	1997 TRAFFIC	% GROWTH	PER ANNUM	US PER ANNUM
Baltimore	1994	6,050,300	6,705,300	10.8%	3.5%	4.2%
Birmingham	1988	1,146,500	1,585,100	38.3%	3.7%	3.2%
Cleveland	1994	5,025,300	5,602,700	11.5%	3.7%	4.2%
Columbus, OH	1993	2,722,100	3,468,000	27.4%	6.2%	5.1%
Indianapolis	1990	2,965,100	3,544,400	19.5%	2.6%	3.4%
Louisville	1994	1,677,600	1,907,500	13.7%	4.4%	4.2%
Providence	1997	2,036,600	2,036,600	NA	NA	
Average Growth					3.6%	3.2%

Relating these findings to Buffalo, a projection of enplanements was developed that assumed an immediate 36 percent increase. This increase was in addition to the natural growth

anticipated to occur in the market. After the initial increase, a normal rate of growth was applied for the remainder of the forecast period. The result was a forecast of potential enplanements that approaches 3.0 million by the year 2020 (Table 3.A-4).

Table 3.A-4 – FORECAST OF POTENTIAL BNIA ENPLANEMENTS: COMPARATIVE METHOD

YEAR	STATUS QUO ENPLANEMENTS	GROWTH PERCENTAGE	TOTAL PROJECTED ENPLANEMENTS
2001	1,618,000	36.0% (SWA growth)	2,200,500
2005	1,739,100	7.5% (Natural growth)	2,365,500
2010	1,908,400	9.7% (Natural growth)	2,595,000
2020	2,160,700	13.2% (Natural growth)	2,937,500

Selection of Preferred Enplanement Forecast

Both the Bottom-up projection and the Comparative Method projection are reasonable estimates of potential airline enplanements, should a low-fare carrier such as Southwest Airlines begin service to Buffalo. Of the two projections, the Bottom-up was lower, registering 2,754,800 enplanements by the year 2020, while the Comparative Method predicted 2,937,500 enplanements for the same period. Since both projections are considered reasonable, the larger of the two was selected as preferred. The primary reason for this selection is the fact that for planning purposes, higher numbers require more extensive contingency planning for facility capacities and requirements impacted by this scenario. This, in turn, better equips NFTA to accommodate such a scenario.

3.A.2 Major/Regional Carrier Split of Enplanements

Similar to the Status Quo forecasts of airline demand, it was important to project the split between Major (including National) carrier enplanements and Regional carrier enplanements. This split can then be used to forecast airline operations by fleet type more easily. For the Low-fare Airline scenario, much of the previous work from the Status Quo projections was used. In essence, the majority of the additional growth was attributed to the Major/National carrier portion of demand, since the low-fare airline would be the major generator of new enplanements. Table 3.A-5 presents a summary of the allocation process, using the newly selected enplanement forecasts as control totals for each forecast year.

Table 3.A-5 – SPLIT BETWEEN MAJOR/NATIONAL ENPLANEMENTS AND REGIONAL CARRIER ENPLANEMENTS					
YEAR	MAJOR/NATIONAL ENPLANEMENTS	PERCENT SHARE	REGIONAL ENPLANEMENTS	PERCENT SHARE	BNIA ENPLANEMENT TOTALS
1997	1,289,581	86.1%	207,350	13.9%	1,496,931
FORECAST					
2005	2,034,300	86.0%	331,200	14.0%	2,365,500
2010	2,195,400	84.6%	399,600	15.4%	2,595,000
2020	2,423,400	82.5%	514,100	17.5%	2,937,500

3.A.3 Potential Airline Aircraft Operations Forecast

A forecast of airline operations is needed to assess the adequacy of the terminal and airfield system throughout the planning period, should the Low-fare Carrier scenario occur. In addition, this forecast will help determine the financial impact and the environmental effects associated with these potential future traffic levels.

Similar to the Status Quo forecast, annual airline aircraft operations were further subdivided into categories for major/national airlines and regional airlines. Table 3.A-6 presents the 1997 level of airline operations, including the split between major/national airlines and regional airlines. For the future, it was assumed that both the Major/Nationals and Regionals would carrier greater load factors, and as such, the enplanements per departure ratios are anticipated to increase. These ratios are displayed in Table 3.A-6.

Table 3.A-6 – SPLIT BETWEEN MAJOR/NATIONAL CARRIER OPERATIONS AND REGIONAL CARRIER OPERATIONS						
YEAR	MAJOR/ NATIONAL ENPLANEMENTS	MAJOR/ NATIONAL OEPRATIONS	ENPLANEMENTS/ DEPARTURE	REGIONAL ENPLANEMENTS	REGIONAL OPERATIONS	ENPLANEMENTS/ DEPARTURE
1997	1,289,581	**36,112**	71.4	207,350	**26,221**	15.8
FORECAST *						
2005	2,034,300	**52,900**	76.9	331,200	**30,800**	21.5
2010	2,195,400	**55,500**	79.1	339,600	**34,000**	23.5
2020	2,423,400	**57,400**	84.5	514,100	**38,800**	26.5

* Forecast operations rounded to the nearest 100.

3.A.4 Potential Airline Fleet Mix Forecast

The forecast of airline fleet mix for the Low-fare Carrier scenario was influenced significantly by the fact that most of the additional aircraft will be in the B-737 series. Table 3.A-7 presents a summary of scheduled annual airline aircraft operations by aircraft type for 1996 and 1997. For the future, the Status Quo scenario anticipated that some aircraft will be retired or taken out of service to Buffalo such as the B-727-200, the B-737-100, the DC-9-10/20, and the F-28. Increased utilization was anticipated for larger aircraft such as the B-757. However, in the Low-fare Carrier scenario, the main increases are expected for the B-737 series (300's through the 800's). The average number of seats per departure trends at BNIA include the following:

	Ave. Seats/Dep.
• 1997	81.8
• 2005	91.3
• 2010	92.2
• 2020	92.5

3.A.5 Potential Peak Period Airline Activity Forecast

Under the Low-fare Carrier scenario, peak period activity forecasts are important in estimating potential additional airfield and terminal area facilities. Measures of this activity include peak hour operations and peak hour enplanements.

Peak Hour Airline Operations

Airline peak hour operations are defined as the highest number of operations to occur during any one hour in any one calendar year. Table 3.A-8 presents the historical and forecast peak period airline activity indicators for the period 1997-2020.

To forecast the peak hour, the Status Quo forecast was used as a baseline case. To this case was added the potential low-fare carrier numbers. Since an airline such as Southwest can turn an aircraft in 25-30 minutes, each flight that occurs within the first 30 minutes of the peak hour will register 2 operations. The forecasts show an increase from the current number of 17 peak hour operations to 28 by the year 2005 (8 more than the Status Quo forecast), and ultimately 33 by the year 2020 (10 more than the Status Quo forecast).

Table 3.A-7 – AIRLINE FLEET MIX FORECAST

		1996		1997		2005		2010		2020	
Aircraft	**Seats**	**Departure**	**Percent**	**Departure**	**Percent**	**Departure**	**Percent**	**Departure**	**Percent**	**Departure**	**Percent**
Majors/Nationals											
ATR-72	64	0	0.0%	36	0.2%	661	2.5%	860	3.1%	1,033	3.6%
B-757	182	0	0.0%	0	0.0%	820	3.1%	1,388	5.0%	2,325	8.1%
B-737-700	149	0	0.0%	0	0.0%	2,777	10.5%	3,469	12.5%	3,846	13.4%
B-737-500	110	408	2.2%	271	1.5%	1,693	6.4%	2,081	7.5%	2,382	8.3%
B-737-400	146	445	2.4%	343	1.9%	2,566	9.7%	2,747	9.9%	2,927	10.2%
B-737-300	128	2,501	13.5%	1,228	6.8%	4,655	17.6%	5,467	19.7%	6,056	21.1%
B-737-200	112	3,243	17.5%	6,645	36.8%	3,835	14.5%	3,469	12.5%	3,014	10.5%
B-737-100	95	4,354	23.5%	921	5.1%	846	3.2%	0	0.0%	0	0.0%
B-727-200	141	2,205	11.9%	2,329	12.9%	1,428	5.4%	833	3.0%	0	0.0%
BaE-146	85	0	0.0%	0	0.0%	661	2.5%	971	3.5%	1,234	4.3%
DC-9-30	102	2,446	13.2%	2,004	11.1%	2,433	9.2%	2,359	8.5%	2,325	8.1%
DC-9-10/20	83	19	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
F-100	95	1,019	5.5%	1,426	7.9%	873	3.3%	999	3.6%	459	1.6%
F-28	68	74	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
MD-88	140	1,816	9.8%	2,853	15.8%	3,200	12.1%	3,108	11.2%	3,100	10.8%
Totals		18,529	100.0%	18,056	100.0%	26,450	100.0%	27,750	100.0%	28,700	100.0%
Average Seats		114.4		118.5		125.1		126.6		128.8	
Regional/Commuter											
15-19 Seats	19	3,601	26.2%	2,989	22.8%	3,280	21.3%	2,822	16.6%	1,959	10.1%
20-40 Seats	34	9,773	71.1%	9,348	71.3%	10,102	65.6%	10,778	63.4%	11,931	61.5%
41-60 Seats	50	371	2.7%	774	5.9%	1,802	11.7%	2,261	13.3%	3,725	19.2%
61-80 Seats	70	0	0.0%	0	0.0%	216	1.4%	1,139	6.7%	1,785	9.2%
Totals		13,746	100.0%	13,111	100.0%	15,400	100.0%	17,000	100.0%	19,400	100.0%
Average Seats		30.4		31.3		33.2		36.1		38.9	
Airport Ave. Seats		78.6		81.8		91.3		92.2		92.5	

Table 3.A-8 - PEAK PERIOD AIRLINE ACTIVITY			
YEAR	PEAK MONTH OPERATIONS[1]	AVERAGE DAY OF PEAK MONTH[2]	PEAK HOUR OPERATIONS
1997	5,941	194	17
FORECAST			
2005	7,700	248	28
2010	8,234	266	30
2020	8,850	285	33

1 Historical peak month operations taken from FAA tower records.

2 Historical average day operations were estimated from the airline schedules. Future average day operations were estimated by dividing peak month operations by 31.

Peak Hour Airline Enplanements

Peak hour airline enplanements are defined as the peak number of enplanements during any one hour period in a calendar year. The Low-fare Carrier forecast used the same methodology as was used for the Status Quo forecasts: peak hour departures times the peak number of enplanements per departure will yield peak hour enplanements. For this analysis, it was assumed that peak number of enplanements per departure was 20 percent greater than the average number of enplanements per departure.

Table 3.A-9 shows the estimate of 1997 actual peak hour enplanements, based upon the airline schedule. For the forecast period, peak hour enplanements are anticipated to grow from 660 in 1997 to 1,507 by the year 2020 - a 128 percent increase over the period (3.7 percent per year). This large increase over the Status Quo forecast would be due primarily to the presence of a low-fare carrier and its operations. Should Southwest Airlines enter the Buffalo market, it is likely that they would serve a minimum of three other cities from Buffalo. These multiple service points can create 6 peak hour operations with one flight from each market. Add to this an additional commuter flight, and the forecast shown in Table 3.A.9 is easily achieved.

Table 3.A-9 – PEAK HOUR ENPLANEMENTS					
YEAR	MAJOR/ NATIONAL PEAK HOUR DEAPRTURES	MAJOR/NATIONAL PEAK HOUR ENPLANEMENTS	REGIONAL PEAK HOUR DEPARTURES	REGIONAL PEAK HOUR ENPLANEMENTS	TOTAL PEAK HOUR ENPLANEMENTS
1997	6	562	5	98	660
FORECAST					
2005	10	970	6	155	1,125
2010	11	1,102	7	197	1,299
2020	12	1,253	8	254	1,507

3.A.6 Instrument Approaches

When the overall airport operations forecast changes, it impacts the forecast of instrument approaches. The 1997 ratio of instrument approaches to total airport operations was held constant at 6.5 percent for the forecast under the Low-fare Carrier scenario. Applying this percentage to the forecast of total airport operations yields the projection on Table 3.A-10.

Table 3.A-10 – FORECAST OF INSTRUMENT APPROACHES			
YEAR	TOTAL AIRPORT OPERATIONS *	INSTRUMENT APPROACHES	INSTRUMENT APPROACH RATIO
1997	148,990	9,630	6.5%
FORECAST			
2005	180,500	11,010	6.5%
2010	191,200	11,660	6.5%
2020	206,200	12,580	6.5%

* Includes Airline, Air Cargo, General Aviation, and Military operations.

3.A.7 Aviation Demand Forecast Summary: Low-fare Carrier Scenario

Table 3.A-11 presents a summary of the aviation demand forecasts for Buffalo-Niagara International Airport for the Low-fare Carrier Scenario. These forecasts differ from the Status Quo forecasts only in the airline activity indicators - the general aviation and military operations forecasts remain unchanged.

Table 3.A-11 – AVIATION DEMAND FORECAST SUMMARY

	ACTUAL	FORECAST		
Aviation Demand Element	1997	2005	2010	2020
Enplanements				
Airline	1,496,931	2,365,500	2,595,000	2,937,500
Major/National	1,289,581	2,034,300	2,195,400	2,423,400
Regional	207,350	331,200	399,600	514,100
Airline Peak Hour Ops.	660	1,125	1,299	1,507
General Aviation	75,233	87,400	92,000	98,300
Aircraft Operations				
Airline	62,333	83,700	89,500	96,200
Major/National	36,112	52,900	55,500	57,400
Regional	26,221	30,800	34,000	38,800
Air Cargo	4,159	4,200	4,300	4,600
General Aviation	76,642	79,200	83,500	90,700
GA Local	13,948	14,900	15,600	17,000
GA Itinerant	62,694	64,300	67,900	73,700
Military	5,856	4,600	4,600	4,600
TOTAL AIRPORT	148,990	171,700	181,900	196,100
Annual Instrument Approaches	9,630	11,160	11,820	12,750
Peak Period Operations				
Airline Peak Hour	17	28	30	33
GA Peak Hour	31	32	33	36
Military Peak Hour	5	5	5	5
TOTAL AIRPORT	53	65	68	74
General Aviation Aircraft				
Service Area Registered Aircraft[1]	632	668	694	753
Based Aircraft at BNIA	48	55	58	63

1 Service area includes Erie and Niagara County registered aircraft.